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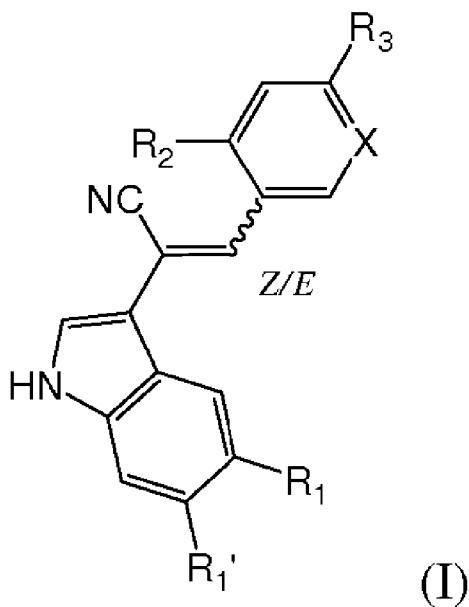
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(54) **Title:** NEW DERIVATIVES OF INDOLE FOR THE TREATMENT OF CANCER, VIRAL INFECTIONS AND LUNG DISEASES

(57) **Abstract:** The present invention relates to a new class of indole derivatives, having a particular MKlp2 inhibition profile and useful as a therapeutic agent, in particular for the treatment of cancer, viral infections and lung diseases.





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NEW DERIVATIVES OF INDOLE FOR THE TREATMENT OF CANCER, VIRAL INFECTIONS
AND LUNG DISEASES**FIELD OF THE INVENTION**

The present invention relates to derivatives of indoles and to their application as therapeutics, and in particular to treat the cancer.

5

BACKGROUND OF THE INVENTION

Cell division is a highly dynamic process, which depends on the proper interaction of mitotic spindle microtubules (MTs) with chromosomes during mitosis. Because of the dynamic nature of mitosis, proteins involved in the process are prime targets for the 10 development of inhibitors that can be used as antimitotic agents with a potential chemotherapeutic value.

Currently, many anti-cancer drugs used in cancer chemotherapy are antimitotic agents, such as taxanes (Paclitaxel, Docetaxel) which target tubulin, the basic component for the polymerization of mitotic microtubules and/or vinca-alkaloids, such as vinorelbine or 15 vinblastine.

Other anti-cancer drugs are alkylating agents, such as cis-platine, DNA intercalating agents, such as doxorubicin, Topoisomerase I or II inhibitors, such as respectively camptothecin and etoposide, and RNA/DNA antimetabolites, such as 5-fluorouracil.

In addition to inhibitors aiming at MT assembly/dynamics and inhibitors targeting 20 mitotic kinases, a new class of targets has emerged, that of kinesin based motor proteins.

Kinesins are proteins which use the free energy of ATP hydrolysis to drive intracellular movement and influence cytoskeleton organization (R. D. Vale and R. J. Fletterick, Annu. Rev. Cell. Dev. Biol. 13, 745-777 (1997)). More than 90 members of this family are known. In particular, a RNAi screen in human cells has identified at least 12 25 different members of such kinesin superfamily as being actively involved in cell division.

Several members of the kinesin superfamily play thus key roles in mitosis and some of them, such as MKlp2 (also known as KIF20A/RAB6KIFL/Rabkinesin-6, protein number NP_005724), are essential for cytokinesis and more particularly for the implementation of the cleavage furrow and spindle midzone formation. Cytokinesis marks the final step of mitosis 30 and the cell cycle, leading to the production of two daughter cells endowed with a complete set of chromosomes and cytoplasmic organelles.

Many steps of cytokinesis, from cleavage furrow and spindle midzone formation, to transport of proteins to the cell division plane as well as furrow ingression are thought to be dependent on the function of different members of the kinesin superfamily, including Mitotic-Kinesin-Like-Protein-1 (MKlp1) and -2 (MKlp2), M-Phase-5 Phosphoprotein-1 (MPP1), human KIF4A (and its very close, with 99% identity, homologue KIF4B, both kinesin-4 family) and KIF14. Another protein is Eg5 (also known as KSP) which drives the movement of microtubules *in vitro*.

Inhibitors of kinesins have already been reported (R. Sakowicz et al., Science 280, 292-295 (1998)) or disclosed, notably in US 6,489,134 and US 6,890,933 but such inhibitors 10 do not show a potential efficacy against MKlp2.

MKlp2 has been shown to be essential for normal cleavage furrow ingression and cytokinesis. Depletion of MKlp2 by siRNA leads to binucleated cells (K Taniuchi et al. Cancer Research 65, 105-112 (2005)). MKlp2 has also been identified as a cytoskeleton-associated proteins essential for lysosomal stability and survival of human cancer cells (L. 15 Groth-Pedersen et al. PLoS One. 7(10), e45381 (2012)). Accordingly, it can thus constitute new target for the development of novel therapeutic strategies against cancer or diseases linked to uncontrolled and/or abnormal cell growth.

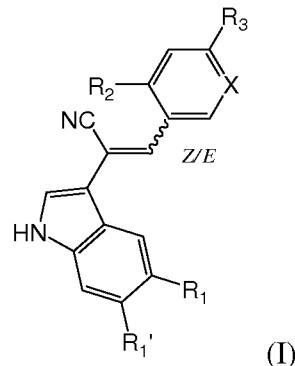
Currently, there is a lack of potent inhibitors for this member of the kinesin family that could be used as an anti-cancer agent and for which the specificity of the anti-MKlp2 activity 20 could be sufficient to prevent off target toxicity.

The use of kinesin inhibitors in HIV infection treatment has also been reported in patent application EP 2 455 456. In addition, mitotic kinesin inhibitors are also used for treating lung disease, particularly pulmonary arterial hypertension, such as described in patent application WO 2012/009097.

25 The inventors have demonstrated that some derivatives of indole are selective inhibitors for MKlp2 in the publication S. Tcherniuk et al. (Angew. Chem. Int. 49, 8228-8231 (2010)) and in the patent application WO 2010/150211. However, alternative or improved inhibitors are still very useful and necessary. A new generation of inhibitors of cytokinesis may in particular be used for the treatment of cancer.

SUMMARY OF THE INVENTION

The present invention relates to compounds of formula (I):



wherein :

5 - X represents a nitrogen atom, a C-CN unit or a N⁺-O⁻ unit, preferably a nitrogen atom or a C-CN unit;

- R₁ and R_{1'} are such that one is H and the other represents a halogen or a (C₁-C₆)alkoxy group, optionally substituted by a carboxylic group or one -NR₁₁R₁₂ unit wherein R₁₁ and R₁₂ represent H or a (C₁-C₆)alkyl group or R₁₁ and R₁₂ taken together form a 3- to 10 7-membered ring optionally interrupted by one or several heteroatoms, preferably a (C₁-C₃)alkoxy group;

10 - R₂ represents:

- a radical (C₁-C₆)alkoxy, (C₃-C₆)cycloalkoxy, aryloxy, heteroaryloxy, (C₁-C₆)alkyl-aryloxy, (C₁-C₆)alkyl-heteroaryloxy, said radicals being optionally substituted by at least one halogen, or a radical thio-(C₁-C₆)alkyl, thio-aryl, 15 thio-heteroaryl, thio-(C₁-C₆)alkyl-aryl or thio-(C₁-C₆)-alkyl-heteroaryl, said radicals being optionally substituted by at least one halogen or by a (C₁-C₆)alkoxy group,
- a -NR₄R₅ unit, a O-(C₁-C₆)alkyl-NR₄R₅ unit or a S-(C₁-C₆)alkyl-NR₄R₅ unit wherein R₄ and R₅ represent H, a (C₁-C₆)alkyl group, or R₄ and R₅ taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, with the proviso that at least one among R₄ and R₅ is not H,
- a NHCOR₆ unit wherein R₆ represents (C₁-C₆)alkyl group,
- an aryl or heteroaryl group optionally substituted by at least one halogen, a trifluoromethyl group, or a (C₁-C₃)alkoxy group,a halogen,

with the proviso that if R_1 or R_1' is a (C_1 - C_3)alkoxy group, then R_2 is not a halogen; and

- R_3 represents a hydrogen, a (C_1 - C_3)alkyl group, a (C_1 - C_3)alkoxy group or a halogen, advantageously a fluorine;

5 and the produgs thereof, in which the nitrogen atom of the indole core is substituted by a group selected from the group consisting of a COR_7 and a CO_2R_7 group, wherein R_7 represents:

- a (C_1 - C_6)alkyl group, optionally substituted by at least a hydroxy group, a (C_1 - C_6)alkyloxy group, a (C_1 - C_6)_npolyalkyloxy group wherein n is 1<n<6, a phosphate or 10 pyrophosphate group and salts or (C_1 - C_3)alkyl ester thereof, a R_8 group, a $-NHCO_2R_8$ unit, a COR_8 group, or a CO_2R_8 group, wherein R_8 is:

- a (C_1 - C_6)alkyl group,
- an aryl, a (C_1 - C_6)alkylaryl, a heteroaryl,
- a $-NR_9R_{10}$ unit wherein R_9 and R_{10} represent a hydrogen, a (C_1 - C_6)alkyl group, or R_9 and R_{10} taken together form a 3- to 7-membered ring, optionally 15 interrupted by one or several heteroatoms, and optionally the ring being substituted by at least one (C_1 - C_6)alkyl group;
- a $NH-NR_9R_{10}$ unit wherein R_9 and R_{10} are such as defined above; or
- a saturated heterocycle or a heteroaryl;

20 or one of its pharmaceutically acceptable salts;

with the proviso that the compound is not (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile.

In a particular embodiment, compounds having formula (I) as defined above are (Z)-isomers (formula Ia) or a prodrug thereof as defined above.

25 In another particular embodiment, compounds having formula (I) as defined above are (E)-isomers (formula Ib) or a prodrug thereof as defined above.

Particularly, the compound has formula (I), (Ia), or (Ib) as defined above with R_1' being H. More particularly, the compound has formula (I), (Ia), or (Ib) as defined above with R_1 being a halogen chosen among a bromine or a chlorine. Alternatively, R_1' is a halogen 30 chosen among a bromine, a chlorine, or a fluorine. In particular, R_1 is H and R_1' is a halogen chosen among a bromine, a chlorine, or a fluorine

Preferably, the compound has formula (I), (Ia), or (Ib) as defined above with R_2 being:

- a radical (C_1 - C_6)alkoxy, phenoxy, said radicals being optionally substituted by at least one halogen;

- a halogen;
- a R_4 -N- R_5 unit or a $S-(C_1-C_6)alkyl-NR_4R_5$ unit, wherein R_4 and R_5 represent H, a $(C_1-C_6)alkyl$ group with the proviso that at least one among R_4 and R_5 is not H,
- 5 ▪ a $NHCOR_6$ unit wherein R_6 represents $(C_1-C_6)alkyl$ group,
- a radical thio- $(C_1-C_6)alkyl$, thio-aryl, thio-heteroaryl, thio- $(C_1-C_6)alkyl$ -aryl, said radicals being optionally substituted by at least one halogen or by a $(C_1-C_6)alkoxy$ group;
- an aryl group optionally substituted by at least one halogen, or a trifluoromethyl group; or
- 10 ▪ a heteroaryl group.

More preferably, the compound has formula (I), (Ia), or (Ib) as defined above with R_2 being:

- a radical $(C_1-C_6)alkoxy$ selected from the group consisting of a methoxy group, an ethoxy group and an isopropoxy group, or a phenoxy group, optionally substituted by a fluorine, such as a trifluoromethyl;
- 15 ▪ a halogen selected from the group consisting of a fluorine and a chlorine,
- a R_4 -N- R_5 unit or a $S-(C_1-C_6)alkyl-NR_4R_5$ unit wherein R_4 and R_5 represent a methyl or an ethyl group;
- a $NHCOR_6$ unit wherein R_6 represents a *tert*-butyl group;
- 20 ▪ a radical selected in the group consisting of a thio-methyl group, a thio-ethyl group, a thio-benzyl group, a thio-pyridinyl group and a thio-phenyl group, optionally substituted by at least one fluorine or a trifluoromethyl group;
- a phenyl group optionally substituted by at least one bromine or a trifluoromethyl group; or
- 25 ▪ a heteroaryl group selected from the group consisting of a furan or a triazol.

30 In a very particular aspect, the compound is selected from the group consisting of:

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;

- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-dimethylamino)pyridine-3-yl)-acrylonitrile, hydrochloride;
- 5 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-phenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-phenoxy)pyridin-3-yl)-acrylonitrile;
- 10 - (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(ethylthio)pyridin-3-yl)-acrylonitrile;
- 15 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3-bromophenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(3-bromophenyl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3,4-dimethoxy)thio)pyridin-3-yl)-acrylonitrile;
- 20 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- 25 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;

- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(2-(dimethylamino)ethylthio)pyridin-3-yl)-acrylonitrile;
- 5 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(4-fluorophenoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 10 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(ethylthio)benzonitrile;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- 15 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-cyano-2-(6-methoxy-1H-indol-3-yl)vinyl)-4-methoxybenzonitrile;
- 20 - (Z)-2-(1-acetyl-5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(1-acetyl-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-methyl 3-(5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indol-1-yl)-3-
- 25 oxopropanoate;
- (Z)-2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(4-methylpiperazin-1-yl)ethyl 5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indole-1-carboxylate;
- 30 - ((Z)-3-(2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-tert-butyl 5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indole-1-carboxylate;

- (R,Z)-benzyl-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-4-oxobutanoate;
- (R,Z)-tert-butyl-5-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-5-oxopentanoate;
- 5 - (R,Z)-benzyl-2-amino-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-4-oxobutanoate;
- (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 10 - (S,Z)-3-(2-(1-(3-aminobutanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (Z)-3-(2-(1-(2-aminoacetyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 15 - (Z)-3-(2-(5-bromo-1-(2-(piperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (Z)-3-(2-(5-bromo-1-(2-(2-methoxyethoxy)ethoxy)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (S,Z)-3-(2-(1-(2-amino-3-hydroxypropanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 20 - (Z)-3-(2-(5-bromo-1-(5-oxopyrrolidine-2-carbonyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (R,Z)-3-(2-(5-bromo-1-(2,6-diaminohexanoyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile dihydrochloride;
- 25 - (Z)-3-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-3-oxopropyl dihydrogen phosphate;

and their pharmaceutically acceptable salts.

More preferably, the compound is selected from the group consisting of:

- 30 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-dimethylamino)pyridine-3-yl)-acrylonitrile, hydrochloride;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- 5 - (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-phenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-phenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- 10 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(ethylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3-bromophenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(3-bromophenyl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- 15 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3,4-dimethoxy)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- 20 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- 25 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- 30 - (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(2-(dimethylamino)ethylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(4-fluorophenoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 5 - (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(ethylthio)benzonitrile;
- 10 - (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- 15 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-cyano-2-(6-methoxy-1H-indol-3-yl)vinyl)-4-methoxybenzonitrile;

and their pharmaceutically acceptable salts.

Even more preferably, the compound is selected from the group consisting of:

- 20 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- 25 - (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;

and their pharmaceutically acceptable salts. The present invention also relates to a compound of the formula (I) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile for use as a drug.

The present invention further relates to a pharmaceutical composition comprising as an active ingredient one compound of the formula (I) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile.

Preferably, the pharmaceutical composition of the present invention is for use in the treatment of cancer.

Optionally, the pharmaceutical composition of the present invention further comprises an additional antitumoral drug, preferably selected from the group consisting of an inhibitor of topoisomerases I or II, a DNA alkylating agent, an anti-metabolic agent, a targeted agent

such as a kinase inhibitor, and/or a therapeutical antibody designed to mediate cytotoxicity against the cancer cells or to modulate one of their key biological functions.

More preferably, the pharmaceutical composition of the present invention is for use for treating cancer in combination with radiotherapy, hyperthermia, surgery (e.g., tumor 5 resection) and/or other antitumoral therapies or before, simultaneously or after surgery (e.g., tumor resection).

In addition, the present invention relates to a kit comprising (a) a compound of the present invention; and (b) an additional antitumoral drug as a combined preparation for simultaneous, separate or sequential use, in particular in the treatment of cancer.

10 Advantageously, the pharmaceutical composition of the present invention is for use in the treatment of viral infections, particularly, HIV infection, HTLV infection or HPV infection.

More advantageously, the pharmaceutical composition of the present invention is for use in the treatment of lung diseases, particularly the treatment of pulmonary hypertension.

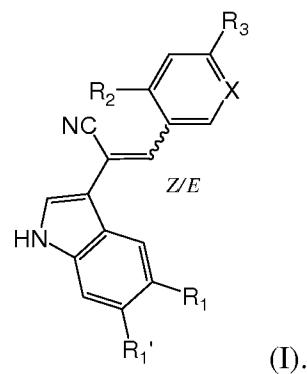
15 More advantageously, the pharmaceutical composition of the present invention is for use in the treatment of pathologies associated with dysregulation of MKlp2 or for use in the treatment of pathologies in which the MKlp2 pathway is dysregulated.

The present invention also concerns the use of a compound of the formula (I) as defined above as a research pharmacological tool.

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DETAILED DESCRIPTION OF THE INVENTION

The inventors identified a new class of derivatives of indoles of the formula (I):

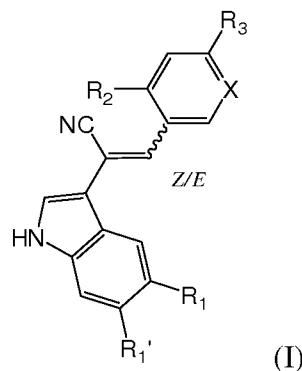


This new class of compounds presents a therapeutic interest, in particular as effective 25 inhibitors of MKlp2, and consequently, can be used as a drug, for instance for treating cancer, viral infections, lung diseases or pathologies associated with dysregulation of MKlp2 or its pathway.

The inventors, surprisingly, discovered that compounds both substituted in R₁ and R₂ leads to greater MKlp2 inhibition compared to the compounds disclosed in patent application WO 2010/150211.

In particular, a better MKlp2 inhibition profile is surprisingly observed with 5 compounds of the formula (I) of the present invention, wherein R₁ or R_{1'} represents a (C₁-C₃)-alkoxy group or a halogen while R₂ substituent is present and distinct from a C₁-C₃ alkyl group.

Accordingly, the present invention relates to compound of formula (I):



10

wherein :

- X represents a nitrogen atom, a C-CN unit or a N⁺-O⁻ unit, preferably a nitrogen atom or a C-CN unit;
- R₁ and R_{1'} are such that one is H and the other represents a halogen or a (C₁-C₆)alkoxy group, optionally substituted by a carboxylic group or one -NR₁₁R₁₂ unit wherein R₁₁ and R₁₂ represent H or a (C₁-C₆)alkyl group or R₁₁ and R₁₂ taken together form a 3- to 7-membered ring optionally interrupted by one or several heteroatoms;
- R₂ represents:
 - a radical (C₁-C₆)alkoxy, (C₃-C₆)cycloalkoxy, aryloxy, heteroaryloxy, (C₁-C₆)alkyl-aryloxy, (C₁-C₆)alkyl-heteroaryloxy, said radicals being optionally substituted by at least one halogen,
 - a hydroxy,
 - a halogen,
 - a -NR₄R₅ unit, a O-(C₁-C₆)alkyl-NR₄R₅ unit or a S-(C₁-C₆)alkyl-NR₄R₅ unit wherein R₄ and R₅ represent H or a (C₁-C₆)alkyl group, or R₄ and R₅ taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, with the proviso that at least one among R₄ and R₅ is not H,

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- a NHCOR_6 unit wherein R_6 represents $(\text{C}_1\text{-}\text{C}_6)\text{alkyl}$ group,
- a radical thio- $(\text{C}_1\text{-}\text{C}_6)\text{alkyl}$, thio-aryl, thio-heteroaryl, thio- $(\text{C}_1\text{-}\text{C}_6)\text{alkyl-aryl}$ or thio- $(\text{C}_1\text{-}\text{C}_6)\text{-alkyl-heteroaryl}$, said radicals being optionally substituted by at least one halogen or by a $(\text{C}_1\text{-}\text{C}_6)\text{alkoxy}$ group,
- 5 ▪ an aryl group optionally substituted by at least one halogen, a trifluoromethyl group, or a $(\text{C}_1\text{-}\text{C}_3)\text{alkoxy}$ group, or
- a heteroaryl group, eventually substituted by a halogen, a trifluoromethyl group or a $(\text{C}_1\text{-}\text{C}_3)\text{alkoxy}$ group,

with the proviso that if R_1 or R_1' is a $(\text{C}_1\text{-}\text{C}_3)\text{alkoxy}$ group, then R_2 is not a halogen; and

- R_3 represents a hydrogen, a $(\text{C}_1\text{-}\text{C}_3)\text{alkyl}$ group, a $(\text{C}_1\text{-}\text{C}_3)\text{alkoxy}$ group or a halogen, advantageously a fluorine;

or one of its pharmaceutically acceptable salts.

In a preferred embodiment, the compound of formula (I) is not $(\text{Z})\text{-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile}$. In an alternative embodiment, the compound of formula (I) is such that R_2 is not an ethoxy group.

In a particular embodiment, when R_1 or R_1' is a $(\text{C}_1\text{-}\text{C}_6)\text{alkoxy}$ group, optionally substituted by one $\text{R}_{11}\text{-N-}\text{R}_{12}$ unit as above defined or a carboxylic group, then R_2 is not a halogen the compound of formula (I).

20 In a preferred embodiment, R_1 and R_1' are such that one represents a halogen or a $(\text{C}_1\text{-}\text{C}_3)\text{alkoxy}$ group, optionally substituted by a carboxylic group or one $\text{R}_{11}\text{-N-}\text{R}_{12}$ unit as above defined. In a more preferred embodiment, R_1 and R_1' are such that one represents a halogen or a $(\text{C}_1\text{-}\text{C}_3)\text{alkoxy}$ group.

The present invention also relates to prodrugs of the compounds disclosed in the 25 present application, preferably prodrugs in which the the nitrogen atom of the indole core is substituted. According, the present invention relates to prodrugs in which the nitrogen atom of the indole core is substituted by a group selected from the group consisting of a COR_7 and a CO_2R_7 group, wherein R_7 represents:

30 - a $(\text{C}_1\text{-}\text{C}_6)\text{alkyl}$ group, optionally substituted by at least a hydroxy group, a $(\text{C}_1\text{-}\text{C}_6)\text{alkyloxy}$ group, a $(\text{C}_1\text{-}\text{C}_6)_n\text{polyalkyloxy}$ group wherein n is $1 < n < 6$, a phosphate or pyrophosphate group and salts or $(\text{C}_1\text{-}\text{C}_3)\text{alkyl}$ ester thereof, a R_8 group, a $-\text{NHCO}_2\text{R}_8$ unit, a COR_8 group, or a CO_2R_8 group, wherein R_8 is:

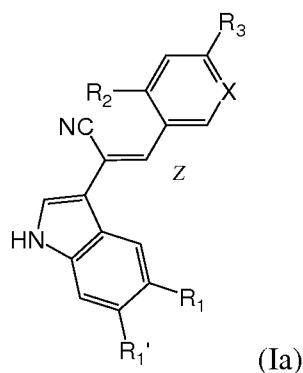
- a $(\text{C}_1\text{-}\text{C}_6)\text{alkyl}$ group,
- an aryl, a $(\text{C}_1\text{-}\text{C}_6)\text{alkylaryl}$, or a heteroaryl,

- a NR_9R_{10} unit wherein R_9 and R_{10} represent a hydrogen, a $(\text{C}_1\text{-}\text{C}_6)$ alkyl group, or R_9 and R_{10} taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, and optionally the ring being substituted by at least one $(\text{C}_1\text{-}\text{C}_6)$ alkyl group;

5 - a $\text{NH-NR}_9\text{R}_{10}$ unit wherein R_9 and R_{10} are such as defined above; or

- a saturated heterocycle or a heteroaryl.

In a particular embodiment, the present invention relates to compounds of formula (Ia):

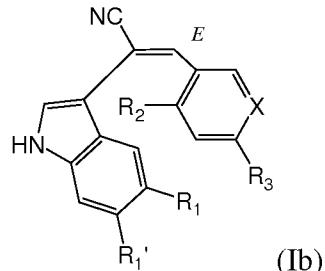


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(Ia)

wherein X, R_1 , $\text{R}_{1'}$, R_2 , R_3 , R_4 , R_5 and R_6 are such as defined above. It also relates to prodrugs thereof as defined in the present document.

In another particular embodiment, the present invention relates to compounds of formula (Ib):

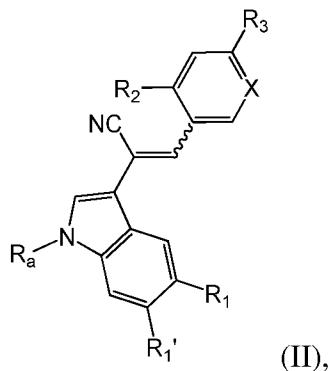


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(Ib)

wherein X, R_1 , $\text{R}_{1'}$, R_2 , R_3 , R_4 , R_5 and R_6 are such as defined above. It also relates to prodrugs thereof as defined in the present document.

In another particular embodiment, the present invention relates to compounds of formula (II):



wherein X, R₁, R_{1'}, R₂, R₃, R₄, R₅ and R₆ are such as defined above, and R_a is a group selected from the group consisting of a COR₇ and a CO₂R₇ group, wherein R₇ represents:

- a (C₁-C₆)alkyl group, optionally substituted by at least a hydroxy group, a (C₁-C₆)alkyloxy group, a (C₁-C₆)_npolyalkyloxy group wherein n is 1<n<6, a phosphate or pyrophosphate group and salts or (C₁-C₃)alkyl ester thereof, a R₈ group, a -NHCO₂R₈ unit, a COR₈ group, or a CO₂R₈ group, wherein R₈ is:

- a (C₁-C₆)alkyl group,

- an aryl, a (C₁-C₆)alkylaryl, or a heteroaryl,

- a NR₉R₁₀ unit wherein R₉ and R₁₀ represent a hydrogen, a (C₁-C₆)alkyl group, or R₉ and R₁₀ taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, and optionally the ring being substituted by at least one (C₁-C₆)alkyl group;

- a NH-NR₉R₁₀ unit wherein R₉ and R₁₀ are such as defined above; or

- a saturated heterocycle or a heteroaryl;

or one of its pharmaceutically acceptable salts.

According to the present invention, the terms below have the following meanings:

The terms mentioned herein with prefixes such as for example C₁-C₃ or C₁-C₆ can also be used with lower numbers of carbon atoms such as C₁-C₂ or C₁-C₅. If, for example, the term C₁-C₃ is used, it means that the corresponding hydrocarbon chain may comprise from 1 to 3 carbon atoms, especially 1, 2 or 3 carbon atoms. If, for example, the term C₁-C₆ is used, it means that the corresponding hydrocarbon chain may comprise from 1 to 6 carbon atoms, especially 1, 2, 3, 4, 5 or 6 carbon atoms.

The term “alkyl” refers to a saturated, linear or branched aliphatic group. The term “(C₁-C₃)alkyl” more specifically means methyl (also called “Me”), ethyl (also called “Et”), propyl, or isopropyl, the term “(C₁-C₆)alkyl” more specifically means methyl, ethyl, propyl, isopropyl, butyl, isobutyl, *tert*-butyl or propyl, pentyl or hexyl.

The term “halogen” corresponds to a fluorine, chlorine, bromine, or iodine atom, preferably a fluorine, chlorine or bromine, and more preferably a chlorine or a bromine.

The term “alkoxy” or “alkyloxy” corresponds to the alkyl group defined hereinabove bonded to the molecule by an -O- (ether) bond. (C₁-C₃)alkoxy includes methoxy, ethoxy, 5 propyloxy, and isopropyloxy. (C₁-C₆)alkoxy includes methoxy, ethoxy, propyloxy, isopropyloxy, butyloxy, isobutyloxy, *tert*-butyloxy, pentyloxy and hexyloxy. The term (C₁-C₆)_npolyalkyloxy corresponds to n (C₁-C₆)alkyloxy bounded thereby forming a linear poly(C₁-C₆)alkylene glycol chain, preferably a linear polyethylene glycol chain. Preferably, n is 1<n<6.

10 The term “thio” corresponds to the alkyl group defined hereinabove bounded to the molecule by a -S- (thioether) bound. Thio-(C₁-C₆)alkyl group includes thio-methyl, thio-ethyl, thio-propyl, thio-butyl, thio-pentyl and thio-hexyl.

The term “aryl” is mono- or bi-cyclic aromatic hydrocarbons having from 6 to 12 carbon atoms, optionally substituted. Aryl may be a phenyl (also called “Ph”), biphenyl or 15 naphthyl. In a preferred embodiment, the aryl is a phenyl.

The term “heteroaryl” as used herein corresponds to an aromatic, mono- or poly-cyclic group comprising between 5 and 14 atoms and comprising at least one heteroatom such as nitrogen, oxygen or sulphur atom. Examples of such mono- and poly-cyclic heteroaryl group may be: pyridyl, dihydropyridyl, thiazolyl, thiophenyl, furanyl, azocinyl, pyranyl, pyrrolyl, 20 pyrazolyl, imidazolyl, triazolyl, tetrazolyl, benzofuranyl, thianaphthalenyl, indolyl, indolenyl, quinolinyl, isoquinolinyl, benzimidazolyl, pyrrolinyl, tetrahydroquinolinyl, tetrahydroisoquinolinyl, triazinyl, 6H-1,2,5-thiadiazinyl, 2H,6H-1,5,2-dithiazinyl, thianthrenyl, isobenzofuranyl, chromenyl, xanthenyl, phenoxyanthinyl, 2H-pyrrolyl, isothiazolyl, isoxazolyl, pyrazinyl, pyridazinyl, indolizinyl, isoindolyl, 3H-indolyl, 1- 25 Hindazolyl, purinyl, 4H-quinolizinyl, phtalazinyl, naphthyridinyl, quinoxalinyl, quinazolinyl, cinnolinyl, pteridinyl, 4aH-carbazolyl, carbazolyl, β -carbolinyl, phenanthridinyl, acridinyl, pyrimidinyl, phenanthrolinyl, phenazinyl, phenothiazinyl, furazanyl, phenoxyazinyl, isochromanyl, chromanyl, imidazolidinyl, imidazolinyl, pyrazolidinyl, pyrazolinyl, indolinyl, isoindolinyl, oxazolidinyl, benzotriazolyl, benzisoxazolyl, oxindolyl, benzoxazolinyl, 30 benzothienyl, benzothiazolyl, isatinyl, dihydropyridyl, pyrimidinyl, pyrazinyl, s-triazinyl, oxazolyl, thiofuranyl. In a preferred embodiment heteroaryl is an aromatic monocyclic comprising 5 or 6 atoms and comprising at least one heteroatom such as nitrogen, oxygen or sulphur atom. Preferably, heteroaryl is pyridyl, thiazolyl, furanyl, pyranyl, pyrrolyl,

imidazolyl, tetrazolyl, benzofuranyl, pyrrolinyl, triazinyl, pyrazinyl, pyridazinyl, triazolyl or tetrazolyl. More preferably, heteroaryl is furanyl or triazolyl.

(C₃-C₆)cycloalkoxy includes cyclopropoxy, cyclobutoxy, cyclopentoxy and cyclohexoxy, (C₃-C₆)cycloalkyl includes cyclopropyl, cyclobutyl, cyclopentyl and 5 cyclohexyl.

The term “saturated heterocycle” as used herein corresponds to a non-aromatic mono- or poly-cyclic group comprising between 5 and 14 atoms and comprising at least one heteroatom such as nitrogen, oxygen or sulphur atom. Examples of such heterocycle may be cyclohexanyl, tetrahydrofuranyl, pyrrolidinyl, piperidinyl, dioxanyl, morpholinyl, piperazinyl. 10 Particularly, the saturated heterocycle may be substituted, for instance by a ketone. More preferably, the saturated heterocycle is oxopyrrolidinyl.

The expression “substituted by at least” means that the radical is substituted by one or several groups of the list.

By “R_x-N-R_y” is intended to refer to a unit “-NR_xR_y”.

15 The terms “carboxylic” “Boc” and “Cbz” respectively correspond to the following groups “-COOH”, “-C(=O)-O-C(CH₃)₃” and ““-C(=O)-O-CH₂Phenyl”.

The expression “with the proviso that if R₁ or R₁’ is a (C₁-C₃)alkoxy group, then R₂ is not a halogen” or “with the proviso that if R₁ or R₁’ is a (C₁-C₆)alkoxy group optionally substituted by one R₁₁-N-R₁₂ unit as above defined or a carboxylic group, then R₂ is not a 20 halogen” means that, when R₁ or R₁’ is a (C₁-C₃)alkoxy group or when R₁ or R₁’ is a (C₁-C₆)alkoxy group, optionally substituted by one R₁₁-N-R₁₂ unit or a carboxylic group, as above defined, R₂ represents:

- a radical (C₁-C₆)alkoxy, (C₃-C₆)cycloalkoxy, aryloxy, heteroaryloxy, (C₁-C₆)alkyl-aryloxy, (C₁-C₆)alkyl-heteroaryloxy, said radicals being optionally substituted by at least one halogen,
- a R₄-N-R₅ unit, a O-(C₁-C₆)alkyl-NR₄R₅ unit or a S-(C₁-C₆)alkyl-NR₄R₅ unit wherein R₄ and R₅ represent H, or a (C₁-C₆)alkyl group, or R₄ and R₅ taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, with the proviso that at least one among R₄ and R₅ is not H,
- a NHCOR₆ unit wherein R₆ represents (C₁-C₆)alkyl group,
- a radical thio-(C₁-C₆)alkyl, thio-aryl, thio-heteroaryl, thio-(C₁-C₆)alkyl-aryl or thio-(C₁-C₆)-alkyl-heteroaryl, said radicals being optionally substituted by at least one halogen or by a (C₁-C₆)alkoxy group,

- an aryl group optionally substituted by at least one halogen, a trifluoromethyl group, or a (C₁-C₃)alkoxy group, or
- a heteroaryl group, eventually substituted by a halogen, a trifluoromethyl group or a (C₁-C₃)alkoxy group.

5 The pharmaceutically acceptable salts include inorganic as well as organic acids salts. Representative examples of suitable inorganic acids include hydrochloric, hydrobromic, hydroiodic, phosphoric, and the like. Representative examples of suitable organic acids include formic, acetic, trichloroacetic, trifluoroacetic, propionic, benzoic, cinnamic, citric, fumaric, maleic, methanesulfonic and the like. Further examples of pharmaceutically acceptable inorganic or organic acid addition salts include the pharmaceutically acceptable salts listed in J. Pharm. Sci. 1977, 66, 2, and in Handbook of Pharmaceutical Salts: Properties, Selection, and Use edited by P. Heinrich Stahl and Camille G. Wermuth 2002. In a preferred embodiment, the salt is selected from the group consisting of maleate, chlorhydrate, bromhydrate, and methanesulfonate.

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R₁ and R₁' are such that one is H and the other represents a halogen or a (C₁-C₆)alkoxy group, optionally substituted by one R₁₁-N-R₁₂ unit as above defined, or a carboxylic group. Preferably, R₁' or R₁ represents a halogen, typically, a bromine, a chlorine or a fluorine, advantageously a bromine or a chlorine, more specifically a bromine. Alternatively, R₁' or R₁ 20 represent a (C₁-C₆)alkoxy group optionally substituted by one R₁₁-N-R₁₂ unit as above defined or a carboxylic group, preferably a (C₁-C₃)alkoxy group optionally substituted by one R₁₁-N-R₁₂ unit as above defined or a carboxylic group, more preferably a (C₁-C₃)alkoxy group, advantageously a methoxy, an ethoxy or an isopropoxy, more advantageously a methoxy. R₁₁ and R₁₂ are such as defined above and preferably represent a (C₁-C₃)alkyl 25 group, and more preferably, a methyl or an ethyl group.

In a preferred embodiment, R₁' is H. In another preferred embodiment, R₁' is a halogen chosen among a bromine, a chlorine, or a fluorine, and R₁ is H.

Particularly, R₂ represents:

30

- a radical (C₁-C₆)alkoxy or phenoxy, said radicals being optionally substituted by at least one halogen, preferably a bromine, a chlorine or a fluorine, more preferably a fluorine, such as a trifluoromethyl;
- a halogen, preferably a bromine, a chlorine, or a fluorine, more preferably a bromine or a chlorine;

- a R_4 -N- R_5 unit or a $S-(C_1-C_6)alkyl-NR_4R_5$ unit, wherein R_4 and R_5 represent H or a $(C_1-C_6)alkyl$ group, with the proviso that at least one among R_4 and R_5 is not H,
- a $NHCOR_6$ unit wherein R_6 represents $(C_1-C_6)alkyl$ group, advantageously a methyl, an ethyl or a *tert*-butyl;
- a radical $thio-(C_1-C_6)alkyl$, $thio-aryl$, $thio-heteroaryl$, $thio-(C_1-C_6)alkyl-aryl$, said radicals being optionally substituted by at least one halogen, a trifluoromethyl, or by a $(C_1-C_6)alkoxy$ group;
- an aryl group optionally substituted by at least one halogen, or a trifluoromethyl group; or
- a heteroaryl group, advantageously a furan, a triazol, a pyridin, a thiazol, a pyran, a pyrrol, an imidazol, a tetrazol, a benzofuran, triazinyl, pyrazinyl, a pyridazin, or a tetrazol.

In a particular embodiment in which R_2 represents a radical $(C_1-C_6)alkoxy$, the radical 15 $(C_1-C_6)alkoxy$ is selected from the group consisting of a methoxy, propoxy, butoxy, pentoxy and hexoxy.

Preferably, R_2 represents:

- a radical $(C_1-C_6)alkoxy$ selected from the group consisting of a methoxy group, an ethoxy group, and an isopropoxy group, preferably selected from the group consisting of a methoxy group, and an isopropoxy group, or a phenoxy group, optionally substituted by a fluorine, such as a trifluoromethyl;
- a halogen selected from the group consisting of a fluorine and a chlorine,
- a R_4 -N- R_5 unit or a $S-(C_1-C_6)alkyl-NR_4R_5$ unit wherein R_4 and R_5 represent a methyl or an ethyl group;
- a radical selected from the group consisting of a thio-methyl group, a thio-ethyl group, a thio-benzyl group, a thio-pyridinyl group and a thio-phenyl group, optionally substituted by at least one fluorine or a trifluoromethyl group;
- a phenyl group optionally substituted by at least one bromine or a trifluoromethyl group; or
- a heteroaryl group selected from the group consisting of a furan or a triazol.

Particularly, R_3 represents a hydrogen; a (C_1 - C_3)alkyl group, preferably a methyl, an ethyl or an isopropyl; a (C_1 - C_3)alkoxy group, preferably a methoxy, an ethoxy or an isopropoxy; or a halogen, advantageously a fluorine. Preferably, R_3 is H, methoxy or fluorine. More preferably, R_3 is H.

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In a particular embodiment of the invention:

- R_1' or R_1 represents a halogen, typically a bromine, a chlorine or a fluorine, advantageously a bromine or a chlorine, more specifically a bromine. In a particular embodiment, R_1' is H. Alternatively R_1' is a halogen chosen among a bromine, a chlorine, or a fluorine, and R_1 is H.
- R_2 represents:
 - a radical (C_1 - C_6)alkoxy, preferably a methoxy, an ethoxy, or an isopropoxy, more preferably a methoxy, or isopropoxy group, and a phenoxy optionally substituted by a fluorine, such as a trifluoromethyl; or
 - a halogen, advantageously a fluorine and a chlorine, more advantageously a chlorine; or
 - a R_4 -N- R_5 unit or a S -(C_1 - C_6)alkyl- NR_4R_5 unit wherein R_4 and R_5 represent a (C_1 - C_6)alkyl group, preferably a methyl or an ethyl group; or
 - a radical thio-(C_1 - C_6)alkyl, preferably a thio-methyl or a thio-ethyl; a radical thio-aryl, preferably a thio-phenyl; a radical thio-heteraryl, preferably, a thio-pyridinyl; or a radical thio-(C_1 - C_6)alkyl-aryl, preferably a thio-benzyl; said radicals being optionally substituted by at least a halogen, preferably a fluorine, a trifluoromethyl, or by a (C_1 - C_6)alkoxy group, preferably a methoxy, ethoxy, isopropoxy, more preferably a methoxy;
 - a phenyl group optionally substituted by at least one halogen, preferably a bromine, or a trifluoromethyl group; or
 - a heteraryl group, preferably a furan, a triazol, a pyridin, a thiazol, a pyran, a pyrrol, an imidazol, a benzofuran, a triazol, or a tetrazol, and more preferably a furan or a triazol; and optionally,
- R_3 represents a hydrogen or a (C_1 - C_3)alkyl group, preferably a methyl, an ethyl or an isopropyl; a (C_1 - C_3)alkoxy group, preferably a methoxy, an ethoxy or an isopropoxy; or a halogen, advantageously a fluorine. Preferably, R_3 is H, methoxy or fluorine. More preferably, R_3 is H.

In another particular embodiment of the invention

- R_1' or R_1 represents a (C_1-C_6) alkoxy group optionally substituted by one $R_{11}-N-R_{12}$ unit as above defined or a carboxylic group, preferably a (C_1-C_3) alkoxy group optionally substituted by one $R_{11}-N-R_{12}$ unit as above defined, preferably wherein R_4 and R_5 represent a (C_1-C_3) alkyl group and more preferably a methyl or an ethyl group, or carboxylic group, more preferably a (C_1-C_3) alkoxy group, still more preferably a methoxy. Advantageously, R_1' is H. Alternatively R_1' is a halogen chosen among a bromine, a chlorine, or a fluorine, and R_1 is H. Optionally, R_1' is a methoxy and R_1 is H.
- R_2 represents:
 - a radical (C_1-C_6) alkoxy, preferably a methoxy, an ethoxy or an isopropoxy, more preferably a methoxy or an ethoxy, still more preferably a methoxy; or a phenoxy group, optionally substituted by a fluorine, such as a trifluoromethyl; or
 - a R_4-N-R_5 unit or a $S-(C_1-C_6)alkyl-NR_4R_5$ unit wherein R_4 and R_5 represent a (C_1-C_6) alkyl group, preferably a methyl or an ethyl group; or
 - a radical thio- (C_1-C_6) alkyl, preferably, a thio-methyl or a thio-ethyl; a radical thio-aryl, preferably a thio-phenyl; a radical thio-heteraryl, preferably, a thio-pyridinyl; or a radical thio- (C_1-C_6) alkyl-aryl, preferably a thio-benzyl; said radicals being optionally substituted by at least a halogen, preferably a fluorine, a trifluoromethyl, or by a (C_1-C_6) alkoxy group, preferably a methoxy, ethoxy, isopropoxy, more preferably a methoxy;
 - a phenyl group optionally substituted by at least one halogen, preferably a bromine, or a trifluoromethyl group; or
 - a heteraryl group, preferably a furan, a triazol, a pyridin, a thiazol, a pyran, a pyrrol, an imidazol, a benzofuran, a pyridazin, or a tetrazol, and more preferably a furan or a triazol; and
- R_3 represents a hydrogen or a (C_1-C_3) alkyl group, preferably a methyl, an ethyl or an isopropyl; a (C_1-C_3) alkoxy group, preferably a methoxy, an ethoxy or an isopropoxy; or a halogen, advantageously a fluorine. More preferably R_3 is H.

The present invention also relates to compounds of formula (II) as above defined.

In a particular embodiment of the invention, R_a is a group selected from the group consisting of a COR₇ and a CO₂R₇ group and R₇ represents a (C₁-C₆)alkyl group, preferably a methyl group or a tert-butyl group.

In another particular embodiment, R_a is a group selected from the group consisting of a 5 COR₇ and a CO₂R₇ group and R₇ is a (C₁-C₆)alkyl group, preferably a methyl, ethyl, propyl group or tert-butyl group, optionally substituted by at least:

- a hydroxy group,

- a (C₁-C₆)_npolyalkyloxy group with n=3,

- a R₈ group, a -NHCO₂R₈ unit, a COR₈ group, or a CO₂R₈ group wherein R₈ is 10 such as defined above. Preferably, R₈ is:

- a (C₁-C₆)alkyl group, preferably a methyl or a tert-butyl group,

- a (C₁-C₆)alkylaryl, preferably, a benzyl group,

- a NR₉R₁₀ unit wherein R₉ and R₁₀ preferably represent a hydrogen, a 15 methyl group or R₉ and R₁₀ taken together form piperazinyl ring, optionally substituted by a

- a phosphate or pyrophosphate group or a salt thereof, preferably a phosphate group.

In another particular embodiment, R₇ represents:

- a NH-NR₉R₁₀ unit wherein R₉ and R₁₀ are hydrogen, or

20 - a saturated heterocycle, preferably oxopyrrolidinyl.

In a preferred embodiment, R_a is a group selected from the group consisting of a COR₇ and a CO₂R₇ group and R₇ represents a methyl or a tert-butyl group, a (C₁-C₃)alkyl substituted by at least one group selected from the group consisting of a CO₂CH₃, N(CH₃)₂, piperazinyl-CH₃, NHBOC, Cbz, Boc, NH₂ and phosphate group.

25 Among the compounds according to the present invention, the following list of compounds may be cited:

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;

30 - (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-dimethylamino)pyridine-3-yl)-acrylonitrile, hydrochloride;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- 5 - (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethylthio)pyridin-3-yl)-acrylonitrile;
- 10 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3-bromophenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(3-bromophenyl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3,4-dimethoxy)thio)pyridin-3-yl)-acrylonitrile;
- 15 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- 20 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- 25 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- 30 - (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(2-(dimethylamino)ethylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(4-fluorophenoxy)benzonitrile;

- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 5 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(ethylthio)benzonitrile;
- (Z)-N-(3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)pyridin-4-yl)pivalamide;
- (Z)-N-(3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)pyridin-4-yl)pivalamide;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- 10 - (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-hydroxypyridin-3-yl)acrylonitrile;
- 15 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-hydroxybenzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-cyano-2-(6-methoxy-1H-indol-3-yl)vinyl)-4-methoxybenzonitrile;
- (Z)-2-(1-acetyl-5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- 20 - (Z)-3-(2-(1-acetyl-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-methyl 3-(5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indol-1-yl)-3-oxopropanoate;
- 25 - (Z)-2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(4-methylpiperazin-1-yl)ethyl 5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indole-1-carboxylate;
- ((Z)-3-(2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 30 - (Z)-tert-butyl 5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indole-1-carboxylate;
- (R,Z)-benzyl-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-4-oxobutanoate;

- (R,Z)-tert-butyl-5-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-5-oxopentanoate;
- (R,Z)-benzyl-2-amino-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-4-oxobutanoate;
- 5 - (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (S,Z)-3-(2-(1-(3-aminobutanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 10 - (Z)-3-(2-(1-(2-aminoacetyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (Z)-3-(2-(5-bromo-1-(2-(piperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 15 - (Z)-3-(2-(5-bromo-1-(2-(2-methoxyethoxy)ethoxy)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (S,Z)-3-(2-(1-(2-amino-3-hydroxypropanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (Z)-3-(2-(5-bromo-1-(5-oxopyrrolidine-2-carbonyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 20 - (R,Z)-3-(2-(5-bromo-1-(2,6-diaminohexanoyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile dihydrochloride;
- (Z)-3-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-3-oxopropyl dihydrogen phosphate;
- 25 and their pharmaceutically acceptable salts.

Preferably, the following list of compounds may be cited:

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-dimethylamino)pyridine-3-yl)-acrylonitrile, hydrochloride;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- 5 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methylthio)pyridin-3-yl)-acrylonitrile;
- 10 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3-bromophenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(3-bromophenyl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- 15 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3,4-dimethoxy)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-
- 20 acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- 25 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(2-(dimethylamino)ethylthio)pyridin-3-yl)-acrylonitrile;

- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(4-fluorophenoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- 5 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(ethylthio)benzonitrile;
- (Z)-N-(3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)pyridin-4-yl)pivalamide;
- (Z)-N-(3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)pyridin-4-yl)pivalamide;
- 10 - (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- 15 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-hydroxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-hydroxybenzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-cyano-2-(6-methoxy-1H-indol-3-yl)vinyl)-4-methoxybenzonitrile;

20 and their pharmaceutically acceptable salts.

More preferably, the following list of compounds may be cited:

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- 25 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- 5 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;(Z)-2-(5-10 chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- 15 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- 20 - (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- 25 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;

and their pharmaceutically acceptable salts.

More preferably, the following list of compounds may be cited:

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- 5 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 10 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- 15 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;

and their pharmaceutically acceptable salts.

20 In another embodiment, compounds are chosen from the group consisting of:

- (Z)-2-(1-acetyl-5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(1-acetyl-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 25 - (Z)-methyl 3-(5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indol-1-yl)-3-oxopropanoate;
- (Z)-2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(4-methylpiperazin-1-yl)ethyl 5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indole-1-carboxylate;
- 30 - ((Z)-3-(2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-tert-butyl 5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indole-1-carboxylate;

- (R,Z)-benzyl-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-4-oxobutanoate;
- (R,Z)-tert-butyl-5-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-5-oxopentanoate;
- 5 - (R,Z)-benzyl-2-amino-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-4-oxobutanoate;
- (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 10 - (S,Z)-3-(2-(1-(3-aminobutanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (Z)-3-(2-(1-(2-aminoacetyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 15 - (Z)-3-(2-(5-bromo-1-(2-(piperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (Z)-3-(2-(5-bromo-1-(2-(2-methoxyethoxy)ethoxy)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (S,Z)-3-(2-(1-(2-amino-3-hydroxypropanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 20 - (Z)-3-(2-(5-bromo-1-(5-oxopyrrolidine-2-carbonyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (R,Z)-3-(2-(5-bromo-1-(2,6-diaminohexanoyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile dihydrochloride;
- 25 - (Z)-3-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-3-oxopropyl dihydrogen phosphate;

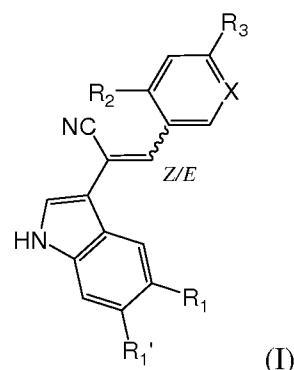
and their pharmaceutically acceptable salts.

Preferably, compounds are chosen from the group consisting of:

- 30 - (Z)-2-(1-acetyl-5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(1-acetyl-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;

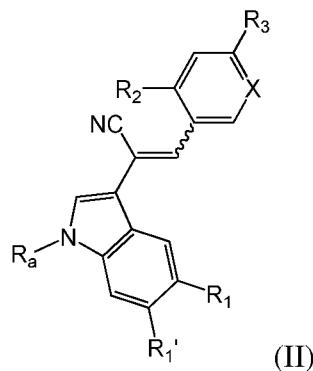
- (Z)-methyl 3-(5-bromo-3-(1-cyano-2-yl)-3-oxopropanoate; (4-methoxypyridin-3-yl)vinyl)-1*H*-indol-1-yl);
- (Z)-2-(5-bromo-1-(2-(dimethylamino)acetyl)-1*H*-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- 5 - (Z)-2-(4-methylpiperazin-1-yl)ethyl 5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1*H*-indole-1-carboxylate;
- ((Z)-3-(2-(5-bromo-1-(2-(dimethylamino)acetyl)-1*H*-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-tert-butyl 5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1*H*-indole-1-carboxylate;
- 10 - (R,Z)-benzyl-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1*H*-indol-1-yl)-2-(tert-butoxycarbonylamino)-4-oxobutanoate;
- (R,Z)-tert-butyl-5-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1*H*-indol-1-yl)-2-(tert-butoxycarbonylamino)-5-oxopentanoate;
- 15 - (R,Z)-benzyl-2-amino-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1*H*-indol-1-yl)-4-oxobutanoate;
- (R,Z)-3-(2-(5-bromo-1-(2,6-diaminohexanoyl)-1*H*-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile dihydrochloride;
- (Z)-3-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1*H*-indol-1-yl)-3-oxopropyl dihydrogen phosphate;
- 20 and their pharmaceutically acceptable salts.

The chemical structures of some compounds of formula (I) and (II) of the invention are illustrated in the following Tables I and II.

Table I

	X	R1	R1'	R2	R3	Z/E
W02010/150211 Example 1	N	H	H	H	H	Z
W02010/150211 Example 4	N	-O-CH ₃	H	H	H	Z
W02010/150211 Example 22	N	-O-CH ₂ -CH ₃	H	H	H	Z
W02010/150211 Example 23	N	-O-CH-(CH ₃) ₂	H	H	H	Z
W02010/150211 Example 24	N	-Cl	H	H	H	Z
W02010/150211 Example 28	N	-O-CH ₃	H	H	-F	Z
W02010/150211 Example 31	N	-O-CH ₃	H	-CH ₃	H	Z
W02010/150211 Example 47	N	-O-CH ₃	H	-Cl	H	Z
W02010/150211 Example 37	N	-Br	H	H	H	Z
W02010/150211 Example 26	N	H	-O-CH ₃	H	H	Z
W02010/150211 Example 52	N	-O-CH ₃	H	H	-O-CH ₃	Z
W02010/150211 Example 30	C-CN	-O-CH ₃	H	H	H	Z
Example 2	N	-O-CH ₃	H	-O-CH ₂ -CH ₃	H	Z
Example 3	N	-Cl	H	-Cl	H	Z
Example 4	N	-Br	H	-Cl	H	Z
Example 5	N	-Br	H	-O-CH ₃	H	Z
Example 5b	N	-Br	H	-O-CH ₃	H	E
Example 6	N	-Cl	H	-N-(CH ₃) ₂	H	Z
Example 7	N	-Cl	H	-N-(CH ₃) ₂	H	Z
Example 8	N	-Br	H	-N-(CH ₃) ₂	H	Z
Example 9	N	-Cl	H	-O-CH ₃	H	Z
Example 9b	N	-Cl	H	-O-CH ₃	H	E
Example 10	N	-Cl	H	-O-C ₆ H ₅	H	Z

Example 11	N	-Br	H	-O-C ₆ H ₅	H	Z
Example 12	N	-O-CH ₃	H	-O-CH ₃	H	Z
Example 13	N	-Br	H	-O-CH ₂ -CH ₃	H	Z
Example 14	N	-Br	H	-O-CH-(CH ₃) ₂	H	Z
Example 15	N	-Br	H	-S-CH ₃	H	Z
Example 16	N	-Br	H	-S-CH ₂ -CH ₃	H	Z
Example 17	N	-Br	H	-(C ₆ H ₄)-3-Br	H	Z
Example 18	N	-Cl	H	-(C ₆ H ₄)-3-Br	H	Z
Example 19	N	-Br	H	-S-C ₆ H ₅	H	Z
Example 20	N	-Br	H	-S-CH ₂ -C ₆ H ₅	H	Z
Example 21	N	-Br	H	-S-C ₆ H ₅ -3,4-(-OCH ₃) ₂	H	Z
Example 22	N	-Br	H	-O-C ₆ H ₅ -4-F	H	Z
Example 23	N	-Cl	H	-O-C ₆ H ₅ -4-F	H	Z
Example 24	N	-Br	H	-N-(CH ₂ CH ₃) ₂	H	Z
Example 25	N	-Br	H	-C ₆ H ₅ -4-CF ₃	H	Z
Example 26	N	-Cl	H	-C ₆ H ₅ -4-CF ₃	H	Z
Example 27	N	-Cl	H	-S-C ₆ H ₅ -4-F	H	Z
Example 28	N	-Br	H	-S-C ₆ H ₅ -4-F	H	Z
Example 29	N	-Cl	H	-C ₄ H ₃ O	H	Z
Example 30	N	-Cl	H	-S-C ₅ H ₄ N	H	Z
Example 31	N	-Br	H	-S-C ₅ H ₄ N	H	Z
Example 32	N	-Br	H	-C ₂ H ₂ N ₃	H	Z
Example 33	N	-Cl	H	-C ₂ H ₂ N ₃	H	Z
Example 34	N	-Br	H	-C ₄ H ₃ O	H	Z
Example 34b	N	-Br	H	-C ₄ H ₃ O	H	E
Example 35	N	-Cl	H	-O-CH ₃	H	Z
Example 36	N	-Br	H	-S-(CH ₂) ₂ -N-(CH ₃) ₂	H	Z
Example 37	C-CN	-Br	H	-O-C ₆ H ₅ -4-F	H	Z
Example 38	C-CN	-Br	H	-O-CH ₃	H	Z
Example 38b	C-CN	-Br	H	-O-CH ₃	H	E
Example 39	C-CN	-Br	H	-N-(CH ₃) ₂	H	Z
Example 40	C-CN	-Cl	H	-O-CH ₃	H	Z
Example 41	C-CN	-Cl	H	-N-(CH ₃) ₂	H	Z
Example 42	C-CN	-Cl	H	-S-CH ₂ CH ₃	H	Z
Example 43	N	Br	H	-NH-C(O)C(CH ₃) ₃	H	Z
Example 44	N	Cl	H	-NH-C(O)C(CH ₃) ₃	H	Z
Example 45	N	H	-Br	-O-CH ₃	H	Z
Example 46	N	H	-F	-O-CH ₃	H	Z
Example 47	N	H	-Cl	-O-CH ₃	H	Z
Example 48	N ⁺⁻ O ⁻	-Br	H	-C ₄ H ₃ O	H	Z
Example 49	N ⁺⁻ O ⁻	-Cl	H	-O-CH ₃	H	Z
Example 50	N	Cl	H	-OH	H	Z
Example 51	C-CN	Br	H	-OH	H	Z
Example 52	C-CN	Cl	H	-OCF ₃	H	Z
Example 53	C-CN	Br	H	-OCF ₃	H	Z
Example 54	C-CN	H	-O-CH ₃	-O-CH ₃	H	Z

Table II

	X	R1	R1'	R2	R3	Z/E	Ra
Example 55	N	Br	H	OCH ₃	H	Z	COCH ₃
Example 56	C-CN	Br	H	OCH ₃	H	Z	COCH ₃
Example 57	N	Br	H	OCH ₃	H	Z	COC(CH ₃) ₃
Example 58	C-CN	Br	H	OCH ₃	H	Z	COC(CH ₃) ₃
Example 59	N	Br	H	OCH ₃	H	Z	COCH ₂ CO ₂ CH ₃
Example 60	N	Br	H	OCH ₃	H	Z	CONHN(CH ₃) ₂
Example 61	N	Br	H	OCH ₃	H	Z	COCH ₂ N(CH ₃) ₂
Example 62	N	Br	H	OCH ₃	H	Z	CO ₂ (CH ₂) ₂ -piperazinyl-CH ₃
Example 63	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ N(CH ₃) ₂
Example 64	C-CN	Br	H	OCH ₃	H	Z	CO ₂ C(CH ₃) ₃
Example 65	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ -CH(NHBoc)Cbz
Example 66	C-CN	Br	H	OCH ₃	H	Z	CO(CH ₂) ₂ -CH(Boc)-NH ₂
Example 67	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ -CH(NH ₂)-Cbz
Example 68	C-CN	Br	H	OCH ₃	H	Z	CO-CH ₂ -piperazinyl-CH ₃
Example 69	C-CN	Br	H	OCH ₃	H	Z	CO-CH ₂ -piperazinyl-CH ₃ .HCl
Example 70	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ -CH(CH ₃)NH ₂
Example 71	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ NH ₂
Example 72	C-CN	Br	H	OCH ₃	H	Z	CO-CH ₂ -piperazinyl
Example 73	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ O(CH ₂) ₂ O(CH ₂) ₂ OCH ₃
Example 74	C-CN	Br	H	OCH ₃	H	Z	COCH(NH ₂)CH ₂ OH
Example 75	C-CN	Br	H	OCH ₃	H	Z	CO-oxopyrrolidine
Example 76	C-CN	Br	H	OCH ₃	H	Z	COCH(NH ₂)-(CH ₂) ₄ NH ₂
Example 77	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ -PO(OCH ₂ CH ₃) ₂
Example 78	C-CN	Br	H	OCH ₃	H	Z	COCH ₃ -P ₂ O ₇ .[t-BuN] ₃ ⁺
Example 79	C-CN	Br	H	OCH ₃	H	Z	CO(CH ₂) ₂ PO ₄ H ₂

The present invention relates to:

- a pharmaceutical composition comprising any compound having the formula (I), (Ia) , (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments; and/or

- a pharmaceutical composition comprising any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, and a pharmaceutically acceptable carrier; and/or
- 5 - a pharmaceutical composition comprising (a) any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, and (b) an additional active ingredient, preferably an additional antitumoral drug; and/or
- a pharmaceutical composition as defined above or any compound having the formula
- 10 (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments for use as a drug; and/or
- a pharmaceutical composition as defined above or any compound having the formula
- 15 (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, for use in the treatment of cancer; and/or
- a pharmaceutical composition as defined above or any compound having the formula
- 20 (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, for use in the treatment of viral infections, particularly HIV infection, HTLV infection, or HPV infection; and/or
- a pharmaceutical composition as defined above or any compound having the formula
- 25 (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, for use for the treatment of lung disease, particularly the treatment of pulmonary arterial hypertension; and/or
- a pharmaceutical composition as defined above or any compound having the formula
- 30 (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, for use in the treatment of pathologies associated with dysregulation of MKlp2 or for use in the treatment of pathologies in which the MKlp2 pathway is dysregulated; and/or
- a product or kit containing (a) any compound of formula (I), (Ia), (Ib) or (II) as disclosed above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments and (b) an additional

active ingredient, preferably an additional antitumoral drug, as a combined preparation for simultaneous, separate or sequential use, in particular in the treatment of cancer; and/or

- a combined preparation which comprises (a) any compound of formula (I), (Ia), (Ib) or (II) as disclosed above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments and (b) an additional active ingredient, preferably an additional antitumoral drug, for simultaneous, separate or sequential use, in particular in the treatment of cancer; and/or
- a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, for the use in the treatment of cancer in combination with radiotherapy, surgery (e.g., tumor resection), hyperthermia and/or other antitumoral therapies or before, simultaneously or after surgery (e.g., tumor resection); and/or

15 - the use of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, for the manufacture of a medicament for the treatment of cancer, viral infections, lung diseases and/or pathologies associated with dysregulation of MKlp2 or its pathway, preferably cancer; and/or

20 - the use of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments and (b) an additional active ingredient, preferably an additional antitumoral drug, for the manufacture of a medicament for the treatment of cancer; and/or

25 - a method for treating a cancer in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments; and/or

30 - a method for treating a cancer in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-

ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments and a pharmaceutically acceptable carrier; and/or

- a method for treating a cancer in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, and (b) an additional active ingredient, preferably an additional antitumoral drug; and/or
- a method for treating a cancer in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, and an effective amount of a pharmaceutical composition comprising an additional active ingredient, preferably an additional antitumoral drug;

and/or

- a method for treating a cancer in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, in combination with radiotherapy, surgery (e.g., tumor resection), hyperthermia and/or other antitumoral therapies; and/or
- a method for treating a viral infection in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments; and/or
- a method for treating a lung disease in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments; and/or
- a method for treating a pathology associated with dysregulation of MKlp2 or its pathway in a subject in need thereof, comprising administering an effective amount of a pharmaceutical composition as defined above or any compound having the formula

(I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments; and/or

5 - the use of any compound having the formula (I), (Ia), (Ib) or (II) as defined above or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile including anyone of the disclosed embodiments, as a pharmacological research tool.

The term "cancer", as used herein, refers to the presence of cells possessing characteristics typical of cancer-causing cells, such as uncontrolled proliferation, immortality, metastatic potential, rapid growth and proliferation rate, and certain characteristic 10 morphological features. The cancer may be solid tumor or hematopoietic tumor. Examples of cancer include, for example, leukemia, lymphoma, blastoma, carcinoma and sarcoma. More particular examples of such cancers include chronic myeloid leukemia, acute lymphoblastic leukemia, Philadelphia chromosome positive acute lymphoblastic leukemia (Ph+ ALL), squamous cell carcinoma, lung cancer, small-cell lung cancer, non-small cell lung cancer, 15 glioma, gastrointestinal cancer, renal cancer, ovarian cancer, liver cancer, colorectal cancer, endometrial cancer, kidney cancer, prostate cancer, thyroid cancer, neuroblastoma, osteosarcoma, pancreatic cancer, glioblastoma multiforme, cervical cancer, stomach cancer, bladder cancer, hepatoma, breast cancer, oesophageal cancer, colon carcinoma, and head and neck cancer, gastric cancer, germ cell tumor, pediatric sarcoma, sinonasal natural killer, 20 multiple myeloma, acute myelogenous leukemia (AML), chronic lymphocytic leukemia, mastocytosis and any symptom associated with mastocytosis. Preferably, the cancer is a colon cancer, a pancreatic cancer, a breast cancer, a lung cancer and a bladder cancer. More preferably, the cancer is a colon cancer, a pancreatic cancer and a bladder cancer. Optionally, the cancer is associated with a dysregulation of MKlp2 or its pathway. In particular, the 25 cancer is associated with an overexpression of MKlp2.

As used herein, the term "treatment", "treat" or "treating" refers to any act intended to ameliorate the health status of patients such as therapy, prevention, prophylaxis and retardation of the disease. In certain embodiments, such term refers to the amelioration or eradication of a disease or symptoms associated with a disease. In other embodiments, this 30 term refers to minimizing the spread or worsening of the disease resulting from the administration of one or more therapeutic agents to a subject with such a disease.

By "effective amount" it is meant the quantity of the pharmaceutical composition of the invention which prevents, removes or reduces the deleterious effects of the treated disease in mammals, including humans. It is understood that the administered dose may be adapted by

those skilled in the art according to the patient, the pathology, the mode of administration, etc. For instance, the compounds of the invention may be used at a dose of 0.01 to 500 mg / kg of body weight / day. In a particular embodiment, the pharmaceutical composition according to the invention comprises 0.01 to 500 mg / kg of the compound of the 5 invention. It is understood that the administered dose may be adapted by those skilled in the art according to the patient, the pathology, the mode of administration, etc.

The administration route can be topical, transdermal, oral, rectal, sublingual, intranasal, intrathecal, intratumoral or parenteral (including subcutaneous, intramuscular, intravenous and/or intradermal). Preferably, the administration route is parenteral, oral or 10 topical. The pharmaceutical composition is adapted for one or several of the above-mentioned routes. The pharmaceutical composition, kit, product or combined preparation is preferably administered by injection or by intravenous infusion or suitable sterile solutions, or in the form of liquid or solid doses via the alimentary canal.

The pharmaceutical composition can be formulated as solutions in pharmaceutically 15 compatible solvents or as emulsions, suspensions or dispersions in suitable pharmaceutical solvents or vehicles, or as pills, tablets or capsules that contain solid vehicles in a way known in the art. Formulations of the present invention suitable for oral administration may be in the form of discrete units as capsules, sachets, tablets or lozenges, each containing a predetermined amount of the active ingredient; in the form of a powder or granules; in the 20 form of a solution or a suspension in an aqueous liquid or non-aqueous liquid; or in the form of an oil-in-water emulsion or a water-in-oil emulsion. Formulations for rectal administration may be in the form of a suppository incorporating the active ingredient and carrier such as cocoa butter, or in the form of an enema. Formulations suitable for parenteral administration conveniently comprise a sterile oily or aqueous preparation of the active ingredient which is 25 preferably isotonic with the blood of the recipient. Every such formulation can also contain other pharmaceutically compatible and nontoxic auxiliary agents, such as, e.g. stabilizers, antioxidants, binders, dyes, emulsifiers or flavouring substances. The formulations of the present invention comprise an active ingredient in association with a pharmaceutically acceptable carrier therefore and optionally other therapeutic ingredients. The carrier must be 30 "acceptable" in the sense of being compatible with the other ingredients of the formulations and not deleterious to the recipient thereof. The pharmaceutical compositions are advantageously applied by injection or intravenous infusion of suitable sterile solutions or as oral dosage by the digestive tract. Methods for the safe and effective administration of most of

these chemotherapeutic agents are known to those skilled in the art. In addition, their administration is described in the standard literature.

The additional antitumoral drug can be selected in the non-exhaustive list of antitumoral agents consisting of an inhibitor of topoisomerases I or II, an anti-mitotic agent, a 5 DNA alkylating agent, an anti-metabolic agent, a targeted agent such as a kinase inhibitor, and/or a therapeutical antibody designed to mediate cytotoxicity against the cancer cells or to modulate one of their key biological functions.

Anti-mitotic agents include, , but are not limited to, paclitaxel, docetaxel and analogs such as larotaxel (also called XRP9881; Sanofi-Aventis), XRP6258 (Sanofi-Aventis), BMS-10 184476 (Bristol-Meyer-Squibb), BMS-188797 (Bristol-Meyer-Squibb), BMS-275183 (Bristol-Meyer-Squibb), ortataxel (also called IDN 5109, BAY 59-8862 or SB-T-101131 ; Bristol-Meyer-Squibb), RPR 109881A (Bristol-Meyer-Squibb), RPR 116258 (Bristol-Meyer-Squibb), NBT-287 (TAPESTRY), PG-paclitaxel (also called CT-2103, PPX, paclitaxel poliglumex, paclitaxel polyglutamate or XyotaxTM), ABRAXANE® (also called Nab-15 Paclitaxel ; ABRAXIS BIOSCIENCE), Tesetaxel (also called DJ-927), IDN 5390 (INDENA), Taxoprexin (also called docosahexanoic acid-paclitaxel ; PROTARGA), DHA-paclitaxel (also called Taxoprexin®), and MAC-321 (WYETH).

Inhibitors of topoisomerases I and/or II include, but are not limited to, etoposide, topotecan, camptothecin, irinotecan, amsacrine, intoplicin, anthracyclines such as 20 doxorubicin, epirubicin, daunorubicin, idarubicin and mitoxantrone. Inhibitors of Topoisomerase I and II include, but are not limited to, intoplicin.

DNA alkylating agent includes, but are not limited to, cisplatin, carboplatin and oxaliplatin. In a preferred embodiment, the DNA alkylating agent is cisplatin.

Anti-metabolic agents block the enzymes responsible for nucleic acid synthesis or 25 become incorporated into DNA, which produces an incorrect genetic code and leads to apoptosis. Non-exhaustive examples thereof include, without limitation, folic acid antagonists, pyrimidine analogs, purine analogs and adenosine deaminase inhibitors, and more particularly Methotrexate, Floxuridine, Cytarabine, 6-Mercaptopurine, 6- Thioguanine, Fludarabine phosphate, Pentostatine, 5-fluorouracil, gemcitabine and capecitabine.

30 The anti-tumoral agent can be alkylating agents including, without limitation, nitrogen mustards, ethylenimine derivatives, alkyl sulfonates, nitrosoureas, metal salts and triazenes. Non-exhaustive examples thereof include Uracil mustard, Chlormethine, Cyclophosphamide (CYTOXAN(R)), Ifosfamide, Melphalan, Chlorambucil, Pipobroman, Triethylenemelamine,

Triethylenethiophosphoramine, Busulfan, Carmustine, Lomustine, cisplatin, carboplatin, oxaliplatin, thiotepa, Streptozocin, Dacarbazine, and Temozolomide.

The anti-tumoral agent can also be a targeted agent, in particular a kinase inhibitor,. The kinase may be selected from the group consisting of intracellular tyrosine or 5 serine/threonine kinases, receptors tyrosine or serine/theonine kinase. For instance, the agents may have ability to inhibit angiogenesis based on the inhibitory activities on VEGFR and PDGFR kinases. In particular, the targeted agent can be selected among the multiple kinase inhibitor drugs which are already approved: Gleevec, which inhibits Abl, and Iressa and Tarceva, which both inhibit EGFR, Sorafenib (Nexavar, BAY 43-9006) which inhibits Raf, 10 Dasatinib (BMS-354825) and Nilotinib (AMN-107, Tasigna) which also inhibits Abl, Lapatinib which also inhibits EGFR, Temsirolimus (Torisel, CCI-779) which targets the mTOR pathway, Sunitinib (Stuten, SU11248) which inhibits several targets including VEGFR as well as specific antibodies inactivating kinase receptors: Herceptin and Avastin.

The term “therapy”, as used herein, refers to any type of treatment of cancer (i.e., 15 antitumoral therapy), including an adjuvant therapy and a neoadjuvant therapy. Therapy comprises radiotherapy and therapies, preferably systemic therapies such as hormone therapy, chemotherapy, immunotherapy and monoclonal antibody therapy.

The term “adjuvant therapy”, as used herein, refers to any type of treatment of cancer given as additional treatment, usually after surgical resection of the primary tumor, in a 20 patient affected with a cancer that is at risk of metastasizing and/or likely to recur. The aim of such an adjuvant treatment is to improve the prognosis. Adjuvant therapies comprise radiotherapy and therapy, preferably systemic therapy, such as hormone therapy, chemotherapy, immunotherapy and monoclonal antibody therapy.

The term “hormone therapy” or “hormonal therapy” refers to a cancer treatment 25 having for purpose to block, add or remove hormones. For instance, in breast cancer, the female hormones estrogen and progesterone can promote the growth of some breast cancer cells. So in these patients, hormone therapy is given to block estrogen and a non-exhaustive list commonly used drugs includes: Tamoxifen, Toremifene, Anastrozole, Exemestane, Letrozole, Goserelin/Leuprolide, Megestrol acetate, and Fluoxymesterone.

30 As used herein, the term “chemotherapeutic treatment” or “chemotherapy” refers to a cancer therapeutic treatment using chemical or biological substances, in particular using one or several antineoplastic agents.

The term “radiotherapeutic treatment” or “radiotherapy” is a term commonly used in the art to refer to multiple types of radiation therapy including internal and external radiation

therapies or radioimmunotherapy, and the use of various types of radiations including X-rays, gamma rays, alpha particles, beta particles, photons, electrons, neutrons, radioisotopes, and other forms of ionizing radiations.

The term “therapeutical antibody” refers to any antibody having an anti-tumoral effect. 5 Preferably, the therapeutical antibody is a monoclonal antibody. Therapeutic antibodies are generally specific for surface antigens, e.g., membrane antigens. Most preferred therapeutic antibodies are specific for tumor antigens (e.g., molecules specifically expressed by tumor cells), such as CD20, CD52, ErbB2 (or HER2/Neu), CD33, CD22, CD25, MUC-1, CEA, KDR, α V β 3, and the like. The therapeutical antibody include, but is not limited to, antibodies 10 such as trastuzumab (anti-HER2 antibody), rituximab (anti-CD20 antibody), alemtuzumab, gemtuzumab, cetuximab, pertuzumab, epratuzumab, basiliximab, daclizumab, labetuzumab, sevirimab, tuvurimab, palivizumab, infliximab, omalizumab, efalizumab, natalizumab, clenoliximab, and bevacizumab.

The general term “viral infection” defines a condition caused by viruses. The term 15 “HIV infection” more significantly defines a condition caused by the Human Immunodeficiency Virus (HIV), the term “HPV infection” more significantly defines a condition caused by the Human PapillomaVirus (HPV), and the term “HTLV infection” more significantly defines a condition caused by the Human T-cell Lymphotropic Virus (HTLV).

The pulmonary arterial hypertension (PAH) is a syndrome characterized by a 20 progressive increase in pulmonary vascular resistance leading to right ventricular overload and eventually cardiac failure.

Preferably, the pathologies associated with dysregulation of MKlp2 or its pathway are Alzheimer’s disease or Creutzfeldt-Jakob’s disease.

Finally, the present invention concerns the use of a compound of the formula (I) as 25 defined above as a research pharmacological tool, in particular as MKlp2 inhibitor. It can be used as a laboratory tool or in a screening method.

FIGURES

Figure 1: Stability of compound 63 in mouse and human plasma.

30 **Figure 2:** Amount of formed compound 38 from compound 63 in mouse and human plasma.

Figure 3: Evaluation of anti-tumor activity of compound 38 in nude mice bearing subcutaneous human colon HCT-116 xenografts.

Figure 4: Evaluation of anti-tumor activity of compound 38 in nude mice bearing subcutaneous non small cell lung carcinoma NCI-H460 xenografts.

EXAMPLES

The following examples illustrate in detail the preparation of compounds of formula (I) according to the invention. The structures of the products obtained have been confirmed by 5 NMR spectra.

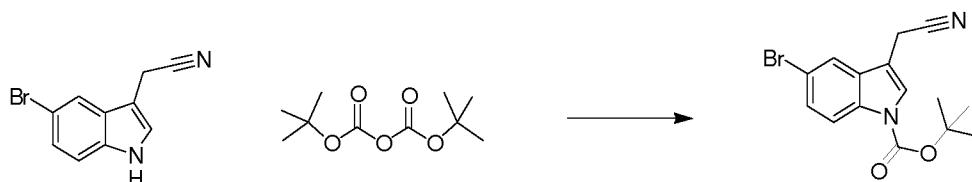
Starting compounds and reactants, unless otherwise indicated, are commercially available or described in literature, or can be prepared according to methods described in literature or known to one skilled in the art.

10

Example 1: Preparation of starting indoles and aldehydes

A) Syntheses of starting indoles

Tert-butyl-5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate



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In a 250 mL pear flask, 2-(5-bromo-1H-indol-3-yl)acetonitrile (1.76 g, 7.49 mmol) was dissolved in 70 mL of acetonitrile to give a colorless solution. Di-tert-butyl-dicarbonate (1.922 mL, 8.98 mmol) and DMAP (0.091 g, 0.749 mmol) were added to the solution and the reaction mixture was stirred at RT for 1h.

TLC: 100% Dichloromethane showed no more starting material.

20

Then the reaction mixture was poured into 50 mL of water, extracted with 2x 50 mL of ethyl acetate and the combined organic layer was successively washed with 1x 50 mL of Brine, dried over Na_2SO_4 , filtered and concentrated *in vacuo* to give a yellow oil which crystallized upon standing to give a yellow solid, $m= 2.59$ g (Yield : 99%)

APCI-MS: (M-H) = 234

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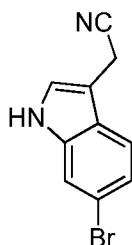
^1H NMR (300 MHz, DMSO-d_6) δ ppm: 8.00 (d, $J = 8.8$ Hz, 1H), 7.91 (d, $J = 1.8$ Hz, 1H), 7.73 (s, 1H), 7.53 (dd, $J = 8.8, 2.0$ Hz, 1H), 4.12 (d, $J = 0.9$ Hz, 2H), 1.61 (s, 9H).

Tert-butyl-5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate is obtained according to the same procedure as for Tert-butyl-5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate.

30

Tert-butyl 6-X-3-(cyanomethyl)- 1H-indole-1-carboxylate**Synthesis of 2-(6-X-1H-indol-3-yl)acetonitrile (X=bromo, fluoro or chloro)**

A mixture of 6-X-1-H-indole-3-carbaldehyde (1eq), formamide (9 mL / mmol), MeOH (9 mL / mmol) and NaBH₄ (3 eq) were stirred 1 h at room temperature. KCN (10 eq) was then 5 added and the resulting mixture was stirred 5 h at 60°C. The reaction was quenched with aqueous NaCl and extracted with CHCl₃, dried over Na₂SO₄, filtrated and concentrated. The residue was purified by silicagel chromatography (CH₂Cl₂ / MeOH, 100 : 0 to 90 : 10) to give the title compound.

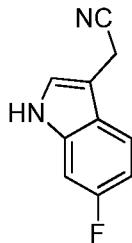
2-(6-bromo-1H-indol-3-yl)acetonitrile

10

6-bromo-1H-indole-3-carbaldehyde (200.0 mg), formamide (8 mL), NaBH₄ (101.0 mg), MeOH (8 ml). KCN (580.0 mg). Aspect of the pure product : white solid. (Yield : 67 %).

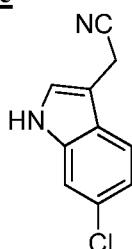
¹H NMR (CDCl₃, 300 MHz) δ ppm : 8.21 (s, 1H), 7.59 (s, 1H), 7.48 (d, 1H), 7.31 (d, 1H), 7.24 (s, 1H), 3.84 (s, 1H).

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2-(6-fluoro-1H-indol-3-yl)acetonitrile

6-fluoro-1H-indole-3-carbaldehyde (200.0 mg), formamide (10 mL), NaBH₄ (138.0 mg), MeOH (10 ml). KCN (791.0 mg). Aspect of the pure product : white solid. (Yield : 75 %).

¹H NMR (CDCl₃, 300 MHz) δ ppm: ppm : 8.48 (s, 1H), 7.53-7.50 (m, 1H), 7.14 (s, 1H), 20 7.09 (d, 1H), 7.0-6.96 (m, 1H), 3.80 (s, 2H).

2-(6-chloro-1H-indol-3-yl)acetonitrile

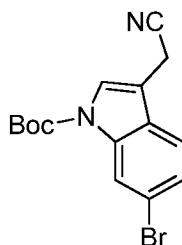
6-chloro-1H-indole-3-carbaldehyde (200.0 mg), formamide (10 mL), NaBH₄ (126.0 mg), MeOH (10 mL), KCN (722.0 mg). Aspect of the pure product : white solid. (Yield : 81 %).

15 ¹H NMR (CDCl₃, 300 MHz) δ ppm: 8.34 (s, 1H), 7.50 (d, 1H), 7.38 (s, 1H), 7.24-7.16 (m, 1H), 7.14 (d, 1H), 3.82 (s, 2H).

Synthesis of Tert-butyl 6-X-3-(cyanomethyl)-1H-indole-1-carboxylate

To a solution of 2-(6-X-1H-indol-3-yl)acetonitrile in CH₂Cl₂, was added Boc₂O (eq) and DMAP (eq). The resulting mixture was stirred 12 h at room temperature, then diluted with CH₂Cl₂, washed with water and concentrated to give the title compound.

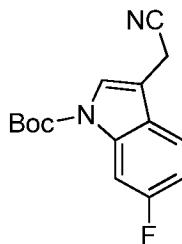
10 **Tert-butyl 6-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate**



2-(6-bromo-1H-indol-3-yl)acetonitrile (138.0 mg), DMAP (3.0 mg), Boc₂O (152.0 mg), CH₂Cl₂ (2.8 mL). 12 h at room temperature. Aspect of the pure product : white solid. (Yield : 90 %).

15 ¹H NMR (CDCl₃, 300 MHz) δ ppm: 8.41 (s, 1H), 7.62 (s, 1H), 7.47-7.36 (m, 2H), 3.78 (s, 2H), 1.70 (s, 9H).

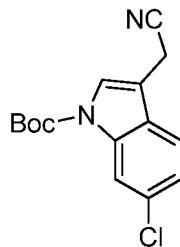
Tert-butyl 6-fluoro-3-(cyanomethyl)-1H-indole-1-carboxylate



2-(6-fluoro-1H-indol-3-yl)acetonitrile (160.0 mg), DMAP (4.3 mg), Boc₂O (238.0 mg), CH₂Cl₂ (4.4 mL). 12 h at room temperature. Aspect of the pure product : white solid. (Yield : 98 %).

15 ¹H NMR (CDCl₃, 300 MHz) δ ppm: 7.91 (d, 1H), 7.63 (s, 1H), 7.50-7.42 (m, 1H), 7.07 (td, 1H), 3.78 (s, 2H), 1.69 (s, 9H).

Tert-butyl 6-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate



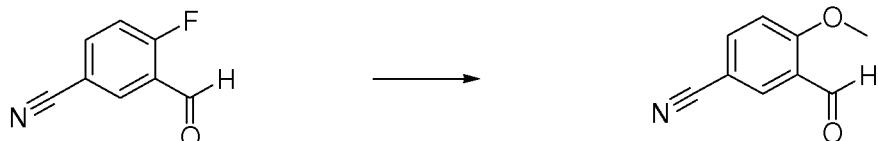
2-(6-chloro-1H-indol-3-yl)acetonitrile (168.0 mg), DMAP (6.0 mg), Boc₂O (233.0 mg).

CH₂Cl₂ (4.0 mL). Aspect of the pure product : white solid. (Yield : 86 %).

5 ¹H NMR (CDCl₃, 300 MHz) δ ppm: 8.25 (s, 1H), 7.64 (s, 1H), 7.45 (d, 1H), 7.29 (d, 1H), 3.77 (s, 2H), 1.70 (s, 9H).

B) Syntheses of starting aldehydes

3-formyl-4-methoxybenzonitrile



10 In a 10 mL reactor flask, 4-fluoro-3-formylbenzonitrile (900 mg, 6.04 mmol) was dissolved under argon in 2 mL of methanol. Sodium methoxide (1.232 mL, 6.64 mmol) was added and the reaction mixture was heated at reflux for 2h.

TLC showed no more starting material.

15 The reaction mixture was poured into 10 mL of water. The resulting solid was filtered, washed with water, DIPE and dried *in vacuo*. The residue was purified by flash chromatography, eluted with a gradient from petroleum ether to MTBE give 587 mg of a grey solid (Yield :59%)

LC-MS: 98%

20 ¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.28 (s, 1H), 8.12 (dd, J = 8.8, 2.2 Hz, 1H), 8.05 (d, J = 2.1 Hz, 1H), 7.43 (d, J = 8.8 Hz, 1H), 4.01 (s, 3H).

3-formyl-4-(1H-1,2,4-triazol-1-yl)benzonitrile



In sealed microwave reactors, 4-fluoro-3-formylbenzonitrile (850 mg, 5.7 mmol) was dissolved in acetonitrile (15 mL), 1H-1,2,4-triazol (590 mg, 8.55 mmol, 1.5eq) and K₂CO₃

(1575 mg, 11.39 mmol, 2 eq) were added to give a colorless suspension. Then the reaction mixture was stirred and heated at 80°C for 5min.

The reaction mixture was poured into 20 mL of water, extracted with 2x 20 mL of EtOAc. The combined organic layers were washed with 1x 20 mL of water, 1x 20 mL of 5 brine, dried over Na₂SO₄, filtered and concentrated *in vacuo* to give an orange solid, m= 983mg.

The solid was triturated with dichloromethane and petroleum ether, filtered and dried *in vacuo* at 45°C overnight to give 493 mg of a brown powder (Yield : 43%)

APCI-MS: (M+H)⁺ =199

10 ¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.01 (s, 1H), 9.33 (s, 1H), 8.46 - 8.29 (m, 3H), 8.05 (d, J = 9.0 Hz, 1H).

4-(1H-1,2,4-triazol-1-yl)nicotinaldehyde

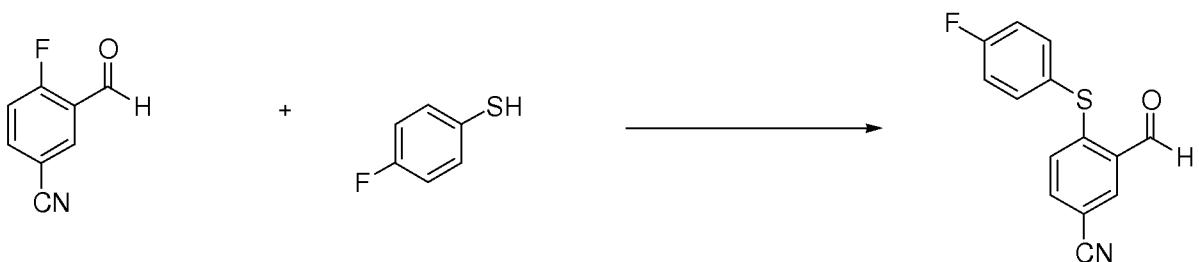


Aspect of the product: yellow solid (Yield: 49%)

15 APCI-MS: (M+H)⁺ =175

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.20 (s, 1H), 9.39 (s, 1H), 8.99 - 8.91 (m, 2H), 8.39 (s, 1H), 7.90 (d, J = 5.5 Hz, 1H).

3-formyl-4-(4-fluorophenylthio)benzonitrile



20 In a 50 mL round-bottomed flask, 4-fluoro-3-formylbenzonitrile (900 mg, 5.73 mmol) and potassium carbonate (872 mg, 6.31 mmol) were suspended in DMF (10 mL) to give a yellow suspension. Then 4-fluorobenzenethiol (0.654 mL, 6.02 mmol) was added and the reaction mixture heated at 70°C for 18h. The reaction mixture was poured into water. The solid was filtered, washed with water and with a few amount of DIPE then dried *in vacuo* to 25 give 1.44g of a pale yellow solid (Yield : 97%)

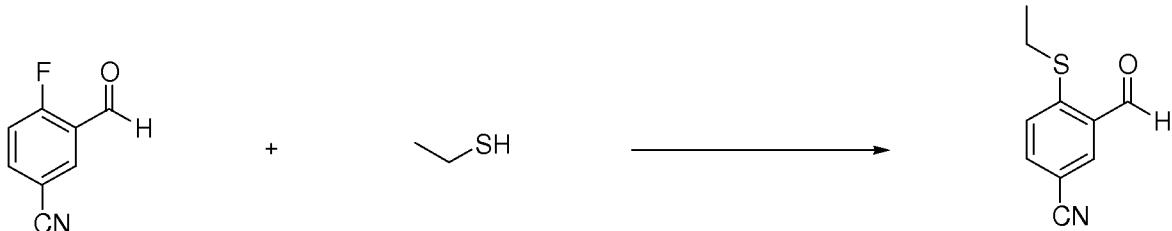
APCI-MS: (M+H)⁺ =257

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.12 (s, 1H), 8.49 (d, J = 1.9 Hz, 1H), 7.85 (dd, J = 8.5, 2.0 Hz, 1H), 7.71 - 7.62 (m, 2H), 7.43 (ddd, J = 10.9, 6.0, 2.6 Hz, 2H), 6.80 (d, J = 8.5 Hz, 1H).

The following examples were prepared according to the previous method.

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4-(ethylthio)-3-formylbenzonitrile



Aspect of the product: yellow solid (Yield: 83%)

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.07 (s, 1H), 8.38 (d, J = 1.9 Hz, 1H), 7.99 (dd, J = 8.4, 1.9 Hz, 1H), 7.63 (d, J = 8.5 Hz, 1H), 3.08 (q, J = 7.4 Hz, 2H), 1.30 (t, J = 7.3 Hz, 10 3H).

4-(dimethylamino)-3-formylbenzonitrile

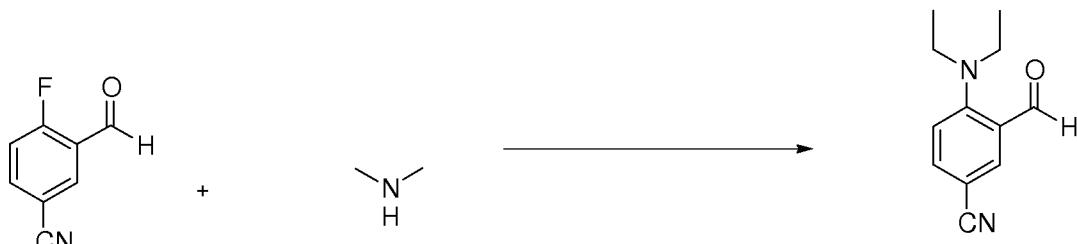


Aspect of the product: orange solid (Yield: 96%)

APCI-MS: (M+H)⁺ = 175

15 ¹H NMR (300 MHz, DMSO-d₆) δ ppm: 9.88 (s, 1H), 8.07 (d, J = 2.2 Hz, 1H), 7.72 (dd, J = 8.9, 2.2 Hz, 1H), 7.09 (d, J = 8.9 Hz, 1H), 2.99 (s, 6H).

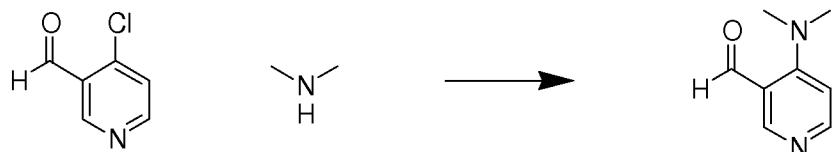
4-(diethylamino)-3-formylbenzonitrile



Aspect of the product: yellow solid (Yield: 83%)

20 APCI-MS: (M+H)⁺ = 203

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 9.91 (s, 1H), 8.00 (d, J = 2.2 Hz, 1H), 7.78 (dd, J = 8.9, 2.2 Hz, 1H), 7.21 (d, J = 8.9 Hz, 1H), 3.44 - 3.35 (m, 4H), 1.11 (t, J = 7.0 Hz, 6H).

4-dimethylamino-3-formyl-pyridine

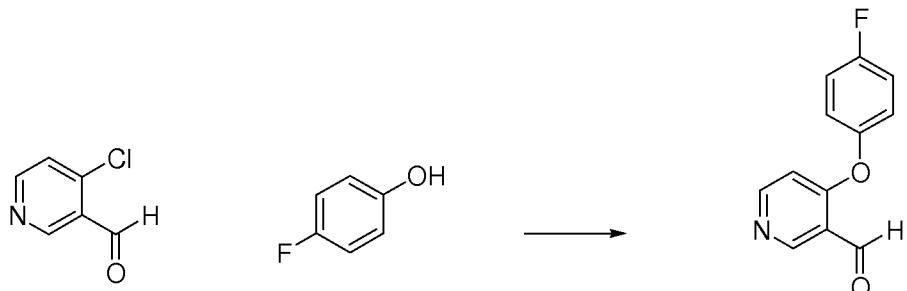
A mixture of 4-chloronicotinaldehyde (500 mg, 3.53 mmol), potassium carbonate (976 mg, 7.06 mmol) and dimethylamine in THF (2.65 mL, 5.30 mmol) was heated at 80°C for 3 5 hours.

TLC (eluent EtOAc) showed no more starting material.

The reaction mixture was concentrated under pressure. Purification by flash chromatography on silica gel column (eluant : CH₂Cl₂ / MeOH 90/10) yielded 0.48g of a pale yellow solid (Yield: 90%)

10 APCI-MS: (M+H)⁺ =151

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 9.93 (s, 1H), 8.60 (s, 1H), 8.23 (d, *J* = 6.1 Hz, 1H), 6.87 (d, *J* = 6.2 Hz, 1H), 2.99 (s, 6H).

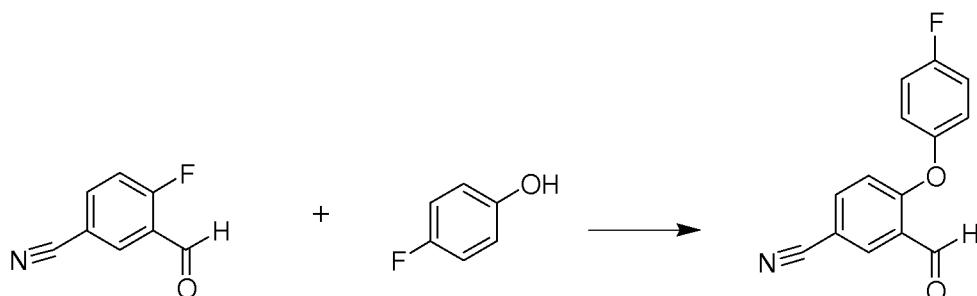
4-fluorophenoxy-3-formylpyridine

15 To a solution of 4-fluorophenol (455 mg, 4.06 mmol) in THF [5 mL] was added HNa (162 mg, 4.06 mmol). After stirring for 0.5 hour, 4-chloronicotinaldehyde (500 mg, 3.53 mmol) was added and the reaction mixture was heated at 65°C for 3 hours.

Then the reaction mixture was diluted with water and brine, extracted with MTBE, dried over MgSO₄ and concentrated under reduced pressure to give 617 mg of an oily 20 compound (Yield: 64%)

APCI-MS: (M+H)⁺ =218

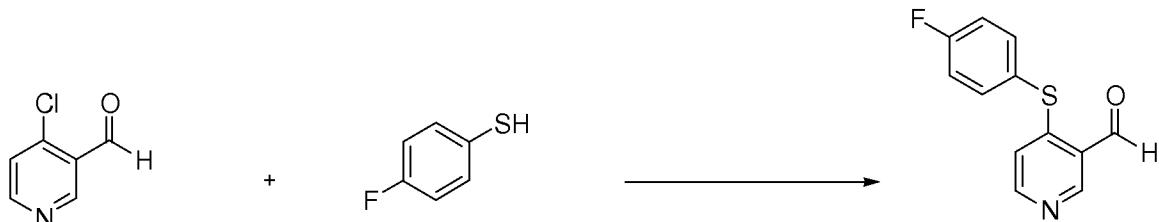
The following example was prepared as the previous method.

4-fluorophenoxy-3-formylbenzonitrile

Aspect of the product: yellow solid (Yield: 64%)

APCI-MS: (M-H) = 240

5 ^1H NMR (300 MHz, DMSO-d₆) δ ppm: 10.41 (s, 1H), 8.23 (d, J = 2.2 Hz, 1H), 8.03 (dd, J = 8.8, 2.2 Hz, 1H), 7.40 - 7.30 (m, 4H), 6.95 (d, J = 8.8 Hz, 1H).

4-fluorophenylthio-3-formylpyridine

10 A mixture of 4-chloronicotinaldehyde (500 mg, 3.53 mmol), potassium carbonate (537 mg, 3.89 mmol) and 4-fluorobenzenethiol (0.403 mL, 3.71 mmol) in DMF (10 mL) was heated at 70°C for 1h.

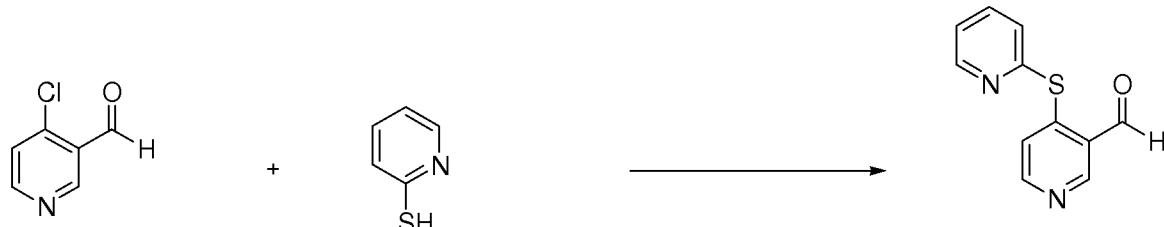
15 The reaction mixture was quenched with water, extracted with 3 x 20 mL of AcOEt, the combined organic were washed with brine, dried over Na₂SO₄, filtered and concentrated under vacuum to give a brown oil. The oil was triturated with 5 mL of DIPE to give 0.46 g of a beige solid (Yield: 55%).

APCI-MS: (M+H)⁺ = 234

15 ^1H NMR (300 MHz, DMSO-d₆) δ ppm: 10.19 (s, 1H), 9.03 (s, 1H), 8.45 (d, J = 5.6 Hz, 1H), 7.69 (dd, J = 8.5, 5.5 Hz, 2H), 7.45 (t, J = 8.7 Hz, 2H), 6.61 (d, J = 5.6 Hz, 1H).

The following examples were prepared as the previous method.

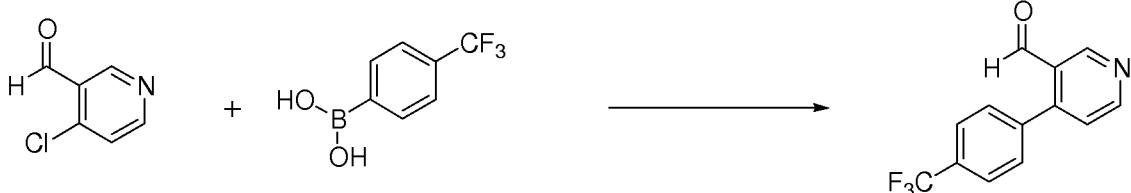
20 4-(pyridin-2-ylthio)nicotinaldehyde



Aspect of the product: yellow solid (Yield: 61%)

20 APCI-MS: (M+H)⁺ = 217

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.18 (s, 1H), 9.04 (s, 1H), 8.68 (d, J = 3.7 Hz, 1H), 8.51 (d, J = 5.5 Hz, 1H), 7.95 (td, J = 7.7, 1.9 Hz, 1H), 7.74 (d, J = 7.8 Hz, 1H), 7.51 (dd, J = 6.5, 4.8 Hz, 1H), 7.00 (d, J = 5.5 Hz, 1H).

5 **3-formyl-4-(4-trifluorophenyl)benzonitrile**

In a 50 mL pear flask, magnetic stirrer, 4-chloronicotinaldehyde (500 mg, 3.53 mmol), 4-trifluoromethylphenylboronic acid (671 mg, 3.53 mmol), triphenylphosphine (55.6 mg, 0.212 mmol), palladium(II) acetate (47.6 mg, 0.212 mmol) and potassium carbonate (976 mg, 10 7.06 mmol) were added successively followed by 1,2-dimethoxyethane (10 mL) and water (2.5 mL). The reaction mixture was stirred and heated at 85°C for 18 hours (LC/MS showed no starting material).

20 mL of water and 20 mL of ethyl acetate were added. The mixture was filtered over Celite and the cake rinsed with 20 mL of ethyl acetate. Organic phases were washed twice 15 with brine, dried over sodium sulfate, filtered and the solvent was removed to give 890 mg of an oil.

The crude oil was purified by flash chromatography on SiO₂, eluted with 100% dichloromethane then 95/5 dichloromethane/acetone to give 370 mg of a grey solid (Yield: 42%)

20 APCI-MS: (M+H)⁺ = 252

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.00 (s, 1H), 9.08 (s, 1H), 8.90 (d, J = 5.1 Hz, 1H), 7.92 (d, J = 8.1 Hz, 2H), 7.78 (d, J = 8.0 Hz, 2H), 7.61 (dd, J = 5.1, 0.6 Hz, 1H)

The following example was prepared as the previous method.

25 **4-(furan-3-yl)nicotinaldehyde**

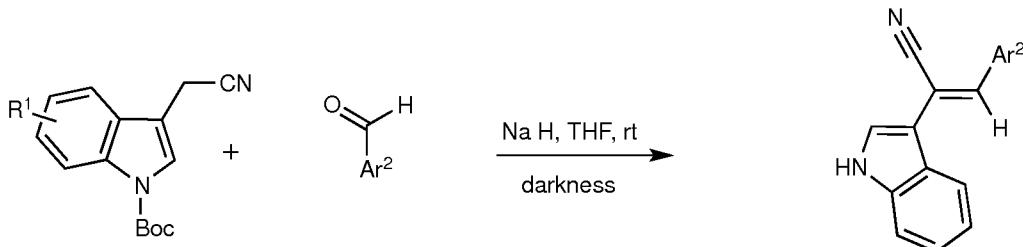
Aspect of the product: yellow solid (Yield: 64%)

LC-MS: (M+H)⁺ = 174

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 10.24 (s, 1H), 8.96 (s, 1H), 8.78 (s, 1H), 8.25 (s, 1H), 7.90 (s, 1H), 7.62 (s, 1H), 6.99 (s, 1H).

Preparation of examples 2 to 53

Method A: Knoevenagel condensation



5

To a solution of cyanomethyl-indole-1-carboxylic acid tert-butyl ester (1 eq.) in THF was added sodium hydride (1.5 eq.) under an argon atmosphere. The reaction apparatus was protected from light and the mixture stirred at room temperature for 1 hour. Then the reaction mixture was cooled to 0°C and the aldehyde (1.2 eq.) was added in portions.

10 The mixture was stirred at room temperature for 24 or 48 hours, then quenched with saturated ammonium chloride aqueous solution and extracted with AcOEt. The combined organic layers were dried over MgSO_4 and evaporated under *vacuo*. When the desired compound protected with a Boc group remained as a side product of the reaction, the reaction mixture was treated with a solution of HCl in dioxane or an aqueous solution of NaOH 1N to complete
 15 the Boc deprotection. Then the crude residue was triturated with a minimum of solvant (MeOH or CH_2Cl_2 or Et_2O), filterated, washed with Et_2O , and dried *in vacuo* for 12 hours (in dark) to afford the corresponding acrylonitrile.

Method B: $\text{S}_{\text{N}}\text{Ar}$ reactions from **(Z)-2-(5-methoxy-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile** or **(Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile**:

20 To a solution of 4-chloropyridine derivative (*Z*)-2-(5-methoxy-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile or (*Z*)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (1 eq.) in MeOH, EtOH or isopropanol was added KOH (2 to 5 eq.) under an argon atmosphere. The reaction apparatus was protected from light and the mixture was refluxed overnight. The mixture was diluted with AcOEt, washed with water then brine. The organic 25 layer was dried over MgSO₄ and reduced *in vacuo*. The crude product was purified by trituration with AcOEt or by flash chromatography to afford the SN_{AR} derivative.

Method C: SN_{AR} reactions from (Z)-2-(5-methoxy-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile or (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile:

To a solution of 4-chloropyridine derivative - (*Z*)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (1 eq.) in DMF was added NaSMe or NaSEt (2 eq.) under an argon

atmosphere. The reaction apparatus was protected from light and the mixture was stirred overnight at room temperature. The mixture was diluted with AcOEt, washed with water then brine. The organic layer was dried over MgSO₄ and reduced *in vacuo*. The crude product was purified by trituration with AcOEt to afford the SN_{AR} derivative.

5 **Method D: SN_{AR} reactions from (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile or (Z)-2-(5-Bromo-1H-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile:**

To a solution of 4-chloropyridine derivative (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile or (1 eq.) in DMF were added arylthiol (1.1 eq.) and sodium or potassium carbonate (2 eq.) under an argon atmosphere. The reaction apparatus was protected 10 from light and the mixture was stirred overnight at room temperature. The mixture was diluted with AcOEt, washed with water then brine. The organic layer was dried over MgSO₄ and reduced *in vacuo*. The crude product was purified by trituration with AcOEt to afford the SN_{AR} derivative.

15 **Method E: E isomers**

Z isomers were dissolved in ethanol and subjected to a 150 W halogen lamp with a continuous argon flux until there was no more starting material (TLC). The solution was then concentrated and the residue was purified by C18 chromatography to give the title compound.

20 **Method F: Synthesis of (Z)-2-(6-X-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

To a solution of tert-butyl 6-X-3-(cyanomethyl)-1H-indole-1-carboxylate(1 eq) in THF, was added NaH (eq). The resulting mixture was stirred 10 min at room temperature and 4-methoxynicotinaldehyde (1.3 eq) was added with one drop of DMF. The mixture was stirred at room temperature hidden from light. The reaction was quenched with aqueous NH₄Cl and extracted with AcOEt, dried over Na₂SO₄, filtrated and concentrated. The residue 25 was dissolved with THF and NaOH 2.5 M was added. The system was stirred at room temperature hidden from light, diluted with AcOEt, dried over Na₂SO₄, filtrated and concentrated. The residue was taken off with a minimal amount of AcOEt and filtrated to give the title compound.

30 **Method G: Synthesis of (Z)-3-(2-(5-X-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine 1-oxide**

To a solution of (Z)-2-(5-X-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile in THF was added m-CPBA (1 eq), the resulting mixture was stirred 12 h at room temperature, hidden from light and a new portion of m-CPBA (0.5 eq) was added. After additional 4 h of

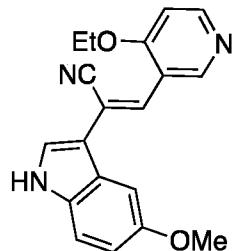
stirring, the mixture was concentrated and the residue was triturated in AcOEt and filtrated to give the title compound.

Methode H: Synthesis of (Z)-3-(2-(5-X-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy) benzonitrile

5 To a solution of tert-butyl 5-X-3-(cyanomethyl)-1H-indole-1-carboxylate (1 eq) in THF, was added NaH (3 eq). The resulting mixture was stirred 10 min at room temperature and 3-formyl-4-(trifluoromethoxy)benzonitrile (1 eq) was added with one drop of DMF. The mixture was stirred at room temperature hidden from light. The reaction was quenched with aqueous NH₄Cl and extracted with AcOEt, dried over Na₂SO₄, filtrated and concentrated. The 10 residue was dissolved with THF and NaOH 2.5 M was added. The system was stirred at room temperature hidden from light, diluted with AcOEt, dried over Na₂SO₄, filtrated and concentrated. The residue was purified by silicagel chromatography (CH₂Cl₂ / MeOH, 100 : 0 to 90 : 10) to give the title compound.

Example 2

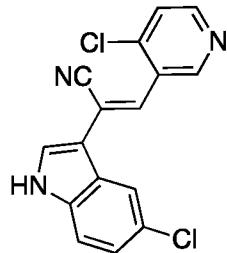
15 **(Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)acrylonitrile**



Method B: (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (50 mg), KOH (45 mg) and EtOH (1.5 mL). Trituration with AcOEt. Aspect of the pure product: yellow solid. (Yield: 67%).

20 ESI-MS: (M+H)⁺ = 320

¹H NMR (Acetone-d₆, 300 MHz) δ ppm: 9.05 (s, 1H), 8.47 (d, J = 5.8 Hz, 1H), 7.81 (s, 1H), 7.75 (s, 1H), 7.49 (d, J = 2.3 Hz, 1H), 7.47 (d, J = 9.0 Hz, 1H), 7.11 (d J= 5.8 Hz, 1H), 6.93 (dd, J = 9.0 Hz, J = 2.3 Hz, 1H), 4.40 (q, J = 7.0 Hz, 1H), 3.88 (s, 3H), 1.49 (t, J = 7.0 Hz, 1H).

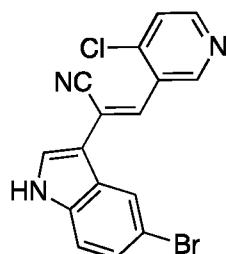
Example 3**(Z)-2-(5-chloro-1*H*-indol-3-yl)-3-(4-chloropyridin-3-yl)acrylonitrile**

Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1*H*-indole-1-carboxylate (670 mg).
 5 Sodium hydride (138 mg). THF 17 mL. 4-chloronicotinaldehyde (457 mg). Trituration of the crude product with MeOH. Aspect of the pure product orange solid. (Yield : 38%)

ESI- MS: (M+H)⁺ = 314¹H NMR (DMSO-d₆, 300 MHz) δ ppm: 12.1 (s, 1H), 9.05 (s, 1H), 8. 6 (d, 1H), 8.06

(d, 1H), 8.03 (d, 1H), 7.8 (s, 1H), 7.75 (d, 1H), 7.57 (dd, 1H), 7.3 (dd, 1H).

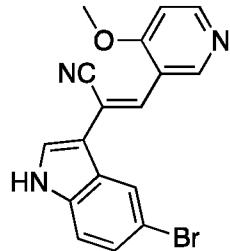
10

Example 4**(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-chloropyridin-3-yl)acrylonitrile**

Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1*H*-indole-1-carboxylate (600 mg).
 Sodium hydride (100 mg). THF 17 mL. 4-chloronicotinaldehyde (355 mg). Trituration of the
 15 crude product with dichloromethane and then washed with methanol and ether. Aspect of the pure product orange brown solid. (Yield : 50%)

ESI- MS: (M+H)⁺ = 358¹H NMR (DMSO-d₆, 300 MHz) δ ppm: 12.1 (s, 1H), 9.03 (s, 1H), 8. 62 (d, 1H), 8.2 (d, 1H), 8.0 (d, 1H), 7.8 (s, 1H), 7.76 (d, 1H), 7.55 (d, 1H), 7.4 (dd, 1H).

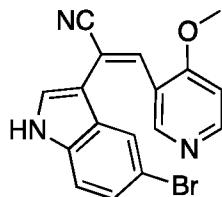
20

Example 5**(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

Method B: *(Z)*-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (80 mg), 5 KOH (25 mg), MeOH (5 mL) and THF (2 mL). The mixture was refluxed for 24 hours. Purification by flash chromatography (CH₂Cl₂/MeOH 100/0 to 96/3). Aspect of the pure product: yellow solid. (Yield : 66%).

ESI-MS: (M+H)⁺ = 354

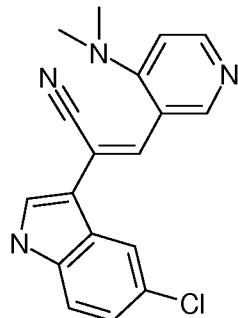
¹H NMR (DMSO-d₆, 300 MHz) δ ppm: 11.96 (s, 1H), 8.83 (s, 1H), 8.52 (d, J = 10.8.8 Hz, 1H), 8.09 (d, J = 1.9 Hz, 1H), 7.90 (d, J = 2.6 Hz, 1H), 7.68 (s, 1H), 7.48 (d, J = 8.7 Hz, 1H), 7.36 (dd, J = 8.7 Hz, J = 1.9 Hz, 1H), 7.20 (d, J = 5.8 Hz, 1H), 3.95 (s, 3H).

Example 5b**(E)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

15 **Method E:** *(Z)*-2-(5-bromo-1*H*-indol-3-yl)-3-(2-methoxyphenyl)acrylonitrile (30 mg). EtOH (40 mL). Reaction time : 18h. Aspect of the pure product : yellow solid. (Yield : 40 %).

ESI-MS : (M+H)⁺ = 354

¹H NMR (methanol-d4, 300 MHz) δ ppm : 8.31 (d, 1H), 8.00 (s, 1H), 7.55 (s, 1H), 7.42 (s, 1H), 7.35 (d, 1H), 7.26-7.14 (m, 2H), 6.96 (d, 1H), 4.00 (s, 3H).

Example 6**(Z)-2-(5-chloro-1*H*-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)acrylonitrile**

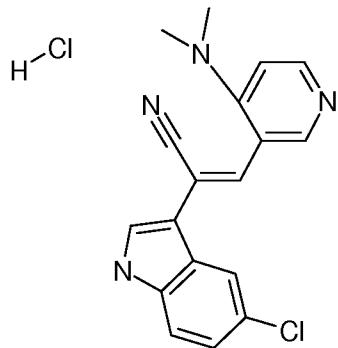
Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg). Sodium hydride (28.9 mg). THF 2 mL. 4-dimethylaminonicotinaldehyde (93 mg). Trituration of the crude product with water and diisopropylether. Aspect of the product pale yellow solid (Yield : 82%)

5 APCI-MS: (M+H)⁺ =323

¹H NMR (300 MHz, DMSO-d₆) δ ppm: 11.92 (s, 1H), 8.52 (s, 1H), 8.26 (d, *J* = 5.8 Hz, 1H), 7.98 (d, *J* = 1.9 Hz, 1H), 7.90 (s, 1H), 7.59 (s, 1H), 7.51 (d, *J* = 8.7 Hz, 1H), 7.23 (dd, *J* = 8.7, 1.9 Hz, 1H), 6.93 (d, *J* = 5.9 Hz, 1H), 1.16 - 1.10 (m, 0.33H), 1.07 (t, *J* = 7.0 Hz, 5.6H).

10 **Example 7**

(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)acrylonitrile, hydrochloride

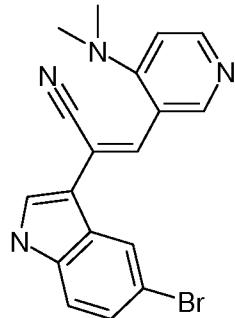


In a 25 mL pear flask, (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)acrylonitrile (60 mg, 0.186 mmol) was dissolved in ethanol (1 mL) and dichloromethane (0.5 mL) to give a yellow solution followed by addition of HCl 37% in water (0.015 mL, 0.186 mmol).

The reaction mixture was concentrated under reduce pressure to give 67 mg of a yellow solid (Yield : 100%)

20 APCI-MS: (M+H)⁺ =323

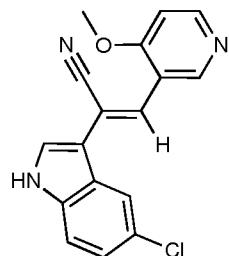
¹H NMR (300 MHz, DMSO-d₆) δ ppm: 14.47 - 13.49 (m, 1H), 12.09 (s, 1H), 8.53 (s, 1H), 8.28 (d, *J* = 7.3 Hz, 1H), 8.08 (s, 1H), 7.91 (s, 2H), 7.53 (d, *J* = 8.7 Hz, 1H), 7.25 (d, *J* = 10.6 Hz, 1H), 7.14 (d, *J* = 7.3 Hz, 1H), 3.25 (s, 6H).

Example 8**(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)acrylonitrile**

Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg).
 5 Sodium hydride (25 mg). THF 2 mL. 4-dimethylaminonicotinaldehyde (81 mg). Trituration of the crude product with water and ethanol. Aspect of the product pale yellow solid (Yield : 61%)

APCI-MS: $(M+H)^+ = 367$

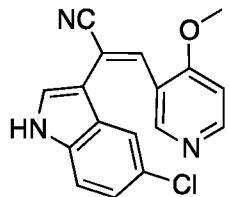
¹H NMR (300 MHz, DMSO-d₆) δ ppm: 11.92 (s, 0.9H), 11.85 - 11.77 (m, 0.1H), 8.51 10 (s, 1H), 8.26 (d, J = 5.9 Hz, 1H), 8.10 (s, 1H), 7.88 (d, J = 2.8 Hz, 1H), 7.62 (s, 1H), 7.46 (d, J = 8.7 Hz, 1H), 7.39 - 7.28 (m, 1H), 6.89 (d, J = 5.9 Hz, 1H), 2.92 (s, 5,6H), 2.85 (s, 0.4H).

Example 9**(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

15 Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (276 mg). THF 7 mL. Sodium hydride (57 mg), 4-methoxypyridine-3-carboxaldehyde (156 mg). Reaction time 24 hours. Trituration of the crude product with MeOH. Aspect of the pure product : orange solid. (Yield : 35%).

ESI-MS: $(M+H)^+ = 310$

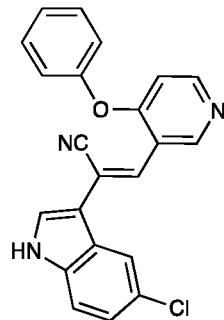
20 ¹H NMR (DMSO-d₆, 300 MHz) δ ppm: 11.97 (s, 1H), 8.82 (s, 1H), 8.51 (d, J = 5.8 Hz, 1H), 7.94 (d, J = 1.8 Hz, 1H), 7.91 (s, 1H), 7.68 (s, 1H), 7.52 (d, J = 8.7 Hz, 1H), 7.24 (dd, J = 8.7, 1.9 Hz, 1H), 7.19 (d, J = 5.8 Hz, 1H), 3.94 (s, 3H).

Example 9b**(E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

Method E: (Z)-2-(5-chloro-1H-indol-3-yl)-3-(2-methoxyphenyl)acrylonitrile (20 mg).
 5 EtOH (35 mL). Reaction time : 8 h. Aspect of the pure product : yellow solid. (Yield : 30 %).

ESI-MS : $(M+H)^+ = 310$

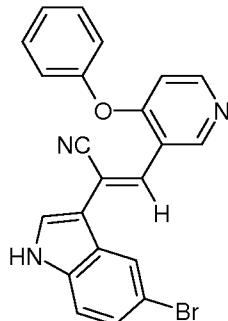
^1H NMR (methanol-d4, 300 MHz) δ ppm : 8.31 (d, 1H), 8.01 (s, 1H), 7.56 (s, 1H), 7.42 (s, 1H), 7.38 (d, 1H), 7.16 (d, 1H), 7.10 (d, 1H), 6.83 (d, 1H), 4.00 (s, 3H).

Example 10**(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)acrylonitrile**

Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (190 mg).
 THF 6 mL. Sodium hydride (40 mg), 4-phenoxyypyridine-3-carboxaldehyde (160 mg).
 Reaction time 24 hours. The reaction mixture was not extracted. A precipitate was formed in
 15 the reaction mixture, filtered and washed with ether. Trituration of the precipitate with
 MeOH. Aspect of the pure product : yellow orange solid. (Yield : 73 %).

ESI-MS: $(M-H) = 370$

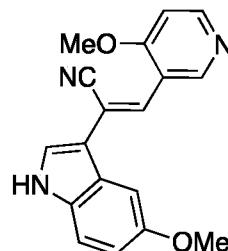
^1H NMR (DMSO-d6, 300 MHz) δ ppm: 8.98 (s, 1H), 8.46 (d, $J = 5.7$ Hz, 1H), 7.99 (s, 1H), 7.87 (s, 1H), 7.73 (s, 1H), 7.62 (d, 1H), 7.50 (m, 2H), 7.35 - 7.2 (m, 3H), 7.17 (dd, $J = 8.7$, 1H), 6.75 (d, $J = 5.7$ Hz, 1H).

Example 11**(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)acrylonitrile**

Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (224 mg). 5 THF 4.9 mL. Sodium hydride (40 mg), 4-phenoxyypyridine-3-carboxaldehyde (160 mg). Reaction time 24 hours. Trituration of the crude product with MeOH. Aspect of the pure product : yellow solid. (Yield : 18.7%).

ESI-MS : (M-H) = 414

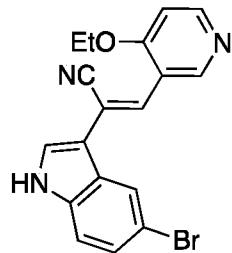
¹H NMR (DMSO-d₆, 300 MHz) δ ppm: 12.01 (s, 1H), 9.0 (s, 1H), 8.48 (d, J = 5.7 Hz, 1H), 8.11 (d, J = 1.7 Hz, 1H), 7.94 (s, 1H), 7.83 (s, 1H), 7.55-7.48 (m, 3H), 7.4– 7.25 (m, 4H), 6.76 (d, J = 5.7 Hz, 1H).

Example 12**(Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

15 **Methode B:** (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (50 mg), KOH (45 mg) and MeOH (1.5 mL). Trituration with AcOEt. Aspect of the pure product: yellow solid. (Yield : 71%).

ESI-MS: (M+H)⁺ = 306

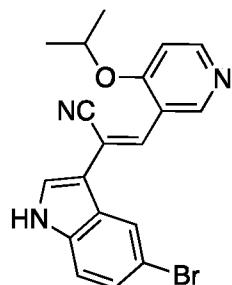
¹H NMR (Acetone-d₆, 300 MHz) δ ppm: 9.02 (s, 1H), 8.50 (d, J = 5.7 Hz, 1H), 7.77 (s, 1H), 7.75 (s, 1H), 7.50 (d, J = 2.3 Hz, 1H), 7.46 (d, J = 8.9 Hz, 1H), 7.14 (d, J = 5.7 Hz, 1H), 6.93 (dd, J = 8.9 Hz, J = 2.3 Hz, 1H), 4.03 (s, 3H), 3.87 (s, 3H).

Example 13**(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-ethoxypyridin-3-yl)acrylonitrile**

Method B: (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (40 mg), 5 KOH (31 mg), EtOH (5 mL). Trituration with AcOEt. Aspect of the pure product: yellow solid. (Yield : 76%).

ESI-MS: (M+H)⁺ = 368

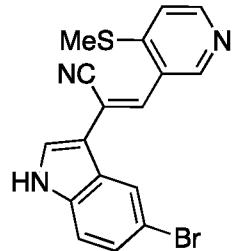
¹H NMR (acetone-d₆, 300 MHz) δ ppm: 9.06 (s, 1H), 8.49 (d, J = 5.5 Hz, 1H), 8.20 (s, 1H), 7.85 (s, 1H), 7.55 (d, J = 8.5 Hz, 1H), 7.40 (d, J = 8.2 Hz, 1H), 7.12 (d, J = 5.8 Hz, 1H), 4.31 (q, J = 7.0 Hz, 2H), 1.54 (t, J = 7.0 Hz, 3H).

Example 14**(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)acrylonitrile**

Method B: (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (70 mg), 15 KOH (55 mg), isopropanol (2 mL). Purification by flash chromatography (CH₂Cl₂/MeOH 100/0 to 95/5). Aspect of the pure product: yellow solid. (Yield : 20%).

ESI-MS: (M+H)⁺ = 382

¹H NMR (MeOD, 300 MHz) δ ppm: 9.02 (s, 1H), 8.42 (d, J = 5.8 Hz, 1H), 8.09 (d, J = 1.5 Hz, 1H), 7.75 (s, 1H), 7.69 (s, 1H), 7.42 (d, J = 8.7 Hz, 1H), 7.36 (dd, J = 8.7 Hz, J = 1.5 Hz, 1H), 7.19 (d, J = 5.8 Hz, 1H), 4.93 (sept, J = 6.0 Hz, 1H), 1.50 (d, J = 6.0 Hz, 6H).

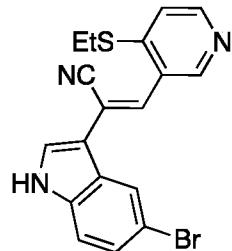
Example 15**(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)acrylonitrile**

Method C: (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (80 mg), 5 NaSMe (31 mg), DMF (1 mL). Aspect of the pure product: yellow solid. (Yield : 61%).

ESI-MS: (M+H)⁺ = 370

¹H NMR (acetone-d₆, 300 MHz) δ ppm: 11.12 (s, 1H), 8.83 (s, 1H), 8.48 (d, J = 5.3 Hz, 1H), 8.24 (d, J = 1.9 Hz, 1H), 7.91 (s, 1H), 7.67 (s, 1H), 7.57 (d, J = 8.7 Hz, 1H), 7.41 (dd, J = 8.7 Hz, J = 1.9 Hz, 1H), 7.39 (d, J = 5.3 Hz, 1H), 2.66 (s, 3H).

10

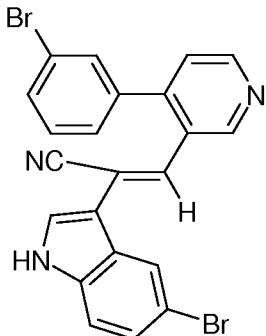
Example 16**(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-(ethylthio)pyridin-3-yl)acrylonitrile**

Method C: (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (80 mg), NaSEt (37 mg), DMF (1 mL). Aspect of the pure product: yellow solid. (Yield : 70%).

15

ESI-MS: (M+H)⁺ = 384

¹H NMR (acetone-d₆, 300 MHz) δ ppm: 11.13 (s, 1H), 8.86 (s, 1H), 8.47 (d, J = 5.5 Hz, 1H), 8.26 (d, J = 1.7 Hz, 1H), 7.91 (s, 1H), 7.68 (s, 1H), 7.56 (d, J = 8.7 Hz, 1H), 7.45-7.39 (m, 2H), 3.21 (q, J = 7.5 Hz, 2H), 1.42 (t, J = 7.5 Hz, 3H).

Example 17**(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3-bromophenyl)pyridin-3-yl)acrylonitrile**

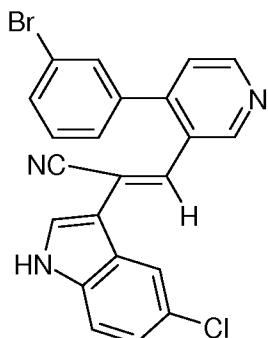
Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (300 mg). 5 THF 6.6 mL. Sodium hydride (54 mg), 4-(3-bromophenyl)-3-pyridinecarboxaldehyde (328 mg). Reaction time 24 hours. Trituration of the crude product with MeOH. Aspect of the pure product : yellow solid. (Yield : 65%).

ESI-MS: $(M+H)^+ = 478$

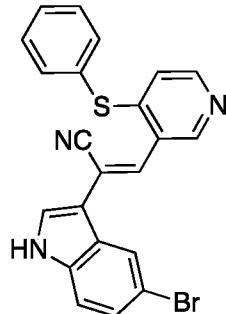
^1H NMR (DMSO-d₆, 300 MHz) δ ppm: 11.96 (s, 1H), 9.04 (s, 1H), 8.72 (d, 1H), 7.84 10 (s, 1H), 7.79-7.68 (m, 3H), 7.65-7.43 (m, 5H), 7.32 (dd, 1H).

Example 18**(Z)-3-(4-(3-bromophenyl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)acrylonitrile**

Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (266 mg). THF 6.8 mL. Sodium hydride (55 mg), 4-(3-bromophenyl)-3-pyridinecarboxaldehyde (336 15 mg). Reaction time 24 hours. Trituration of the crude product with MeOH. Aspect of the pure product : yellow solid. (Yield : 52%).

ESI-MS: $(M+H)^+ = 434$

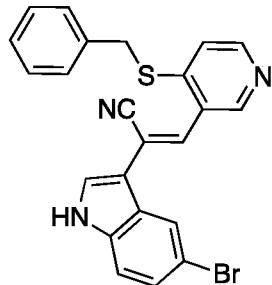
^1H NMR (DMSO-d₆, 300 MHz) δ ppm: 11.96 (s, 1H), 9.04 (s, 1H), 8.72 (d, 1H), 7.86 20 (s, 1H), 7.81-7.68 (m, 3H), 7.66-7.46 (m, 5H), 7.22 (dd, 1H).

Example 19**(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)acrylonitrile**

Method D: (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (80 mg), 5 thiophenol (25 μ L), sodium carbonate (47 mg), DMF (1 mL). Aspect of the pure product: yellow solid. (Yield : 53%).

ESI-MS: $(M+H)^+ = 432$

1H NMR (DMSO-d₆, 300 MHz) δ ppm: 12.05 (s, 1H), 8.81 (s, 1H), 8.40 (d, $J = 5.3$ Hz, 1H), 8.15 (d, $J = 1.7$ Hz, 1H), 7.96 (s, 1H), 7.73 (s, 1H), 7.62 (m, 2H), 7.55 (m, 3H), 7.50 (d, $J = 8.7$ Hz, 1H), 7.38 (dd, $J = 8.7$ Hz, $J = 1.7$ Hz, 1H), 6.81 (d, $J = 5.3$ Hz, 1H).

Example 20**(Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1*H*-indol-3-yl)acrylonitrile**

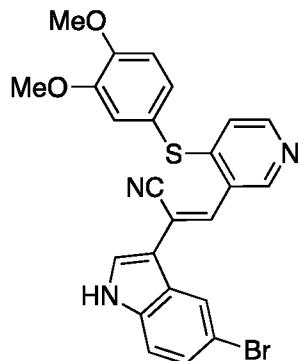
Method D: (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (50 mg), 15 benzyl mercaptan (18 μ L), sodium carbonate (30 mg), DMF (1 mL). Aspect of the pure product: yellow solid. (Yield : 47%).

ESI-MS: $(M+H)^+ = 446$

1H NMR (DMSO-d₆, 300 MHz) δ ppm: 12.01 (s, 1H), 8.73 (s, 1H), 8.58 (d, $J = 5.2$ Hz, 1H), 8.12 (d, $J = 1.2$ Hz, 1H), 7.92 (s, 1H), 7.60 (s, 1H), 7.56 (d, $J = 5.2$ Hz, 1H), 7.49-7.47 (m, 3H), 7.37-7.33 (m, 3H), 7.28 (m, 1H), 4.47 (s, 2H).

Example 21(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-((3,4-dimethoxyphenyl)thio)pyridin-3-

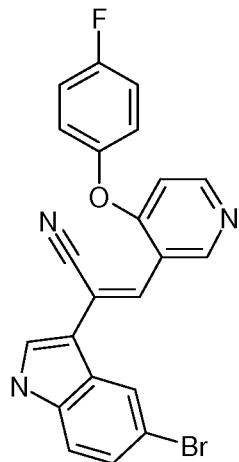
yl)acrylonitrile



5 **Method D:** (Z)-2-(5-Bromo-1*H*-indol-3-yl)-3-(4-chloro-3-yl)acrylonitrile (61 mg), 3,4-dimethoxythiophenol (37 μ L), sodium carbonate (36 mg), DMF (1 mL). Aspect of the pure product: yellow solid. (Yield : 50%).

ESI-MS: $(M+H)^+ = 492$

1H NMR (DMSO-d₆, 300 MHz) δ ppm: 12.05 (s, 1H), 8.76 (s, 1H), 8.36 (d, $J = 10$ 5.2 Hz, 1H), 8.17 (s, 1H), 7.96 (s, 1H), 7.70 (s, 1H), 7.51 (d, $J = 8.5$ Hz, 1H), 7.39 (d, $J = 8.5$ Hz, 1H), 7.22 (d, $J = 8.2$ Hz, 1H), 7.19 (s, 1H), 7.13 (d, $J = 8.5$ Hz, 1H), 6.74 (d, $J = 5.2$ Hz, 1H), 3.82 (s, 3H), 3.76 (s, 3H).

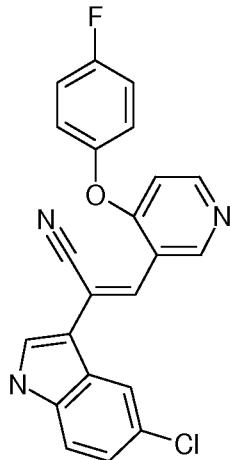
Example 22(Z)-2-(5-bromo-1*H*-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)acrylonitrile

Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1*H*-indole-1-carboxylate (200 mg). THF 2 mL. Sodium hydride (31.7 mg), 4-(4-fluorophenyl)-3-pyridinecarboxaldehyde (148 mg). Reaction time 1h30. Trituration of the crude product with DCM. Aspect of the product : yellow solid. (Yield : 10%).

¹H NMR (300 MHz, DMSO-d6) δ ppm: 12.01 (s, 1H), 8.98 (s, 1H), 8.46 (d, J = 5.7 Hz, 1H), 8.11 (d, J = 1.7 Hz, 1H), 7.94 (s, 1H), 7.83 (s, 1H), 7.48 (d, J = 8.7 Hz, 1H), 7.38 – 7.31 (m, 5H), 6.73 (d, J = 5.7 Hz, 1H).

Example 23

5 (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)acrylonitrile



Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (200 mg). THF 2 mL. Sodium hydride (35.1 mg), 4-(4-fluorophenyl)-3-pyridinecarboxaldehyde (163 mg). Reaction time 1 hour 30 minutes. Trituration of the crude product with DCM. Aspect of 10 the product : yellow solid. (Yield : 82%).

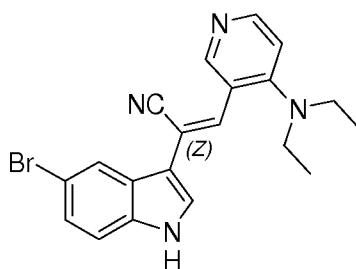
APCI-MS: (M+H)⁺ = 390

¹H NMR (300 MHz, DMSO-d6) δ ppm: 8.98 (s, 1H), 8.46 (d, J = 5.7 Hz, 1H), 7.99 – 7.92 (m, 2H), 7.83 (s, 1H), 7.52 (d, J = 8.7 Hz, 1H), 7.34 (d, J = 5.9 Hz, 4H), 7.24 (dd, J = 8.7, 1.8 Hz, 1H), 6.73 (d, J = 5.7 Hz, 1H).

15

Example 24

(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)acrylonitrile



Method A: Aspect of the product: yellow solid (Yield : 60%)

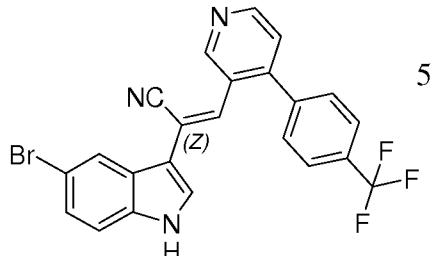
APCI-MS: (M+H)⁺ = 395

20

¹H NMR (300 MHz, DMSO-d6) δ ppm: 11.93 (s, 0.83H), 11.88 – 11.76 (m, 0.12H), 8.52 (s, 1H), 8.27 (d, J = 5.8 Hz, 1H), 8.12 (d, J = 1.7 Hz, 1H), 7.88 (s, 1H), 7.59 (s, 1H), 7.51 – 7.21 (m, 2H), 6.93 (d, J = 5.9 Hz, 1H), 3.32 – 3.24 (m, 4H), 1.07 (t, J = 7.0 Hz, 6H).

Example 25

(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)acrylonitrile



Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (120 mg). THF 3 mL. Sodium hydride (20.05 mg), 4-(4-trifluoromethylphenyl)-3-pyridinecarboxaldehyde (108 mg). Reaction time 16 hours. Purification by chromatography on 24 g Redisep column 20-40 μ m, eluted with a gradient of CH_2Cl_2 / MeOH from 100/00 to 95/05. Dissolution of the solid 10 in EtOH (3 mL) and water (0.3 mL) and concentration in a Genevac evaporator to remove the traces of solvent. Aspect of the product: yellow solid. (Yield : 57%).

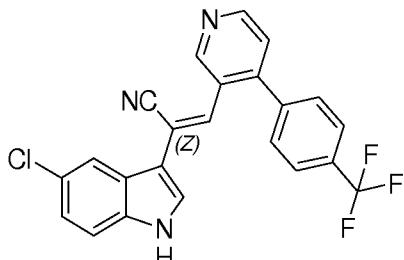
APCI-MS: $(\text{M}+\text{H})^+ = 468$

^1H NMR (300 MHz, DMSO-d6) δ ppm: 12.19 - 11.57 (s, 1H), 9.11 (s, 1H), 8.80 - 8.61 (d, 1H), 7.66 (, m, 11H).

15

Example 26

(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)acrylonitrile



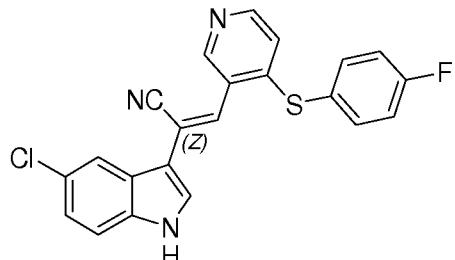
Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (120 mg). 20 THF 3 mL. Sodium hydride (23.11 mg), 4-(4-trifluoromethylphenyl)-3-pyridinecarboxaldehyde (124 mg). Reaction time 16 hours. Purification by chromatography on 24 g Redisep column 20-40 μ m, eluted with a gradient of CH_2Cl_2 / MeOH from 100/00 to 95/05. Dissolution of the solid in EtOH (3 mL) and water (0.3 mL) and concentration in a Genevac evaporator to remove the traces of solvent. Aspect of the product: yellow solid. 25 (Yield : 68%).

APCI-MS: $(\text{M}+\text{H})^+ = 424$

¹H NMR (300 MHz, DMSO-d6) δ ppm: 12.40 - 11.44 (m, 1H), 9.10 (s, 1H), 8.73 (d, *J* = 5.1 Hz, 1H), 7.91 - 7.16 (m, 11H).

Example 27

(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-5 yl)acrylonitrile



Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg). THF 2 mL. Sodium hydride (28.9 mg), 4-(4-fluorophenylthio)-3-pyridinecarboxaldehyde (144 mg). Reaction time 16 hours. Trituration of the crude product with heptane and 10 diisopropylether. Aspect of the product: yellow solid. (Yield : 42%).

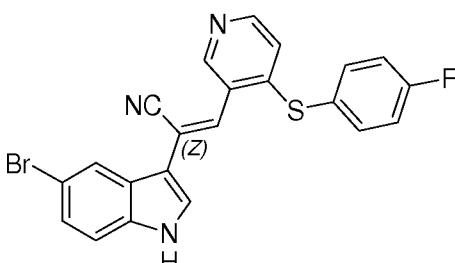
APCI-MS: (M+H)⁺ =406

¹H NMR (300 MHz, DMSO-d6) δ ppm: 8.79 (s, 1H), 8.38 (d, *J* = 5.4 Hz, 1H), 7.97 (s, 2H), 7.68 (s, 4H), 7.56 (d, *J* = 8.6 Hz, 1H), 7.42 (d, *J* = 8.6 Hz, 3H), 7.26 (s, 1H), 6.76 (d, *J* = 5.4 Hz, 1H).

15

Example 28

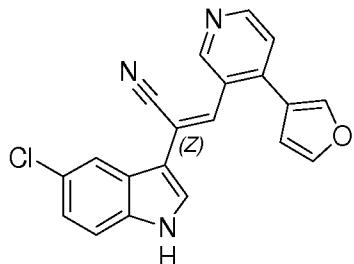
(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)acrylonitrile



Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg). 20 THF 2 mL. Sodium hydride (25.06 mg), 4-(4-fluorophenylthio)-3-pyridinecarboxaldehyde (125 mg). Reaction time 16 hours. Trituration of the crude product with heptane and ether. Aspect of the product: yellow solid. (Yield : 32%).

APCI-MS: (M+H)⁺ =450

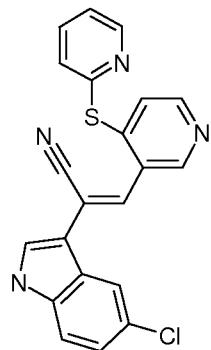
¹H NMR (300 MHz, DMSO-d6) δ ppm: 11.98 (s, 1H), 8.82 - 8.74 (m, 1H), 8.43 - 8.35 25 (m, 1H), 8.18 - 8.13 (m, 1H), 7.99 - 7.93 (m, 1H), 7.70 (dd, *J* = 8.6, 2.7 Hz, 3H), 7.44 (qd, *J* = 8.6, 7.1 Hz, 4H), 6.80 - 6.73 (m, 1H).

Example 29**(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)acrylonitrile**

Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg).
 5 THF 3 mL. Sodium hydride (17.33 mg), 4-(furan-3-yl)nicotinaldehyde 107 mg). Reaction time 16 hours. Trituration of the crude product with heptane and diisopropylether. Aspect of the product: yellow solid. (Yield : 21%).

APCI-MS: $(M+H)^+ = 346$

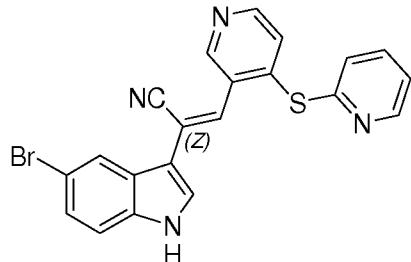
¹H NMR (300 MHz, DMSO-d6) δ ppm: 11.99 (s, 1H), 8.93 (s, 1H), 8.64 (d, $J = 5.2$ Hz, 1H), 8.10 (s, 1H), 8.01 - 7.92 (m, 2H), 7.87 (s, 1H), 7.77 (s, 1H), 7.64 (d, $J = 5.1$ Hz, 1H), 7.53 (d, $J = 8.7$ Hz, 1H), 7.25 (dd, $J = 8.7, 1.9$ Hz, 1H), 6.97 (s, 1H).

Example 30**(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridin-2-ylthio)pyridin-3-yl)acrylonitrile**

15 Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg). THF 2 mL. Sodium hydride (28.9 mg), 4-(pyridin-2-ylthio)-nicotinaldehyde (134 mg). Reaction time 16 hours. Trituration of the crude product with heptane and diisopropylether. Aspect of the product: yellow solid. (Yield : 55%).

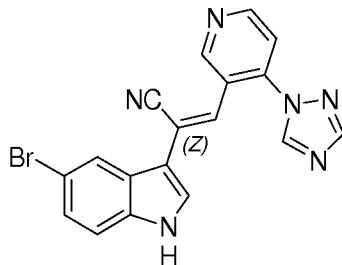
APCI-MS: $(M+H)^+ = 389$

20 ¹H NMR (300 MHz, DMSO-d6) δ ppm: 9.00 (s, 1H), 8.60 - 8.52 (m, 1H), 8.48 (d, $J = 3.8$ Hz, 1H), 7.86 (s, 1H), 7.81 - 7.73 (m, 1H), 7.68 (s, 1H), 7.59 (s, 1H), 7.52 (d, $J = 5.3$ Hz, 2H), 7.43 (d, $J = 7.9$ Hz, 1H), 7.28 (dd, $J = 7.0, 5.2$ Hz, 1H), 7.20 - 7.12 (m, 1H).

Example 31**(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(pyridin-2-ylthio)pyridin-3-yl)acrylonitrile**

Method A: *tert*-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg).
 5 THF 2 mL. Sodium hydride (25.06 mg), 4-(pyridin-2-yl)thio-nicotinaldehyde (116 mg).
 Reaction time 16 hours. Trituration of the crude product with heptane and ether. Aspect of the product: yellow solid. (Yield : 65%).

APCI-MS: $(M+H)^+ = 433$
 ^1H NMR (300 MHz, DMSO-d6) δ ppm: 9.00 (s, 1H), 8.62 - 8.57 (m, 1H), 8.52 - 8.46 (m, 1H), 7.91 - 7.86 (m, 2H), 7.78 (ddd, $J = 9.5, 7.7, 1.8$ Hz, 1H), 10 7.68 (s, 1H), 7.56 - 7.52 (m, 1H), 7.49 - 7.42 (m, 2H), 7.37 - 7.26 (m, 2H).

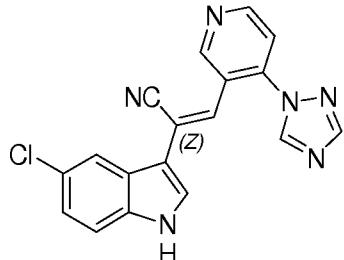
Example 32**(Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)acrylonitrile**

Method A: *tert*-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg).
 15 THF 2 mL. Sodium hydride (25.06 mg), 4-(1H-1,2,4-triazol-1-yl)nicotinaldehyde (118 mg).
 Reaction time 16 hours. Trituration of the crude product with ethanol. Aspect of the product: yellow solid. (Yield : 32%).

APCI-MS: $(M+H)^+ = 391$
 20 ^1H NMR (300 MHz, DMSO-d6) δ ppm: 12.00 (s, 1H), 9.28 (s, 1H), 9.14 (s, 1H), 8.81 (d, 1H), 8.37 (s, 1H), 8.10 (s, 1H), 7.87 (s, 3H), 7.52 - 7.29 (m, 2H).

Example 33

(Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)acrylonitrile



5 **Method A:** tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg). THF 5 mL. Sodium hydride (28.9 mg), 4-(1H-1,2,4-triazol-1-yl)nicotinaldehyde (136 mg). Reaction time 16 hours. Purification by flash chromatography on 24g Redisep column 20-40 µm, gradient 100% CH₂Cl₂ to CH₂Cl₂ / MeOH (90/10). Aspect of the product: yellow solid. (Yield : 33%).

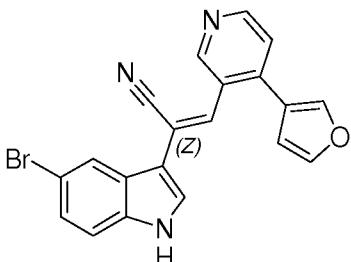
10 Aspect of the product: yellow solid (Yield : 33%)

APCI-MS: (M+H)⁺ =347

¹H NMR (300 MHz, DMSO-d6) δ ppm: 12.32 - 11.49 (m, 1H), 9.27 (s, 1H), 9.15 (d, J = 4.0 Hz, 1H), 8.82 (d, J = 5.4 Hz, 1H), 8.66 - 8.57 (m, 0.1H), 8.46 - 8.25 (m, 1H), 8.03 - 7.71 (m, 4H), 7.59 - 7.35 (m, 1H), 7.25 (dd, J = 8.7, 2.0 Hz, 1H).

Example 34

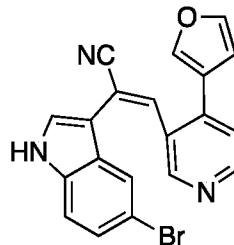
(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)acrylonitrile



15 **Method A:** tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg). THF 3 mL. Sodium hydride (15.03 mg), 4-(furan-3-yl)nicotinaldehyde (93 mg). Reaction time 16 hours. Trituration of the crude product with water and NaOH. Aspect of the product: yellow solid. (Yield : 27%).

APCI-MS: (M+H)⁺ =390

¹H NMR (300 MHz, DMSO-d6) δ ppm: 11.98 (s, 1H), 8.92 (s, 1H), 8.64 (d, J = 5.2 Hz, 1H), 8.13 - 8.06 (m, 2H), 7.92 (d, J = 2.7 Hz, 1H), 7.87 (t, J = 1.7 Hz, 1H), 7.76 (s, 1H), 7.63 (d, J = 5.1 Hz, 1H), 7.48 (d, J = 8.7 Hz, 1H), 7.35 (dd, J = 8.7, 1.8 Hz, 1H), 6.96 (d, J = 1.0 Hz, 1H).

Example 34b**(E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)acrylonitrile**

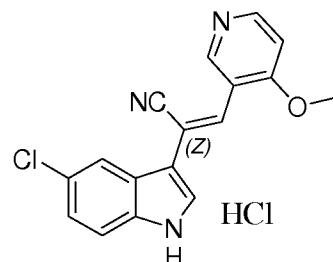
Method E: (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)acrylonitrile 5 (20 mg). EtOH (40 mL). Reaction time : 8 h. Aspect of the pure product : yellow solid. (Yield : 60 %).

ESI-MS : $(M+H)^+ = 390$

^1H NMR (methanol-d4, 300 MHz) δ ppm: 8.37 (d, 1H), 8.19 (s, 1H), 8.0 (s, 1H), 7.72 (s, 1H), 7.60 (d, 1H), 7.45 (s, 1H), 7.38 (s, 1H), 7.30 (d, 1H), 7.19 (d, 1H), 6.98 (s, 1H), 6.89 10 (s, 1H).

Example 35

(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile, hydrochloride



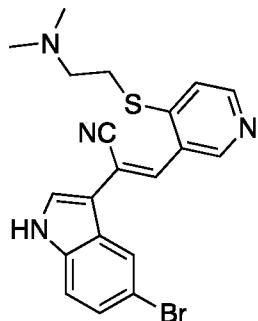
15 **Method A:** tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (300 mg). THF 5 mL. Sodium hydride (57.8 mg), 4-methoxynicotinaldehyde (170 mg). Reaction time 16 hours. Trituration of the crude product with DCM and 4N HCl in dioxane. Aspect of the product: yellow solid. (Yield : 81%).

APCI-MS: $(M+H)^+ = 310$

20 ^1H NMR (300 MHz, DMSO-d6) δ ppm: 12.18 (s, 1H), 9.12 (s, 1H), 8.86 (d, $J = 6.8$ Hz, 1H), 7.99 (d, $J = 3.1$ Hz, 2H), 7.71 (d, $J = 6.8$ Hz, 1H), 7.64 (s, 1H), 7.55 (d, $J = 8.7$ Hz, 1H), 7.27 (dd, $J = 8.7, 1.9$ Hz, 1H), 4.16 (s, 3H).

Example 36

(Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((2-dimethylamino)ethyl)thio)pyridin-3-yl)acrylonitrile



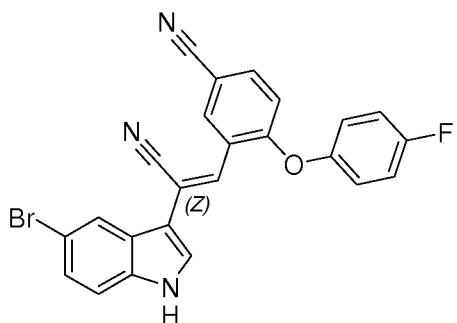
5 **Method D:** (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)acrylonitrile (50 mg). DMF 2.0 mL. Potassium carbonate (64 mg), 2-(dimethylaminoethanethiol hydrochloride (25 mg). Reaction time 12 hours at 60°C. Trituration of the crude product with AcOEt. Aspect of the pure product : yellow solid. (Yield : 50%).

ESI-MS: (M+H)⁺ = 428

10 ¹H NMR (acetone-d₆, 300 MHz) δ ppm: 11.14 (s, 1H), 8.86 (s, 1H), 8.48 (s, 1H), 8.28 (d, 1H), 7.92 (s, 1H), 7.74 (s, 1H) 7.57 (d, 1H), 7.48 (d, 1H), 7.44 (dd, 1H), 3.33 (t, 2H), 2.70 (t, 2H), 2.28 (s, 6H).

Example 37

(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(4-fluorophenoxy)benzonitrile

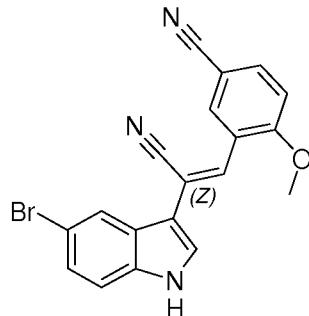


15

Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (100 mg). THF 2.0 mL. Sodium hydride (16.71 mg), 3-cyano-4-fluorophenoxy-benzaldehyde (102 mg). Reaction time 1 hour 30 minutes. Purification by flash chromatography, eluent petroleum ether/MTBE. Aspect of the pure product : yellow solid. (Yield : 48%).

20 APCI-MS: (M-H) = 456

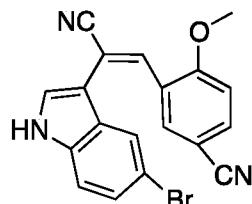
¹H NMR (300 MHz, DMSO-d₆) δ ppm: 12.02 (s, 1H), 8.39 (s, 1H), 8.05 (s, 1H), 7.93 (s, 1H), 7.86 (d, J = 6.6 Hz, 1H), 7.81 (s, 1H), 7.47 (d, J = 8.7 Hz, 1H), 7.32 (dd, J = 15.3, 7.0 Hz, 5H), 6.95 (d, J = 8.7 Hz, 1H).

Example 38**(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile**

Method A : Tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (150 mg, 0.447 mmol) THF 2 mL, NaH (25.06 mg, 0.626 mmol), 3-formyl-4-methoxybenzonitrile (88 mg, 0.537 mmol). Reaction time 1 hour 30 minutes. The reaction mixture diluted with water (20 mL). The resulting solid was filtered, washed successively with water, CH_2Cl_2 , DIPE and acetonitrile and dried *in vacuo* to give 55 mg of a yellow solid (Yield : 30%)

APCI-MS: $(\text{M}-\text{H}) = 376$

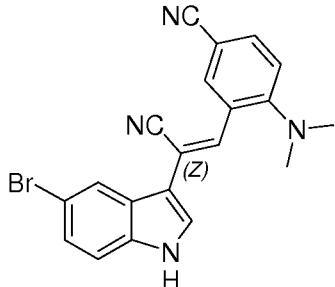
10 ^1H NMR (300 MHz, DMSO-d_6) δ ppm: 11.99 (s, 1H), 8.22 (s, 1H), 8.08 (s, 1H), 7.91 (s, 2H), 7.70 (s, 1H), 7.60 – 7.15 (m, 3H), 3.97 (s, 3H).

Example 38b**(E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile**

15 **Method E:** (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (20 mg). EtOH (40 mL). Reaction time : 8 h. Aspect of the pure product : yellow solid. (Yield : 60 %).

ESI-MS : $(\text{M}+\text{H})^+ = 379$

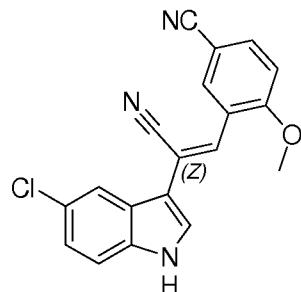
19 ^1H NMR (methanol-d4, 300 MHz) δ ppm : 7.61 (d, 1H), 7.49 (s, 1H), 7.36 (s, 1H), 7.32 (d, 1H), 7.26-7.13 (m, 3H), 6.85 (d, 1H), 3.91 (s, 3H).

Example 39**(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile**

Method A: *tert*-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (120 mg). 5 THF 2.5 mL. Sodium hydride (11.55 mg), 3-cyano-4-dimethylamino-benzaldehyde (73.3 mg). Reaction time 16 hours. Silical gel flash-column chromatography (eluent heptane/ethyl acetate. Aspect of the purified product : yellow solid. (Yield : 33%).

APCI-MS: $(M+H)^+ = 391$

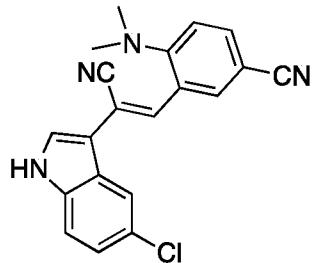
^1H NMR (300 MHz, DMSO-d₆) δ ppm: 11.98 (s, 1H), 8.10 (d, $J = 1.6$ Hz, 1H), 8.05 10 (d, $J = 1.7$ Hz, 1H), 7.91 (s, 1H), 7.75 (dd, $J = 8.6, 2.1$ Hz, 1H), 7.56 (s, 1H), 7.48 (d, $J = 8.7$ Hz, 1H), 7.35 (dd, $J = 8.7, 1.8$ Hz, 1H), 7.16 (d, $J = 8.7$ Hz, 1H), 2.89 (s, 6H).

Example 40**(Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile**

Method A: *tert*-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (200 mg). 15 THF 2.0 mL. Sodium hydride (35.1 mg), 3-cyano-4-methoxybenzaldehyde (124 mg). Reaction time 1 hour 30 minutes. Silical gel flash-column chromatography (petroleum ether/DIPE) and trituration of the purified product with acetonitrile. Aspect of the pure product : yellow solid. (Yield : 40%).

APCI-MS: $(M-H) = 332$

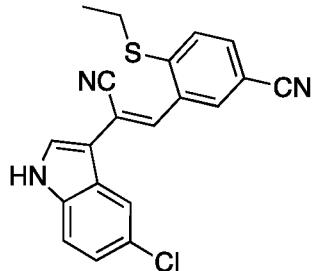
^1H NMR (300 MHz, DMSO-d₆) δ ppm: 8.21 (s, 1H), 7.93 (d, $J = 6.5$ Hz, 3H), 7.70 (s, 1H), 7.52 (d, $J = 8.7$ Hz, 1H), 7.29 (dd, $J = 22.2, 9.6$ Hz, 2H), 3.96 (s, 3H).

Example 41**(Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile**

Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (200 mg).
 5 THF 2.0 mL. Sodium hydride (35.1 mg), 3-cyano-4-dimethylaminobenzaldehyde (134 mg). Reaction time 1 hour 30 minutes. Silical gel flash-column chromatography (petroleum ether/DIPE) and trituration of the purified product with acetonitrile. Aspect of the pure product : yellow solid. (Yield : 33%).

APCI-MS: (M+H)⁺ = 347

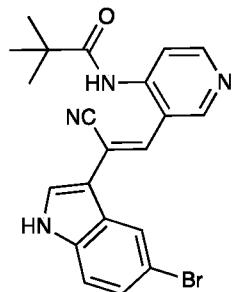
10 ¹H NMR (300 MHz, DMSO-d₆) δ ppm: 11.95 (s, 1H), 8.04 (d, J = 1.7 Hz, 1H), 8.00 – 7.89 (m, 2H), 7.75 (dd, J = 8.6, 2.0 Hz, 1H), 7.62 – 7.45 (m, 2H), 7.30 – 7.09 (m, 2H), 2.89 (s, 6H).

Example 42**(Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(ethylthio)benzonitrile**

15 **Method A:** tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (200 mg). THF 2.0 mL. Sodium hydride (35.1 mg), 3-cyano-4-ethylthiobenzaldehyde (145 mg). Reaction time 1 hour 30 minutes. Silical gel flash-column chromatography (petroleum ether/DIPE) and trituration of the purified product with acetonitrile. Aspect of the pure product : yellow solid. (Yield : 36%).

APCI-MS: (M-H) = 362

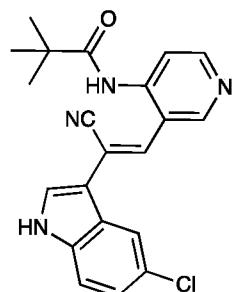
¹H NMR (300 MHz, DMSO-d₆) δ ppm: 12.04 (s, 1H), 8.12 (s, 1H), 8.04 – 7.92 (m, 2H), 7.87 (dd, J = 8.3, 1.7 Hz, 1H), 7.72 – 7.58 (m, 2H), 7.54 (d, J = 8.7 Hz, 1H), 7.27 (dd, J = 8.7, 1.9 Hz, 1H), 3.18 (q, J = 7.3 Hz, 2H), 1.31 (t, J = 7.3 Hz, 3H).

Example 43**(Z)-N-(3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)pyridin-4-yl)pivalamide**

Method A: tert-butyl 5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (300 mg). 5 THF 6 mL. Sodium hydride (54 mg), N-(formyl-pyridin-4-yl)-2,2-dimethyl-propionamide (258 mg). Reaction time 24 hours. Silical gel flash-column chromatography (elution with cycloheptane/AcOEt : 1/1 to 1/9) and trituration with methanol. Aspect of the pure product : yellow solid. (Yield : 13%).

ESI-MS: (M-H) = 421

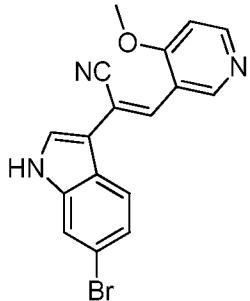
10 ^1H NMR (DMSO-d₆, 300 MHz) δ ppm: 11.98 (s, 1H), 9.49 (s, 1H), 8.96 (s, 1H), 8.55 (s, 1H), 8.17 (d, 1H), 7.88 (d, 1H), 7.68 (s, 1H), 7.56 (d, 1H), 7.50 (d, 1H), 1.25 (s, 9H).

Example 44**(Z)-N-(3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)pyridin-4-yl)pivalamide**

15 Method A: tert-butyl 5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (300 mg). THF 6 mL. Sodium hydride (62 mg), N-(formyl-pyridin-4-yl)-2,2-dimethyl-propionamide (298 mg). Reaction time 24 hours. Silical gel flash-column chromatography (elution with cycloheptane/AcOEt : 1/1 to 1/9) of the residue afforded the corresponding acrylonitrile as a yellow solid (Yield : 18%).

20 ESI-MS: (M+H)⁺ = 379

^1H NMR (DMSO-d₆, 300 MHz) δ ppm: 11.98 (s, 1H), 9.49 (s, 1H), 8.96 (s, 1H), 8.55 (s, 1H), 8.17 (s, 1H), 7.85 (s, 1H), 7.68 (s, 1H), 7.56 (m, 1H), 7.25 (d, 1H), 1.22 (s, 9H).

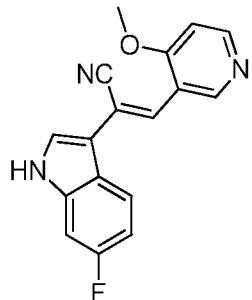
Example 45**(Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

Method F: Tert-butyl 6-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (84.0 mg), 5 NaH (10.0 mg). THF (2 mL). 10 min at rt. 4-methoxynicotinaldehyde (41.0 mg). 12 h at rt. Trituration of the crude in AcOEt. Aspect of the pure product : yellow solid. (Yield : 35%).

ESI-MS : $(M+H)^+ = 356$

^1H NMR (methanol-d4, 300 MHz) δ ppm : 8.95 (s, 1H), 8.47 (d, 1H), 7.87 (d, 1H), 7.76 (s, 1H), 7.70-7.65 (m, 2H), 7.33 (d, 1H), 7.21 (d, 1H), 4.06 (s, 3H).

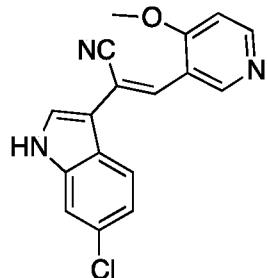
10

Example 46**(Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

Method F: Tert-butyl 6-fluoro-3-(cyanomethyl)-1H-indole-1-carboxylate (98.0 mg), 15 NaH (18.0 mg). THF (3 mL). 10 min at rt. 4-methoxynicotinaldehyde (58.0 mg). 12 h at rt. Trituration of the crude in AcOEt. Aspect of the pure product : yellow solid. (Yield : 43%).

ESI-MS: $(M+H)^+ = 294$

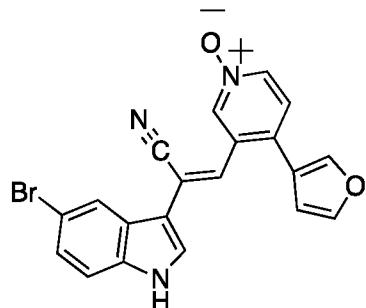
^1H NMR (methanol-d4, 300 MHz) δ ppm: 8.30 (d, 1H), 8.00 (s, 1H), 7.55 (s, 1H), 7.41 (s, 1H), 7.38 (d, 1H), 7.16 (d, 1H), 7.10 (dd, 1H), 6.82 (d, 1H), 4.00 (s, 3H).

Example 47**(Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile**

Method F: Tert-butyl 6-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (100.0 mg), 5 NaH (18.0 mg). THF (3 mL). 10 min at rt. 4-methoxynicotinaldehyde (56.0 mg). 12 h at rt. NaOH 2.5 M (1.5 mL). 12 h at rt. Trituration of the crude in AcOEt. Aspect of the pure product : yellow solid. (Yield : 42%).

ESI-MS: $(M+H)^+ = 310$

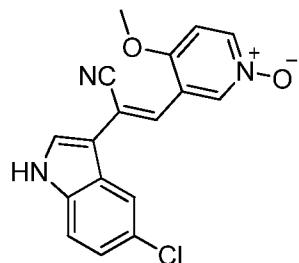
^1H NMR (methanol-d4, 300 MHz) δ ppm: 8.95 (s, 1H), 8.48 (d, 1H), 7.92 (d, 1H), 10 7.76 (s, 1H), 7.71 (s, 1H), 7.50 (d, 1H), 7.24-7.18 (m, 2H), 4.06 (s, 3H).

Example 48**(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide**

Method G: (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)acrylonitrile (30.0 mg), m-CPBA (28.0 + 15.0 mg). THF (1.0 mL). 16h at room temperature. Trituration of the crude in AcOEt. Aspect of the pure product : yellow solid. (Yield : 72%).

ESI-MS : $(M+H)^+ = 408$

^1H NMR (methanol-d4, 300 MHz) δ ppm : 8.83 (s, 1H), 8.37 (d, 1H), 8.03 (s, 1H), 8.01-7.92 (m, 2H), 7.82 (s, 1H), 7.79-7.72 (m, 1H), 7.66-7.56 (m, 2H), 7.54-7.33 (m, 1H), 20 6.86 (s, 1H).

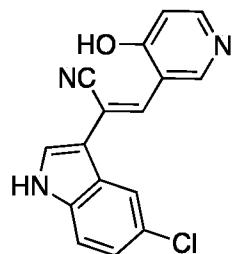
Example 49**(Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine 1-oxide**

Method G : (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile 5 (30.0 mg), m-CPBA (33.0 + 16.0 mg). THF (1.5 mL). 16h at room temperature. Trituration of the crude in AcOEt. Aspect of the pure product : yellow solid. (Yield : 80%).

ESI-MS : $(M+H)^+ = 326$

^1H NMR (methanol-d4, 300 MHz) δ ppm : 8.84 (s, 1H), 8.33 (d, 1H), 7.94 (s, 1H), 7.81 (s, 1H), 7.59 (s, 1H), 7.50 (d, 1H), 7.35 (d, 1H), 7.26 (d, 1H), 4.11 (s, 3H).

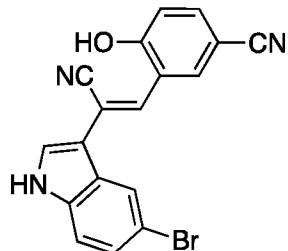
10

Example 50**(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-hydroxypyridin-3-yl)acrylonitrile**

To a solution of (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile (30.0 mg, 1 eq) in NMP (0.2 mL) were added LiCl (41.0 mg, 10 eq) and p-Toluenesulfonic acid 15 (166.0 mg, 10 eq). The resulting mixture was stirred 1h30 at 180 °C then cooled to room temperature and extracted with AcOEt. The combined organic layers were washed with water and dried over Na_2SO_4 , filtrated and concentrated. The residue was taken off with a minimal amount of AcOEt and filtrated to give 18.0 mg of the title compound (Yield : 95 %).

ESI-MS : $(M+H)^+ = 297$

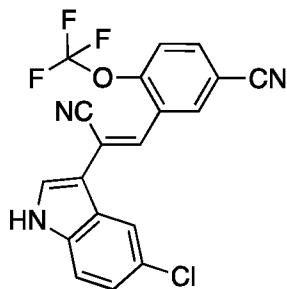
20 ^1H NMR (methanol-d4, 300 MHz) δ ppm : 9.02 (s, 1H), 8.58 (d, 1H), 8.35 (s, 1H), 8.19 (s, 1H), 8.08 (d, 1H), 7.50-7.38 (m, 2H), 7.23 (d, 1H).

Example 51**(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-hydroxybenzonitrile**

To a solution of (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (30.0 mg, 1 eq) in NMP (0.2 mL) were added LiCl (33.0 mg, 10 eq) and p-Toluenesulfonic acid (136.0 mg, 10 eq). The resulting mixture was stirred 1h30 at 180 °C then cooled to room temperature and extracted with AcOEt. The combined organic layers were washed with water and dried over Na₂SO₄, filtrated and concentrated. The residue was purified by silicagel chromatography (CH₂Cl₂ / MeOH, 100 : 0 to 90 : 10) to give 15.0 mg of the title compound (Yield : 52 %).

ESI-MS : (M+H)⁺ = 366

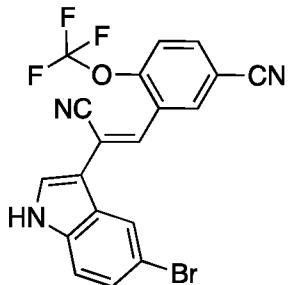
¹H NMR (methanol-d4, 300 MHz) δ ppm : 8.27 (s, 1H), 8.18 (s, 1H), 7.90-7.53 (m, 2H), 7.53 (d, 1H), 7.45-7.13 (m, 3H).

Example 52**15 (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile**

Method H: tert-butyl-5-chloro-3-(cyanomethyl)-1H-indole-1-carboxylate (1 eq), NaH (3 eq), 3-formyl-4-(trifluoromethoxy)benzonitrile (1 eq). Room temperature hidden from light. Aspect of the pure product : yellow solid. (Yield : 20%).

20 ESI-MS: (M+H)⁺ = 387

¹H NMR (methanol-d4, 300 MHz) δ ppm: 8.49 (d, 1H), 7.92 (d, 1H), 7.83 (s, 1H), 7.68 (s, 1H), 7.82 (s, 1H), 7.58-7.42 (m, 2H), 7.28 (d, 1H).

Example 53**(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile**

Method H: tert-butyl-5-bromo-3-(cyanomethyl)-1H-indole-1-carboxylate (1 eq), NaH 5 (3 eq), 3-formyl-4-(trifluoromethoxy)benzonitrile (1 eq). Room temperature hidden from light. Aspect of the pure product: yellow solid. (Yield : 39 %).

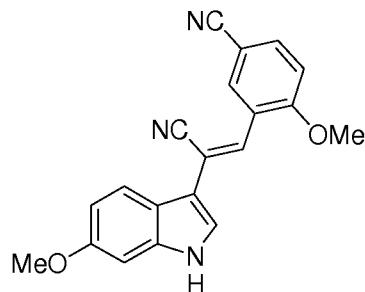
ESI-MS: $(M+H)^+ = 433$

1H NMR (methanol-d4, 300 MHz) δ ppm : 8.48 (s, 1H), 8.07 (s, 1H), 7.91 (d, 1H), 7.80 (s, 1H), 7.66 (s, 1H), 7.49-7.35 (m, 3H).

10

Example 54**(Z)-3-(2-cyano-2-(6-methoxy-1H-indol-3-yl)vinyl)-4-methoxybenzonitrile**

15

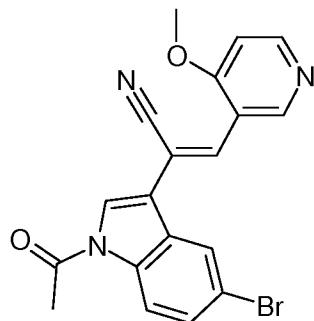


Method A: tert-butyl 3-(cyanomethyl)-6-methoxy-1H-indole-1-carboxylate (175mg), 3-formyl-4-methoxybenzonitrile (103mg), NaH (34mg), THF (2ml). Reaction time 2 hours at RT. 20 Poured in water, extracted with Ethyl acetate and trituration with diethyl ether. Aspect of the pure product : yellow solid. (Yield : 18%)

APCI-MS: $(M+H)^+ = 330$

1H NMR (300 MHz, $CDCl_3$) δ ppm 11.61 (s, 1H), 8.23 (d, $J = 1.7$ Hz, 1H), 7.93 (dd, $J = 8.7, 2.0$ Hz, 1H), 7.79 (d, $J = 8.8$ Hz, 1H), 7.69 (s, 2H), 7.32 (d, $J = 8.7$ Hz, 1H), 6.98 (d, $J = 2.2$ Hz, 1H), 6.84 (dd, $J = 8.8, 2.2$ Hz, 1H), 3.97 (s, 3H), 3.80 (s, 3H).

Some compounds of the previous examples have been the subject of tests which have demonstrated their specific relevance as inhibitors of MKlp2, and their cytotoxic effects on human cancer cells.

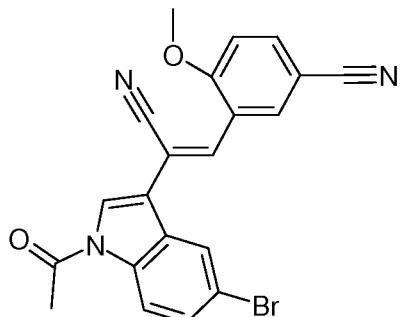
Preparation of examples 55 to 79**Example 55*****(Z)-2-(1-acetyl-5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile***

5 To a solution of (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile (50.0 mg, 1 eq) in THF (4 mL) were added pyridine (1 mL), NEt₃ (0.085 mL, 4.5 eq), DMAP (8.8 mg, 0.5 eq) and acetyl chloride (0.044 mL, 3.6 eq). The resulting mixture was stirred 48h at RT, then neutralized with saturated NH₄Cl and extracted with AcOEt. The combined organic layers were washed with water and dried over Na₂SO₄, filtrated and concentrated. The residue 10 was taken off with a minimal amount of MeOH and filtrated to give the title compound as an orange solid (36.0 mg, 65 %).

ESI-MS : (M+H)⁺ = 396

¹H NMR (300 MHz, CDCl₃) δ ppm 9.12 (s, 1H), 8.62 (d, J = 5.3 Hz, 1H), 8.47 (d, J = 8.9 Hz, 1H), 8.05 (d, J = 1.9 Hz, 1H), 7.84 (s, 1H), 7.81 (s, 1H), 7.58 (dd, J = 8.9 Hz, 1.9 Hz, 15 1H), 6.98 (s, 1H), 4.04 (s, 3H), 2.73 (s, 3H).

The following example was prepared as the previous method.

Example 56***(Z)-3-(2-(1-acetyl-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile***

(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (30 mg), THF (2.4 ml), pyridine (0.6 mL), NEt₃ (0.051 mL, 4.5 eq), DMAP (5.3 mg, 0.5 eq) and acetyl

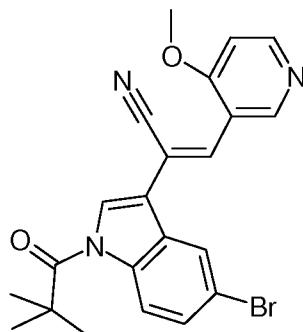
chloride (0.027 mL, 3.6 eq). Reaction time 48 hours. Extracted with AcOEt, precipitated with MeOH. Aspect of the pure product : yellow solid. (Yield : 40%).

ESI-MS : $(2M)^+ = 839$

^1H NMR (300 MHz, CDCl_3) δ ppm 8.30 (d, $J = 1.7$ Hz, 1H), 8.08 (d, $J = 1.7$ Hz, 1H), 7.83-7.79 (m, 1H), 7.78 (s, 1H), 7.73 (s, 1H), 7.45-7.35 (m, 2H), 7.30 (s, 1H), 7.27 (s, 1H), 4.06 (s, 3H), 2.76 (s, 3H).

Example 57

(Z)-2-(5-bromo-1-pivaloyl-1*H*-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile



10 To a solution of (Z)-2-(5-chloro-1*H*-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile (30.0 mg, 1 eq) in THF (1 mL) was added NaH (6.7 mg, 2 eq), The mixture was stirred 10 min at room temperature and pivaloyl chloride (0.011 mL, 1.1 eq) was added. The resulting solution was stirred 3h at room temperature, poured in saturated NH_4Cl and extracted with CH_2Cl_2 . The combined organic layers were dried over Na_2SO_4 , filtrated and concentrated to give the title 15 compound as a white solid (37.0 mg, 100 %).

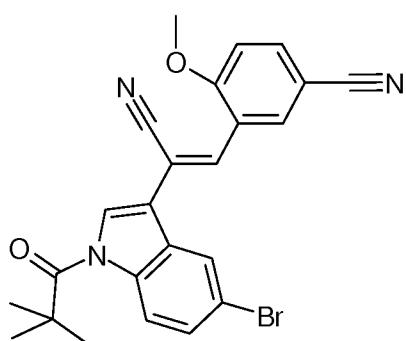
ESI-MS : $(M+H)^+ = 438$

^1H NMR (300 MHz, CD_3OD) δ ppm 9.20 (s, 1H), 8.82 (d, $J = 6.8$ Hz, 1H), 8.45 (d, $J = 9.0$ Hz, 1H), 8.35 (s, 1H), 8.13 (d, $J = 1.9$ Hz, 1H), 7.88 (s, 1H), 7.68 (d, $J = 6.8$ Hz, 1H), 7.60 (dd, $J = 9.0$ Hz, 1.9 Hz, 1H), 4.30 (s, 3H), 1.57 (s, 9H).

20 The following examples were prepared as the previous method.

Example 58

(Z)-3-(2-(5-bromo-1-pivaloyl-1*H*-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile



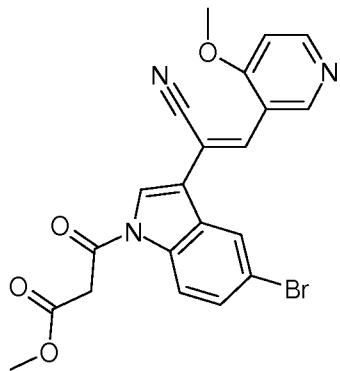
(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (500 mg), THF (16 ml), NaH 60 % in oil (0.105 g, 2 eq), pivaloyl chloride (0.216 mg, 1.35 eq). Reaction time 12 hours. Poured into AcOEt,. Aspect of the pure product : white solid. (Yield : 100 %).

5 ESI-MS : $(M+H)^+ = 462$

^1H NMR (300 MHz, DMSO-D6) δ ppm 8.39 (s, 1H), 8.36 (s, 1H), 8.27 (s, 1H), 8.12 (s, 1H), 8.01 (dd, $J = 8.9$ Hz, 1.5 Hz, 1H), 7.97 (s, 1H), 7.61 (dd, $J = 8.9$ Hz, 1.5 Hz, 1H), 7.38 (d, $J = 8.9$ Hz, 1H), 3.98 (s, 3H), 1.50 (s, 9H).

Example 59

10 (Z)-methyl-3-(5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indol-1-yl)-3-oxopropanoate



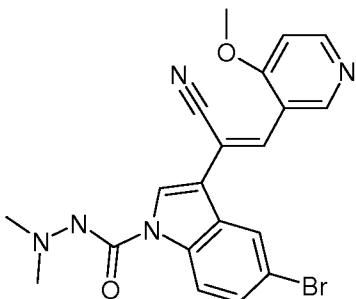
(Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile (100.0 mg), THF (4 mL), NaH 60 % in oil (0.01 g, 1 eq), methylmalonyl chloride (0.042 g, 1.1 eq). 15 Reaction time : 12 hours. Purification by silicagel chromatography CH_2Cl_2 / MeOH (100 : 0 to 90 : 10). Aspect of the pure product : yellow solid. (Yield : 72 %).

ESI-MS : $(M+H)^+ = 454$

^1H NMR (300 MHz, CD_3OD) δ ppm 8.95 (s, 1H), 8.49 (s, 1H), 8.07 (s, 1H), 7.76-7.60 (m, 2H), 7.48-7.29 (m, 2H), 7.22 (s, 1H), 4.07 (s, 3H), 3.96 (s, 3H), 3.85 (s, 2H).

20 **Example 60**

(Z)-5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)- N',N' -dimethyl-1H-indole-1-carbohydrazide



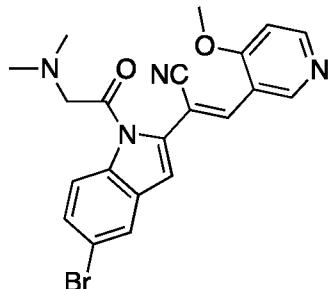
To a mixture of (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile (50.0 mg, 1eq) in CH₂Cl₂ was added DIPEA (0.024 mL, 1eq) and triphosgene (64.0 mg, 0.37 eq). The mixture was stirred 20 min at room temperature and a solution of dimethylhydrazine (0.011 mL, 1 eq), DIPEA (0.024 mL, 1eq) in CH₂Cl₂ was added. The mixture was stirred 2 h at room temperature and concentrated. The residue was purified by silicagel chromatography (CH₂Cl₂ / MeOH (100 : 0 to 90 : 10) to give the title compound as a yellow solid (61 %).

ESI-MS : (M+H)⁺ = 440

¹H NMR (300 MHz, CD₃OD) δ ppm 9.00 (s, 1H), 8.53 (d, J = 5.8 Hz, 1H), 8.34-8.27 (m, 1H), 8.14-8.10 (m, 2H), 7.88 (s, 1H), 7.52 (d, J = 8.5 Hz, 1H), 7.25 (d, J = 6.0 Hz, 1H), 4.08 (s, 3H), 2.56 (s, 6H).

Example 61

(Z)-2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile



15

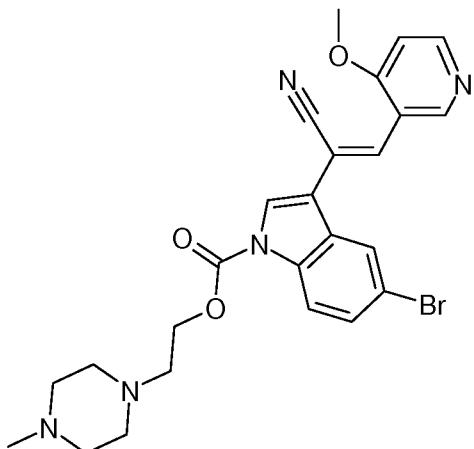
To a mixture of (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine (60 mg) in DMF (2ml) was added 2-(dimethylamino)acetic acid (28mg), PyBOP (132mg), TEA (48μl). The mixture was stirred at RT for 2 hours, poured in water and filtered. Aspect of the pure product : yellow solid. (Yield : 87%).

20 APCI-MS: (M+H)⁺ = 438

¹H NMR (300 MHz, DMSO-d6) δ ppm 8.89 (s, 1H), 8.58 (d, J = 5.8 Hz, 1H), 8.38 (d, J = 8.9 Hz, 1H), 8.33 (s, 1H), 8.19 (s, 1H), 7.94 (s, 1H), 7.66 (d, J = 7.3 Hz, 1H), 7.25 (d, J = 5.8 Hz, 1H), 4.26 (s, 2H), 3.97 (s, 3H), 2.54 (s, 6H).

Example 62

(Z)-2-(4-methylpiperazin-1-yl)ethyl 5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1*H*-indole-1-carboxylate



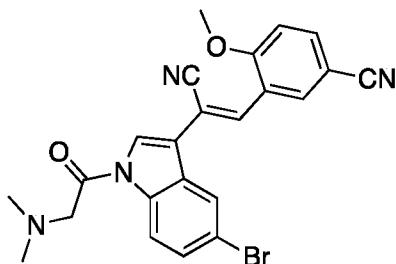
5 To a mixture of (Z)-2-(5-chloro-1*H*-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile (30.0 mg, 1eq) in CH₂Cl₂ (1 mL) was added NaH (7.0 mg, 1.2 eq). The mixture was stirred 10 min at room temperature and triphosgene (15.6 mg, 0.37 eq) was added. The mixture was stirred 3 h at room temperature and a solution of 2-(4-methylpiperazin-1-yl)ethanol (11.0 mg, 1 eq), DIPEA (0.024 mL, 1eq) in CH₂Cl₂ was added. The mixture was stirred 2 h at room 10 temperature and concentrated. The residue was purified by silicagel chromatography (CH₂Cl₂ / MeOH (100 : 0 to 90 : 10) to give the title compound as a yellow solid (41 %).

ESI-MS : (M+H)⁺ = 524

¹H NMR (300 MHz, CD₃OD) δ ppm 8.95 (s, 1H), 8.48 (d, J = 6.0 Hz, 1H), 8.07 (s, 1H), 7.73 (s, 1H), 7.69 (s, 1H), 7.48-7.29 (m, 2H), 7.21 (d, J = 6.0 Hz, 1H), 4.07 (s, 3H), 3.69 15 (t, J = 6.0 Hz), 2.74-2.40 (m, 6H), 2.29 (s, 4H).

Example 63

((Z)-3-(2-(5-bromo-1-(2-(dimethylamino)acetyl)-1*H*-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile



20 (Z)-3-(2-(5-bromo-1*H*-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (100 mg), DMF (2ml), 2-(dimethylamino)acetic acid (34mg), PyBOP (206mg), TEA (74μl). Reaction

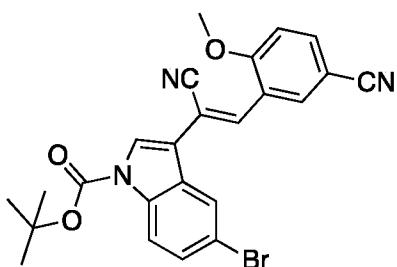
time 2 hours. Poured in water and diisopropylether. Aspect of the pure product : yellow solid. (Yield : 82%).

APCI-MS: (M+H)⁺ = 462

¹H NMR (300 MHz, DMSO-d6) δ ppm 8.38 (d, J = 10.8 Hz, 2H), 8.29 (s, 1H), 8.16 (s, 1H), 8.00 (d, J = 10.7 Hz, 1H), 7.94 (s, 1H), 7.64 (d, J = 10.6 Hz, 1H), 7.37 (d, J = 8.8 Hz, 1H), 3.96 (d, J = 10.2 Hz, 5H), 2.38 (s, 6H).

Example 64

(Z)-tert-butyl 5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indole-1-carboxylate



10

A mixture of (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (150mg), Di-tert-butyl dicarbonate (104mg), DMAP (5mg) in acetonitrile (3ml) was stirred at RT for 0.25h. The mixture was poured in water and filtered. Aspect of the pure product : yellow solid. (Yield : 88%).

15 APCI-MS: (M-H-Boc) = 376

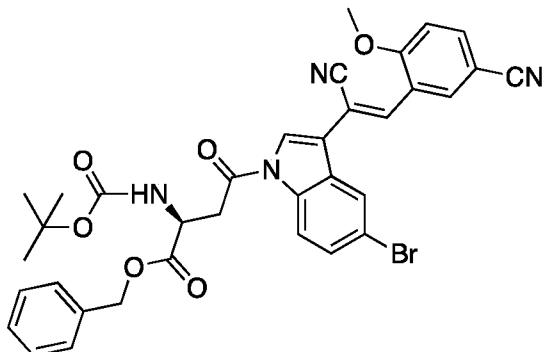
¹H NMR (300 MHz, DMSO-d6) δ ppm 8.26 (d, J = 1.8 Hz, 1H), 8.16 (d, J = 1.8 Hz, 1H), 8.11 (d, J = 8.9 Hz, 1H), 8.06 (s, 1H), 8.00 (dd, J = 8.7, 2.1 Hz, 1H), 7.92 (s, 1H), 7.63 (dd, J = 8.9, 1.9 Hz, 1H), 7.36 (d, J = 8.8 Hz, 1H), 3.97 (s, 3H), 1.65 (s, 9H).

20

The following examples were prepared as the previous method.

Example 65

(R,Z)-benzyl-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-4-oxobutanoate



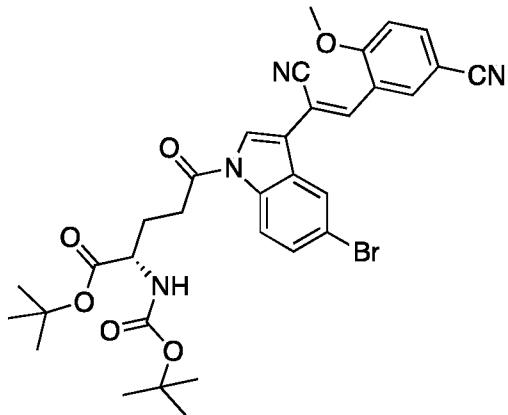
((Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (150 mg), DMF (4,5ml), (S)-4-(benzyloxy)-3-(tert-butoxycarbonylamino)-4-oxobutanoic acid (160mg), PyBOP (310mg), TEA (111 μ l). Reaction time 3 hours. Poured in water and diisopropylether. Aspect of the pure product : yellow solid. (Yield : 61%).

5 APCI-MS: (M-H-Boc) = 583

1 H NMR (300 MHz, DMSO-d6) δ ppm 8.37 (d, J = 7.6 Hz, 2H), 8.30 (s, 1H), 8.17 (s, 1H), 8.08 - 7.90 (m, 2H), 7.64 (d, J = 8.8 Hz, 1H), 7.46 (d, J = 7.5 Hz, 1H), 7.43 - 7.25 (m, 6H), 5.15 (s, 2H), 4.64 (d, J = 5.5 Hz, 1H), 3.98 (s, 3H), 3.60 (s, 2H), 1.36 (s, 9H).

Example 66

10 **(R,Z)-tert-butyl-5-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-5-oxopentanoate**



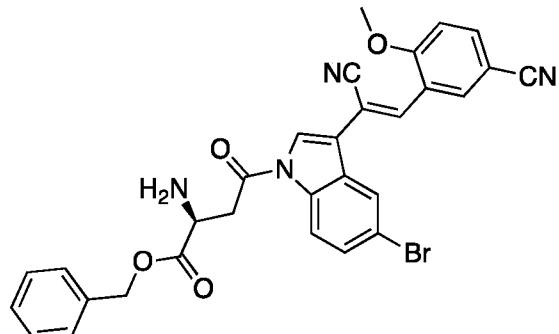
(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (200 mg), DMF (5ml), (S)-5-tert-butoxy-4-(tert-butoxycarbonylamino)-5-oxopentanoic acid (201mg), 15 PyBOP (413mg), TEA (147 μ l). Reaction time 2 hours. Poured in water, extracted with AcOEt and trituration of the purified product with diisopropylether. Aspect of the pure product : yellow solid. (Yield : 53%).

APCI-MS: (M+H) $^+$ = 507

1 H NMR (300 MHz, DMSO-d6) δ ppm 8.46 - 8.33 (m, 2H), 8.29 (d, J = 1.8 Hz, 1H), 20 8.17 (d, J = 1.7 Hz, 1H), 8.01 (dd, J = 8.7, 2.0 Hz, 1H), 7.96 (s, 1H), 7.64 (dd, J = 8.9, 1.7 Hz, 1H), 7.38 (d, J = 8.8 Hz, 1H), 7.22 (d, J = 7.9 Hz, 1H), 3.99 (s, 4H), 3.22 (d, J = 6.1 Hz, 2H), 2.13 (m, 1H), 1.99 (m, 1H), 1.39 (d, J = 9.2 Hz, 18H)

Example 67

(R,Z)-benzyl-2-amino-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-4-oxobutanoate



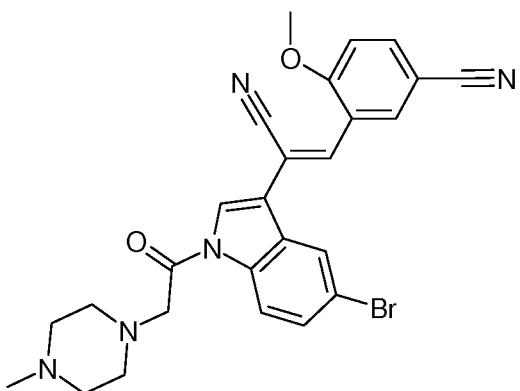
5 A mixture of (R,Z)-benzyl 4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-4-oxobutanoate (116 mg), HCl-Dioxane 4M (1,5ml) in EtOH (2ml) was stirred at RT for 24 hours. After concentration to dryness, the residue was triturated with water and filtered. Aspect of the pure product : yellow solid. (Yield : 62%).

10 APCI-MS: $(M+H)^+ = 583$

^1H NMR (300 MHz, DMSO-d6) δ ppm 8.39 (s, 1H), 8.35 - 8.30 (m, 2H), 8.20 (d, $J = 1.8$ Hz, 1H), 8.03 (dd, $J = 8.7, 2.1$ Hz, 1H), 7.98 (s, 1H), 7.68 (dd, $J = 8.9, 1.9$ Hz, 1H), 7.37 (dd, $J = 10.4, 6.3$ Hz, 3H), 7.33 - 7.25 (m, 3H), 5.25 (s, 2H), 4.62 (t, $J = 4.9$ Hz, 1H), 3.99 (s, 3H), 3.86 (d, $J = 3.9$ Hz, 2H)

Example 68

(Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile



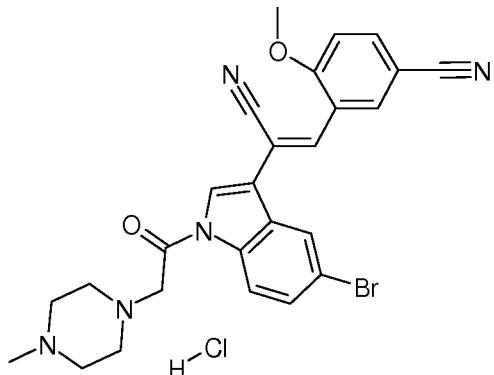
(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (150mg), 20 (4-methylpiperazin-1-yl)acetic acid (78mg), PyBOP (310mg), Triethylamine (0.11 ml), DMF (2ml). Reaction time 5 h at RT. Poured in water and triturated with methylene chloride. Aspect of the product: yellow solid. (Yield : 92%)

APCI-MS: $(M+H)^+ = 518$

^1H NMR (300 MHz, DMSO-d6) δ ppm 8.43 - 8.32 (m, 2H), 8.30 (d, $J = 1.8$ Hz, 1H), 8.19 (d, $J = 1.7$ Hz, 1H), 8.02 (dd, $J = 8.8, 2.0$ Hz, 1H), 7.95 (s, 1H), 7.65 (dd, $J = 8.9, 1.8$ Hz, 1H), 7.38 (d, $J = 8.8$ Hz, 1H), 4.13 (s, 2H), 3.98 (s, 3H), 2.97 (m, 8H), 2.68 (s, 3H).

5 **Example 69**

(Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride



A suspension of (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (114mg), HCl-Dioxane 4M (0.3 ml) in dioxane (1ml) was stirred few minutes and concentrated under vacuum. Aspect of the product: yellow solid. (Yield: 95%)

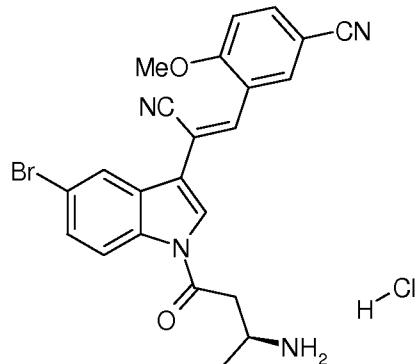
APCI-MS: $(M+H)^+ = 518$

^1H NMR (300 MHz, DMSO-d6) δ ppm 10.47 (s, 1H), 8.43 - 8.33 (m, 2H), 8.30 (d, $J = 1.8$ Hz, 1H), 8.19 (d, $J = 1.8$ Hz, 1H), 8.02 (dd, $J = 8.7, 2.1$ Hz, 1H), 7.96 (s, 1H), 7.66 (dd, $J = 8.9, 1.9$ Hz, 1H), 7.39 (d, $J = 8.8$ Hz, 1H), 4.33 (s, 2H), 3.98 (s, 3H), 3.44 (d, $J = 11.5$ Hz, 2H), 3.19 (s, 4H), 2.91 (s, 2H), 2.78 (s, 3H).

The following examples were prepared as the previous method

Example 70

20 **(S,Z)-3-(2-(1-(3-aminobutanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride**



(S,Z)-tert-butyl 4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-4-oxobutan-2-ylcarbamate (125mg), HCl 37% (0.092 ml), EtOH (2ml).

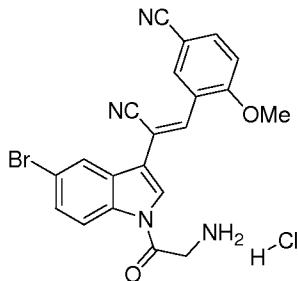
Reaction time 1 h at reflux. Aspect of the pure product: yellow solid. (Yield : 65%).

APCI-MS: (M+H)⁺ = 463

5 ¹H NMR (300 MHz, DMSO-d6) δ ppm 8.44 - 8.34 (m, 2H), 8.29 (d, J = 1.9 Hz, 1H), 8.19 (d, J = 1.8 Hz, 1H), 8.13 - 7.82 (m, 5H), 7.66 (dd, J = 8.9, 1.9 Hz, 1H), 7.37 (d, J = 8.8 Hz, 1H), 3.97 (s, 3H), 3.76 (dd, J = 13.0, 6.4 Hz, 1H), 3.53 - 3.42 (m, 2H), 1.34 (d, J = 6.6 Hz, 3H).

Example 71

10 (Z)-3-(2-(1-(2-aminoacetyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride



15

(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (150mg), 2-(tert-butoxycarbonylamino)acetic acid (87mg), PyBOP (310mg), Triethylamine (0.11 ml), Reaction time 3 hours at RT. Then HCl 37% (0.165 ml), DMF (2ml) 2 hours at reflux. Aspect 20 of the product: yellow solid. (Yield: 50%)

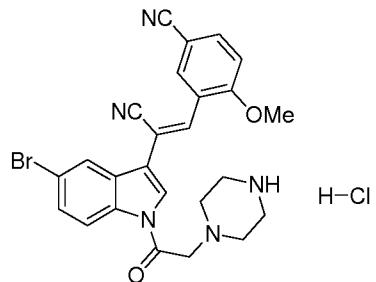
APCI-MS: (M+H)⁺ = 435

¹H NMR (300 MHz, DMSO-d6) δ ppm 8.60 (s, 2H), 8.38 (d, J = 8.4 Hz, 2H), 8.31 (d, J = 1.9 Hz, 1H), 8.22 (d, J = 1.8 Hz, 1H), 8.06 - 7.97 (m, 2H), 7.70 (dd, J = 8.9, 1.9 Hz, 1H), 7.39 (d, J = 8.8 Hz, 1H), 4.68 (s, 2H), 3.98 (s, 3H).

25

Example 72

(Z)-3-(2-(5-bromo-1-(2-(piperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride



30

(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (150mg), 2-(4-(tert-butoxycarbonyl)piperazin-1-yl)acetic acid (121mg), PyBOP (310mg), Triethylamine

(011 ml), reaction time 3 hours at RT. Then HCl 37% (0.165 ml), DMF (2ml) 2 hours at reflux. Aspect of the product: yellow solid. (Yield: 46%)

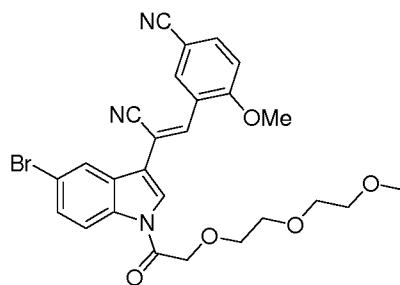
APCI-MS: $(M+H)^+ = 504$

^1H NMR (300 MHz, DMSO-d6) δ ppm 9.36 (s, 1H), 8.44 - 8.33 (m, 2H), 8.31 (d, $J = 5$ Hz, 1H), 8.21 (d, $J = 1.8$ Hz, 1H), 8.03 (dd, $J = 8.7, 2.1$ Hz, 1H), 7.96 (s, 1H), 7.68 (dd, $J = 8.9, 1.8$ Hz, 1H), 7.39 (d, $J = 8.8$ Hz, 1H), 4.62 (s, 2H), 3.98 (s, 3H), 3.26 (d, $J = 17.6$ Hz, 8H).

Example 73

(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile

15



(Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (150mg), 2-(2-methoxyethoxy)acetic acid (88mg), PyBOP (310mg), Triethylamine (0.11 ml), DMF (2ml). Reaction time 18 hours at RT. Poured in water and washed with acetonitrile. 20 Aspect of the product: yellow solid. (Yield: 33%)

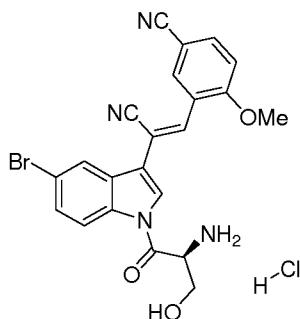
APCI-MS: $(M+H)^+ = 538$

^1H NMR (300 MHz, DMSO-d6) δ ppm 8.39 (d, $J = 8.9$ Hz, 1H), 8.33 - 8.23 (m, 2H), 8.18 (d, $J = 1.7$ Hz, 1H), 8.01 (dd, $J = 8.7, 2.0$ Hz, 1H), 7.94 (s, 1H), 7.65 (dd, $J = 8.9, 1.8$ Hz, 1H), 7.38 (d, $J = 8.8$ Hz, 1H), 4.93 (s, 2H), 3.98 (s, 3H), 3.81 - 3.68 (m, 2H), 3.60 (d, $J = 5.0$ Hz, 2H), 3.55 - 3.48 (m, 2H), 3.39 (d, $J = 5.3$ Hz, 2H), 3.19 (s, 3H). 25

Example 74

(S,Z)-3-(2-(1-(2-amino-3-hydroxypropanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride

30



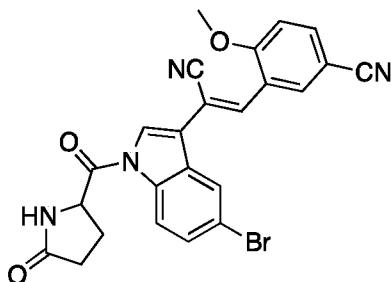
(S,Z)-tert-butyl 1-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-3-hydroxy-1-oxopropan-2-ylcarbamate (220mg), HCl 37% (110µl), EtOH (2ml). Reaction time 1 h at reflux. Aspect of the product: yellow solid. (Yield : 61%).

APCI-MS: $(M+H)^+ = 465$

5 ^1H NMR (300 MHz, DMSO-d6) δ ppm 8.68 (d, $J = 19.5$ Hz, 3H), 8.38 (d, $J = 8.9$ Hz, 1H), 8.31 (d, $J = 1.9$ Hz, 1H), 8.20 (d, $J = 1.8$ Hz, 1H), 8.01 (dd, $J = 9.6, 2.9$ Hz, 2H), 7.70 (dd, $J = 8.9, 1.9$ Hz, 1H), 7.38 (d, $J = 8.8$ Hz, 1H), 5.69 (s, 1H), 5.24 (s, 1H), 3.96 (d, $J = 5.0$ Hz, 5H).

Example 75

10 (Z)-3-(2-(5-bromo-1-(5-oxopyrrolidine-2-carbonyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile



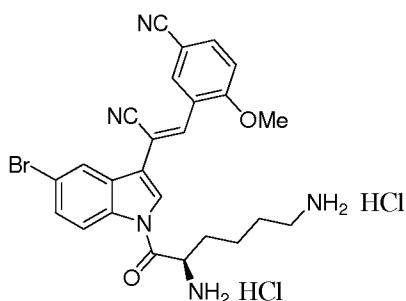
To a mixture of (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile (100 mg) in DMF (2ml) was added 5-oxopyrrolidine-2-carboxylic acid 15 (37mg), BOP (128mg), TEA (58µl). The mixture was stirred at RT for 3 hours, poured in water and filtered. Aspect of the pure product : yellow solid. (Yield : 60 %).

ESI+MS : $(M+H)^+ = 490$

15 ^1H NMR (300 MHz, MeOD-d6) δ ppm 8.44 (s, 1H), 8.22 (s, 1H), 8.08 (s, 1H), 7.91(dd, $J = 8.8, 2.0$ Hz, 1H), 7.95 (s, 1H), 7.65 (dd, $J = 14.0, 2.1$ Hz, 2H), 7.71 (s, 1H), 7.40-20 7.31 (m, 2H), 4.21 (t, $J = 6.0$ Hz, 1H), 3.98 (s, 3H), 2.73-2.13 (m, 4H).

Example 76

(R,Z)-3-(2-(5-bromo-1-(2,6-diaminohexanoyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile dihydrochloride



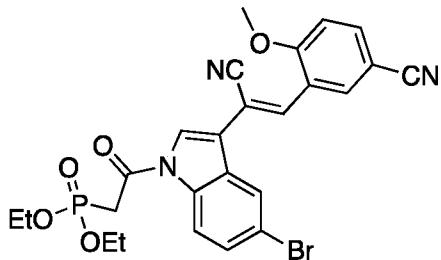
(R,Z)-tert-butyl-6-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-6-oxohexane-1,5-diyldicarbamate (320mg), HCl 37% (164µl), EtOH (3ml). Reaction time 1 hour at reflux. Aspect of the pure product: pale yellow solid. (Yield : 67%)

APCI-MS: (M+H)⁺ = 506

5 ¹H NMR (300 MHz, CD₃OD) δ ppm 8.68 (s, 3H), 8.40 (d, J = 8.9 Hz, 1H), 8.32 (d, J = 1.7 Hz, 1H), 8.22 (d, J = 1.8 Hz, 1H), 8.07 - 8.00 (m, 2H), 7.91 (s, 2H), 7.71 (dd, J = 8.9, 1.8 Hz, 1H), 7.40 (d, J = 8.8 Hz, 1H), 5.19 (s, 1H), 3.99 (s, 3H), 2.72 (s, 2H), 1.96 (s, 2H), 1.46 (m, 4H).

Example 77

10 (Z)-diethyl (2-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-oxoethyl)phosphonate



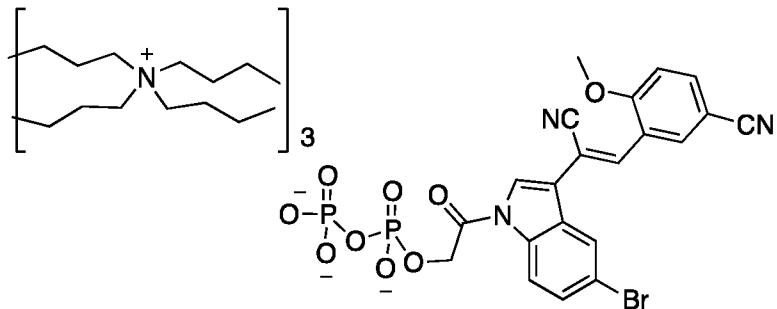
To a solution of (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile (0.382 g, 1 eq) in THF (6 mL) was added NaH 60 % in mineral oil (0.048 g, 1.2 eq). The resulting solution was stirred 30 min at room temperature and a solution of diethyl (2-chloro-2-oxoethyl)phosphonate (0.216 g, 1eq) in THF (3 mL). The mixture was stirred overnight, quenched with saturated NH₄Cl, extracted with AcOEt, dried over Na₂SO₄, filtrated and concentrated. The residue was purified by silicagel chromatography CH₂Cl₂ / MeOH (100 : 0 to 90 : 10) to give the title compound as yellow solid (36 %).

20 ESI-MS : (M+H)⁺ = 556

¹H NMR (300 MHz, CD₃OD) δ ppm 8.28 (s, 1H), 8.07 (s, 1H), 7.81 (dd, J = 8.5 Hz, 1.8 Hz, 1H), 7.43 (d, J = 8.9 Hz, 1H), 7.36 (d, J = 8.9 Hz, 1H), 7.29 (d, J = 8.5 Hz, 1H), 4.2 (q, J = 7.0 Hz, 4H), 4.06 (s, 3H), 3.10 (d, J = 20.0 Hz, 2H), 1.36 (t, J = 7.0 Hz, 6 H).

Example 78

(Z)-2-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-oxoethyl diphosphate, tetrabutylammonium salt



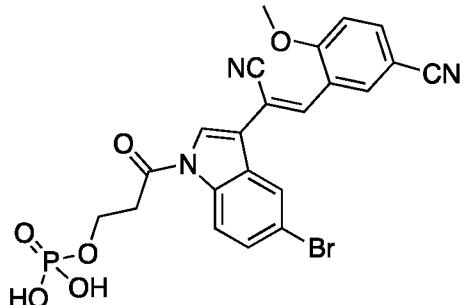
5 To a solution of (Z)-3-(2-(5-bromo-1-(2-bromoacetyl)-1H-indol-3-yl)-2-cyanovinyl)-4- methoxybenzonitrile (0.036 g, 1 eq) in AcCN (1 mL) was added Tributylammonium pyrophosphate (0.092 g, 1.3 eq). The reaction mixture was stirred 48 h at room temperature and concentrated to give the title compound as a yellow solid (60 %).

ESI-MS: $(M-H)^+ = 590$

10 ^1H NMR (300 MHz, CD₃OD) δ ppm 8.24 (d, $J = 1.9$ Hz, 1H), 8.00 (s, 1H), 7.75 (dd, $J = 8.7$ Hz, 2.1 Hz, 1H), 7.71-7.67 (m, 2H), 7.50 (d, $J = 8.7$ Hz, 1H), 7.35 (s, 1H), 7.31 (dd, $J = 8.7$ Hz, 1.7 Hz, 1H), 7.25 (d, $J = 8.7$ Hz, 1H), 4.97 (d, $J = 20$ Hz, 2H), 4.03 (s, 3H), 4.06 (s, 3H), 3.27-3.22 (m, 24 H), 1.72-1.62 (m, 24 H), 1.49-1.37 (m, 24 H), 1.03 (t, $J = 7.2$ Hz, 36 H).

Example 79

(Z)-3-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-3-oxopropyl dihydrogen phosphate



20 To a solution of (Z)-3-(2-(5-bromo-1-(3-hydroxypropanoyl)-1H-indol-3-yl)-2- cyanovinyl)-4-methoxybenzonitrile (0.047 g, 1 eq) in THF (3.1 mL) and AcCN (3.6 mL) was added DIPEA (90 μ L). The reaction mixture was cooled to 0°C and POCl₃ (0.078 mL, 8 eq) was added dropwise. The resulting solution was stirred 3h at 0°C and 1 M KH₂PO₄ (PH = 4) (5 mL) was added dropwise. The mixture was stirred overnight and concentrated. The residue

was purified by C18 flash chromatography H₂O / MeOH (100 : 0 to 0 : 100) to give the title compound as yellow solid (40 %).

¹H NMR (300 MHz, CD₃OD) δ ppm 8.30 (s, 1H), 8.04 (s, 1H), 8.00-7.97 (m, 2H), 7.83-7.80 (m, 2H), 7.40 (dd, J = 9.0 Hz, 1.5 Hz, 1H), 7.29 (d, J = 8.7 Hz, 1H), 4.06 (s, 3H), 5 3.73 (m, 2 H), 3.23 (m, 2H).

Evaluation of inhibitory effects on the microtubule stimulated ATPase activity of the MKlp2 motor domain.

Material and methods

10 MKlp2 ATPase activity was measured by monitoring real time free phosphate generation using the Kinesin ELIPA Assay Kit. The assay is based upon an absorbance shift (330 nm - 360 nm) that occurs when 2-amino-6-mercaptopurine ribonucleoside (MESG) is catalytically converted to 2-amino-6-mercaptopurine in the presence of inorganic phosphate (Pi). One molecule of Pi will yield one molecule of 2-amino-6-mercaptopurine in an essentially irreversible reaction. Hence, the absorbance at 360 nm is directly proportional to the amount of Pi generated in the kinesin ATPase reaction.

15 Human recombinant MKlp2 motor domain₁₋₅₁₉, His tagged (Cytoskeleton, Cat. # MP05), plus porcine brain microtubules (Cytoskeleton, cat. # MT002) were used.

All experiments were performed at 22°C

20 **Condition 1, compound preparation.**

The compounds were dissolved in DMSO at 30x the maximum concentration to be tested. Each compound had a seven point dose-response evaluation, with final concentrations 100, 33, 11, 3.7, 1.2, 0.4, 0.13 μM. DMSO solutions were pipetted directly into each well.

Condition 2, reaction's "motor mix".

25 The following were mixed sequentially in the specified order at RT to obtain the "motor mix".

20 mL: 15 mM Pipes-NaOH pH 7.0, 10 mM MgCl₂, 30 μM Tx (Buffer 1).

10 mL: 5x MSEG (ELIPA 1 reagent, Cat. # BK051).

10 mL: 2.5 mg/mL porcine brain microtubules (3 x 10mg Cat. # MT002-XL 30 resuspended in 12 mL of Buffer 1).

0.25 mL: 500 μg/mL MKlp2 protein.

0.5 mL: 100 x PNP (ELIPA 2 reagent, cat. # BK051).

Condition 3, reaction initiation.

The motor mix was pipetted into each well to obtain 80% of total volume. The reaction was initiated by adding a 20% of total volume of 5 mM ATP into each well.

10 The reactions were measured in a SpectraMax M2 (Molecular Devices) set in kinetic 5 mode and 360 nm absorbance wavelength. The start protocol was 5 second rapid circular mixing, 21 readings, 30 seconds apart.

IC₅₀ values were determined as the concentration to inhibit 50% of the MKlp2 ATPase activity.

Evaluation of cytotoxicity effects on human cancer cells10 **Material and methods**

The effects of the compounds of the invention on the viability of human cancer cells were studied on various human cancer cell lines of differing tissue origins (A549, NCI-H460: lung cancer; MDA-MB-231: breast cancer; HCT-116, HT-29: colon cancer; MIA-PaCa-2: pancreatic cancer; K562: leukaemia). All cell lines were obtained from ATCC or ECACC.

15 Cells were cultured in the culture media described below, under a 37°C, 5% CO₂ humidified atmosphere, according to a standard operating procedure.

Organ cell line culture medium

A549: RPMI 1640 + 10% FBS + 2 mM sodium pyruvate

NCI-H460: RPMI 1640 + 10% FBS + 10 mM HEPES + 1 mM Sodium pyruvate +

20 2.5 g/l glucose

HCT-116: Mc Coy's 5a + 10% FBS + 0.5 mM Ultraglutamine

HT-29: Mc Coy's 5a + 10% FBS + 0.5 mM Ultraglutamine

MDA-MB-231: Ham's F12 + 10% FBS

K562: RPMI 1640 + 10% FBS + 2 mM ultraglutamine

25 MIA-PaCa-2: DMEM + 10% FBS

On D0, the cells were plated in 90 µl in 96 wells plates at densities ranging from 500 to 5,000 cells per well.

On D1, the cells were treated as described below: the compounds of invention were 30 diluted in DMSO in order to obtain a concentration of 5 mM. This solution was serially diluted in PBS + 10% FBS in order to obtain the concentrations of 500.000, 166.667, 55.555, 18.518, 6.173, 2.058, 0.686, 0.229, 0.076 and 0.025 µM. The addition of 10 µl in each well allowed the testing concentrations of 50.000, 16.6667, 5.5555, 1.8518, 0.6173, 0.2058, 0.0686, 0.0229, 0.0076 and 0.0025 µM.

Following addition of the test substance the cells were protected from light. The solvents (DMSO and specific control solvent were added at the maximal concentration: 10 µl/well (3 wells/condition)).

On D4, the Cell Proliferation Reagent WST-1 was added to each well (10 µl/well), 5 according to a standard operating procedure. The cells were then incubated for 30 min to 4h at 37°C-5% CO₂. After these incubations, the 96-well plates were shaken thoroughly for 1 min with Multiskan® EX apparatus (Thermo Labsystems, France). The absorbence was measured at 450 nm, the reference wavelength being 620 nm. The analysis of the results was performed with the Ascent software 2.6 (ThermoLabsystems, France), Microsoft Excel 2003 and 10 GraphPad Prism 4.03 softwares to give the concentration of the compounds that induces the death of 50 % of the cells (IC₅₀).

The results for some compounds considered in above-cited examples in term of inhibition of microtubule stimulated ATPase activity of MKlp2 are illustrated in Tables 3 and 15 6 hereafter.

The results for some compounds considered in above-cited examples in term of cytotoxicity on K562 cells are illustrated in Table 4 and 6 hereafter.

The results for some compounds considered in above-cited examples in term of cytotoxicity on other human cancer cells are illustrated in Table 5 hereafter.

Table 3

	X	R1	R1'	R2	R3	MKlp2 IC ₅₀ (µM)
W02010/150211-Example 1	N	H	H	H	H	3.8
W02010/150211-Example 4	N	-O-CH ₃	H	H	H	4.2
W02010/150211-Example 22	N	-O-CH ₂ -CH ₃	H	H	H	5.2
W02010/150211-Example 23	N	-O-CH-(CH ₃) ₂	H	H	H	5.2
W02010/150211-Example 24	N	-Cl	H	H	H	1.1
W02010/150211-Example 28	N	-O-CH ₃	H	H	-F	2.4
W02010/150211-Example 31	N	-O-CH ₃	H	-CH ₃	H	2.3
W02010/150211-Example 47	N	-O-CH ₃	H	-Cl	H	1.6
W02010/150211-Example 37	N	-Br	H	H	H	1.5
W02010/150211-Example 26	N	H	-O-CH ₃	H	H	26.5
W02010/150211-Example 52	N	-O-CH ₃	H	H	-O-CH ₃	12.6
W02010/150211-Example 30	C-CN	-O-CH ₃	H	H	H	4.4
Example 2	N	-O-CH ₃	H	-O-CH ₂ -CH ₃	H	0.3

Example 3	N	-Cl	H	-Cl	H	0.8
Example 4	N	-Br	H	-Cl	H	0.7
Example 5	N	-Br	H	-O-CH ₃	H	0.05
Example 5b	N	-Br	H	-O-CH ₃	H	0.61
Example 6	N	-Cl	H	-N-(CH ₃) ₂	H	0.5
Example 7	N	-Cl	H	-N-(CH ₃) ₂	H	0.8
Example 8	N	-Br	H	-N-(CH ₃) ₂	H	0.9
Example 9	N	-Cl	H	-O-CH ₃	H	0.1
Example 10	N	-Cl	H	-O-C ₆ H ₅	H	0.3
Example 11	N	-Br	H	-O-C ₆ H ₅	H	0.5
Example 12	N	-O-CH ₃	H	-O-CH ₃	H	0.3
Example 13	N	-Br	H	-O-CH ₂ -CH ₃	H	0.1
Example 14	N	-Br	H	-O-CH-(CH ₃) ₂	H	0.2
Example 15	N	-Br	H	-S-CH ₃	H	0.2
Example 16	N	-Br	H	-S-CH ₂ -CH ₃	H	0.3
Example 17	N	-Br	H	-(C ₆ H ₄)-3-Br	H	0.3
Example 18	N	-Cl	H	-(C ₆ H ₄)-3-Br	H	0.3
Example 19	N	-Br	H	-S-C ₆ H ₅	H	0.3
Example 20	N	-Br	H	-S-CH ₂ -C ₆ H ₅	H	0.2
Example 21	N	-Br	H	-S-C ₆ H ₅ -3,4-(-OCH ₃) ₂	H	0.4
Example 22	N	-Br	H	-O-C ₆ H ₅ -4-F	H	0.09
Example 23	N	-Cl	H	-O-C ₆ H ₅ -4-F	H	0.09
Example 24	N	-Br	H	-N-(CH ₂ CH ₃) ₂	H	1.1
Example 25	N	-Br	H	-C ₆ H ₅ -4-CF ₃	H	0.4
Example 26	N	-Cl	H	-C ₆ H ₅ -4-CF ₃	H	0.5
Example 27	N	-Cl	H	-S-C ₆ H ₅ -4-F	H	0.3
Example 28	N	-Br	H	-S-C ₆ H ₅ -4-F	H	0.09
Example 29	N	-Cl	H	-C ₄ H ₃ O	H	0.03
Example 30	N	-Cl	H	-S-C ₅ H ₄ N	H	0.3
Example 31	N	-Br	H	-S-C ₅ H ₄ N	H	0.4
Example 32	N	-Br	H	-C ₂ H ₂ N ₃	H	0.06
Example 33	N	-Cl	H	-C ₂ H ₂ N ₃	H	0.1
Example 34	N	-Br	H	-C ₄ H ₃ O	H	0.07
Example 34b	N	-Br	H	-C ₄ H ₃ O	H	0.96
Example 35	N	-Cl	H	-O-CH ₃	H	<0.07
Example 36	N	-Br	H	-S-(CH ₂) ₂ -N-(CH ₃) ₂	H	0.3
Example 37	C-CN	-Br	H	-O-C ₆ H ₅ -4-F	H	0.9
Example 38	C-CN	-Br	H	-O-CH ₃	H	0.2
Example 39	C-CN	-Br	H	-N-(CH ₃) ₂	H	0.2
Example 40	C-CN	-Cl	H	-O-CH ₃	H	0.2
Example 41	C-CN	-Cl	H	-N-(CH ₃) ₂	H	0.4
Example 42	C-CN	-Cl	H	-S-CH ₂ CH ₃	H	0.6
Example 45	N	H	-Br	-O-CH ₃	H	0.2
Example 46	N	H	-F	-O-CH ₃	H	0.12
Example 47	N	H	-Cl	-O-CH ₃	H	0.2

Example 48	N ⁺ -O-	-Br	H	-C ₄ H ₃ O	H	0.73
Example 49	N ⁺ -O-	-Cl	H	-O-CH ₃	H	0.56
Example 54	C-CN	H	O-CH ₃	-O-CH ₃	H	1.4
Example 59: Prodrug with Ra = COCH ₂ CO ₂ CH ₃	N	Br	H	-O-CH ₃	H	0.57
Example 62: Prodrug with Ra = CO ₂ (CH ₂) ₂ -piperazinyl-CH ₃	N	Br	H	-O-CH ₃	H	0.35

Table 4

	X	R1	R1'	R2	R3	K562 IC50 (μM)
W02010/150211-Example 1	N	H	H	H	H	21.4
Example 3	N	-Cl	H	-Cl	H	3.6
Example 4	N	-Br	H	-Cl	H	1.4
Example 5	N	-Br	H	-O-CH ₃	H	0.8
Example 5b	N	-Br	H	-O-CH ₃	H	3.92
Example 34b	N	-Br	H	-C ₄ H ₃ O	H	14.26
Example 8	N	-Br	H	-N-(CH ₃) ₂	H	7.5
Example 9	N	-Cl	H	-O-CH ₃	H	1.4
Example 12	N	-O-CH ₃	H	-O-CH ₃	H	0.9
Example 15	N	-Br	H	-S-CH ₃	H	2.9
Example 24	N	-Br	H	-N-(CH ₂ CH ₃) ₂	H	3.1
Example 29	N	-Cl	H	-C ₄ H ₃ O	H	4.7
Example 34	N	-Br	H	-C ₄ H ₃ O	H	2.2
Example 38	C-CN	-Br	H	-O-CH ₃	H	0.03
Example 39	C-CN	-Br	H	-N-(CH ₃) ₂	H	0.6
Example 48	N ⁺ -O-	-Br	H	-C ₄ H ₃ O	H	6.71
Example 49	N ⁺ -O-	-Cl	H	-O-CH ₃	H	9.23
Example 50	N	Cl	H	-OH	H	14.72
Example 51	C-CN	Br	H	-OH	H	0.5
Example 52	C-CN	Cl	H	-OCF ₃	H	0.85
Example 53	C-CN	Br	H	-OCF ₃	H	0.38
Example 54	C-CN	H	-O-CH ₃	-O-CH ₃	H	0.02

Table 5

	X	R1	R1'	R2	R3	IC50 (μM)
Example 5	N	-Br	H	-O-CH ₃	H	HCT-116 : 0.7 MDA-MB-231 : 1.7 MIA-PaCa-2 : 0.7 NCI-H460 : 0.9
Example 38	C-CN	-Br	H	-O-CH ₃	H	HCT-116 : 0.06 MDA-MB-231 : 0.07 MIA-PaCa-2 : 0.04 NCI-H460 : 0.04
Example 39	C-CN	-Br	H	-N-(CH ₃) ₂	H	A549 : 0.5 HT-29 : 0.3 MDA-MB-231 : 0.3 MIA-PaCa-2 : 0.2

Table 6

5

	X	R1	R1'	R2	R3	Z/E	Ra	MKlp2 IC50 (μM)	K562 IC50 (μM)
Example 55	N	Br	H	OCH ₃	H	Z	COCH ₃	13.7	0.55
Example 56	C-CN	Br	H	OCH ₃	H	Z	COCH ₃	16.7	0.25
Example 57	N	Br	H	OCH ₃	H	Z	COC(CH ₃) ₃	20	0.2
Example 58	C-CN	Br	H	OCH ₃	H	Z	COC(CH ₃) ₃	7.5	0.06
Example 61	N	Br	H	OCH ₃	H	Z	COCH ₂ N(CH ₃) ₂	0.4	0.33
Example 63	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ N(CH ₃) ₂	10.6	0.04
Example 64	C-CN	Br	H	OCH ₃	H	Z	CO ₂ C(CH ₃) ₃	19.6	0.24
Example 65	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ -CH(NHBoc)Cbz	10.1	0.04
Example 66	C-CN	Br	H	OCH ₃	H	Z	CO(CH ₂) ₂ -CH(Boc)-NHBoc	5.4	0.03
Example 67	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ -CH(NH ₂)-Cbz	3.1	0.04
Example 68	C-CN	Br	H	OCH ₃	H	Z	CO-CH ₂ -piperazinyl-CH ₃	>50	0.03
Example 69	C-CN	Br	H	OCH ₃	H	Z	CO-CH ₂ -piperazinyl-CH ₃ .HCl	>50	0.03
Example 70	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ -CH(CH ₃)NH ₂	>50	0.01
Example 71	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ NH ₂ .HCl	1.9	0.01
Example 72	C-CN	Br	H	OCH ₃	H	Z	CO-CH ₂ -piperazinyl.HCl	>50	0.01
Example 73	C-CN	Br	H	OCH ₃	H	Z	COCH ₂ O(CH ₂) ₂ O(CH ₂) ₂ OCH ₃	>50	0.03
Example 74	C-CN	Br	H	OCH ₃	H	Z	COCH(NH ₂)CH ₂ OH	2.1	0.01
Example 75	C-CN	Br	H	OCH ₃	H	Z	CO-oxopyrrolidine	4.6	0.02
Example 76	C-CN	Br	H	OCH ₃	H	Z	COCH(NH ₂)-(CH ₂) ₄ NH ₂	1.3	0.04
Example 79	C-CN	Br	H	OCH ₃	H	Z	CO(CH ₂) ₂ PO ₄ H ₂	>50	0.4

Stability studies in mouse or human plasma

The study was to evaluate the stability of the disclosed compounds after incubation in 10 mouse or human plasma and to measure the metabolites formed. For the disclosed compound, a stock solution was prepared at 200 μM in DMSO. This solution was then 100-fold diluted in

1 ml of mouse or human plasma in order to obtain the required concentration of 2 μ M. One aliquot of 100 μ l was taken (T0) and the remaining solution was incubated at 37°C in water bath for 60 min, 120 min and 240 min.

At the end of each incubation time 100 μ l of plasma was taken, 100 μ l of acetonitrile containing 0.1% of formic acid were added to each aliquot in order to stop the enzymatic reaction and to precipitate the proteins. Samples was vortexed/mixed and centrifuged 5 min at 16434.6 g (= 14000 rpm) (4°C). After centrifugation, the clear supernatant (at least 150 μ l) was transferred into 1.2 ml HPLC glass vials and sealed. Samples were placed into the refrigerated autosampler and 20 μ l were injected into a HPLC-MS/MS.

10 The Results are expressed with the percentage of test substance remaining by comparing area under specific chromatographic peak of test samples after incubation with area under specific chromatographic peak at T0 (Tables 7 and 8 and figures 1 and 2).

Table 7:

Remaining compound 63 (%) (mean \pm SEM, n = 2)		
Incubation time (min)	Mouse plasma	Human plasma
0	100.0 \pm 0.0	100.0 \pm 0.0
60	9.0 \pm 0.8	49.2 \pm 5.1
120	10.7 \pm 8.7	27.2 \pm 5.4
240	4.9 \pm 0.5	21.2 \pm 11.2
Half-life time:	~33 min	~60 min

15

Table 8:

Compound 38 formed from compound 63 (arbitrary units) (mean \pm SEM, n = 2)		
Incubation time (min)	Mouse plasma	Human plasma
0	0.6 \pm 0.1	0.5 \pm 0.0
60	3.2 \pm 0.1	2.5 \pm 0.4
120	3.7 \pm 0.4	2.6 \pm 0.1
240	2.9 \pm 0.2	3.4 \pm 0.8

In-vivo evaluation of anti-tumor activity of compound 38 in nude mice bearing subcutaneous human colon carcinoma HCT-116 xenografts

Protocol:

5 The effects of one compound of the invention were studied on the tumor growth of human cancer cells in nude mice. The human colon carcinoma HCT-116 cell line was obtained from ATCC. The induction in nude mice was realized by subcutaneous injection in the right flank of each mouse of 10×10^6 HCT-116 cells in 200 μ l serum-free medium. When the tumor volume reached 130 mm^3 , mice were randomized in to 3 groups (10 mice/group).

10 Mice of group 1 were treated by intraperitoneal injection of vehicle (solutol HS15 at 38% in NaCl 0.9%) according to the treatment schedule 1Q2Dx3 for 1 week (from D0 to D7) and then 1Q1Dx21 (from D8 to D27).

Mice of group 2 were treated by intraperitoneal injection of cisplatin (diluted in NaCl 0.9%) at 4 mg/kg according to the treatment schedule 1Q3Dx3.

15 Mice of group 3 were treated by intraperitoneal injection of compound 38 (diluted in solutol HS15 at 38% in NaCl 0.9%) at 37.5 mg/kg according to the treatment schedule 1Q2Dx3 for 1 week (from D0 to D7) and then 1Q1Dx21 (from D8 to D27).

The body weight and tumor volume of mice were recorded twice a week until the end of the experiment. The results are illustrated in Table 9 and figure 3.

20

Table 9: Mean body weight change (MBWC) of mice of each group.

At the beginning of the treatment, the mean body weight (MBW) was 21 g.

Treatment	MBWC D0-D4	MBWC D0-D7	MBWC D0-D10	MBWC D0-D14	MBWC D0-D17	MBWC D0-D21	MBWC D0-D24	MBWC D0-D28
vehicle	-0.48 g	+0.21 g	- 0.07 g	-0.18 g	+0.68 g	+0.62 g	+1.04 g	+1.48 g
Cisplatin 4 mg/kg	-1.1 g	-2.54 g	-3.33 g	-2.22 g	-1.26 g	-0.38 g	-0.02 g	-0.1 g
Cpd 38 37.5 mg/kg	-1.04 g	-0.76 g	-1.08 g	-1.57 g	-1.58 g	-1.43 g	-1.83 g	-2.54 g

Results:

25 Antitumor activity was observed in HCT-116 xenograft bearing nude mice , treated with cisplatin at 4 mg/kg, validating the sensitivity of the tumor model to antitumora agents (figure 3).

Antitumor activity was observed in HCT-116 xenograft bearing nude mice and treated with compound 38 at 37.5 mg/kg (figure 3).

Compound 38 treatment was well tolerated in nude mice bearing HCT-116 xenograft (table 9).

A moderate loss of body weight was observed during treatment (Table 9 ranging from 4% to 12%).

5

In-vivo evaluation of anti-tumor activity of compound 38 in nude mice bearing subcutaneous human large cell lung carcinoma NCI-H460 xenografts

Protocol:

The effects of one compound of the invention were studied on the tumor growth of 10 human cancer cells in nude mice. The human large lung carcinoma NCI-H460 cell line was obtained from ATCC. The induction in nude mice was realized by subcutaneous injection in the right flank of each mouse with 5×10^6 NCI-H460 cells in 200 μ l serum-free medium. When the tumor volume reached 80 mm^3 , mice were randomized in 2 groups (10 mice/group).

Mice of group 1 were treated by intraperitoneal injection of vehicle (solutol HS15 at 15 38% in NaCl 0.9%) according to the treatment schedule 1Q1Dx17.

Mice of group 2 were treated by intraperitoneal injection of compound 38 (diluted in solutol HS15 at 38% in NaCl 0.9%) at 37.5 mg/kg according to the treatment schedule 1Q1Dx17.

The tumor volume was recorded twice a week until the end of the experiment.

20

Table 10 Mean body weight change (MBWC) of mice of each group.

At the beginning of the treatment, the mean body weight (MBW) was 21 g.

Treatment	MBWC D0-D3	MBWC D0-D4	MBWC D0-D7	MBWC D0-D10	MBWC D0-D14	MBWC D0-D17
vehicle	+0.33 g	+0.16 g	+1.3 g	+1.54 g	+2.48 g	+3.44 g
Cpd 38 37.5 mg/kg	-0.96 g	-1.76 g	-1.82 g	-2.12 g	-1.83 g	-1.55 g

Results:

Antitumor activity was observed on NCI-H460 xenograft bearing nude mice, treated with 25 compound 38 at 37.5 mg/kg (Figure 4).

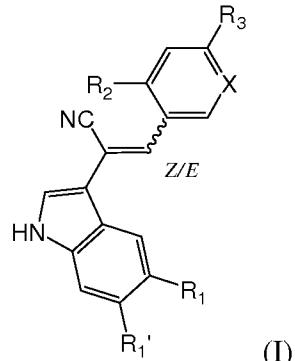
Compound 38 treatment was well tolerated in nude mice bearing NCI-H460 xenograft (table 10).

A moderate loss of body weight was observed during treatment (Table 9 ranging from 5% to 10%).

30

Claims

1. Compound of formula (I) :



5

wherein :

- X represents a nitrogen atom, a C-CN unit or a N+-O- unit, preferably a nitrogen atom or a C-CN unit;
- R₁ and R_{1'} are such that one is H and the other represents a halogen or a (C₁-C₆)alkoxy group, optionally substituted by a carboxylic group or one -NR₁₁R₁₂ unit wherein R₁₁ and R₁₂ represent H, a (C₁-C₆)alkyl group, or R₁₁ and R₁₂ taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, preferably a (C₁-C₃)alkoxy group;
- R₂ represents:
 - a radical (C₁-C₆)alkoxy, (C₃-C₆)cycloalkoxy, aryloxy, heteroaryloxy, (C₁-C₆)alkyl-aryloxy, (C₁-C₆)alkyl-heteroaryloxy, said radicals being optionally substituted by at least one halogen, or a radical thio-(C₁-C₆)alkyl, thio-aryl, thio-heteroaryl, thio-(C₁-C₆)alkyl-aryl or thio-(C₁-C₆)-alkyl-heteroaryl, said radicals being optionally substituted by at least one halogen or by a (C₁-C₆)alkoxy group,
 - a -NR₄R₅ unit, a O-(C₁-C₆)alkyl-NR₄R₅ unit or a S-(C₁-C₆)alkyl-NR₄R₅ unit wherein R₄ and R₅ represent H, a (C₁-C₆)alkyl group, or R₄ and R₅ taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, with the proviso that at least one among R₄ and R₅ is not H,
 - a NHCOR₆ unit wherein R₆ represents (C₁-C₆)alkyl group,
 - an aryl or heteroaryl group optionally substituted by at least one halogen, a trifluoromethyl group, or a (C₁-C₃)alkoxy group, or

- a halogen,

with the proviso that if R_1 or R_1' is a $(C_1\text{-}C_3)$ alkoxy group, then R_2 is not a halogen; and

- R_3 represents a hydrogen, a $(C_1\text{-}C_3)$ alkyl group, a $(C_1\text{-}C_3)$ alkoxy group or a halogen, 5 advantageously a fluorine;

and the produgs thereof, in which the nitrogen atom of the indole core is substituted by a group selected from the group consisting of a COR_7 and a CO_2R_7 group, wherein R_7 represents:

- a $(C_1\text{-}C_6)$ alkyl group, optionally substituted by at least a hydroxy group, a $(C_1\text{-}C_6)$ alkyloxy group, a $(C_1\text{-}C_6)_n$ polyalkyloxy group wherein n is $1 < n < 6$, a phosphate or pyrophosphate group and salts or $(C_1\text{-}C_3)$ alkyl ester thereof, a R_8 group, a $-NHCO_2R_8$ unit, a COR_8 group, or a CO_2R_8 group, wherein R_8 is:

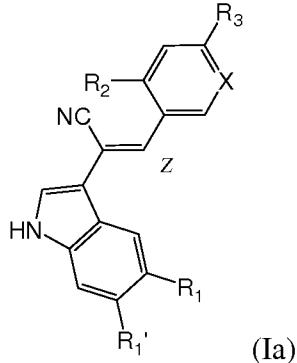
- a $(C_1\text{-}C_6)$ alkyl group,
- an aryl, a $(C_1\text{-}C_6)$ alkylaryl, or a heteroaryl,
15 - a $-NR_9R_{10}$ unit wherein R_9 and R_{10} represent a hydrogen, a $(C_1\text{-}C_6)$ alkyl group, or R_9 and R_{10} taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, and optionally the ring being substituted by at least one $(C_1\text{-}C_6)$ alkyl group;

- a $NH-NR_9R_{10}$ unit wherein R_9 and R_{10} are such as defined above; or
20 - a saturated heterocycle or a heteroaryl;

or one of its pharmaceutically acceptable salts;

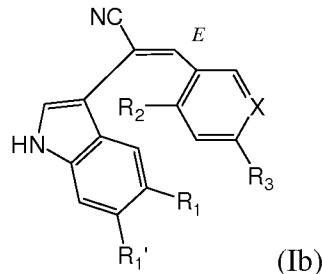
with the proviso that the compound is not (Z) -3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile.

25 2. Compound according to claim 1, wherein the compound has the formula (Ia):



wherein X , R_1 , R_1' , R_2 , R_3 , R_4 , R_5 and R_6 are such as defined in Claim 1 or a prodrug thereof as defined in claim 1.

3. Compound according to claim 1, wherein the compound has the formula (Ib):



wherein X, R₁, R_{1'}, R₂, R₃, R₄, R₅ and R₆ are such as defined in Claim 1 or a prodrug thereof
5 as defined in claim 1.

4. Compound according to claims 1 to 3, wherein R_{1'} is H.

5. Compound according to claims 1 to 4, wherein R₁ represents a halogen selected in the
10 group consisting of a bromine and a chlorine.

6. Compound according to claims 1 to 3, wherein R₁ is H.

7. Compound according to claims 1 to 3 and 6, wherein R_{1'} is a halogen chosen among a
15 bromine, a chlorine, or a fluorine.

8. Compound according to anyone of claims 1 to 7, wherein R₂ represents:

- a radical (C₁-C₆)alkoxy, or phenoxy, said radicals being optionally substituted by at least one halogen;
- a halogen;
- a R₄-N-R₅ unit or a S-(C₁-C₆)alkyl-NR₄R₅ unit, wherein R₄ and R₅ represent H or a (C₁-C₆)alkyl group, with the proviso that at least one among R₄ and R₅ is not H,
- a NHCO₆ unit wherein R₆ represents (C₁-C₆)alkyl group,
- a radical thio-(C₁-C₆)alkyl, thio-aryl, thio-heteroaryl, thio-(C₁-C₆)alkyl-aryl, said radicals being optionally substituted by at least one halogen or by a (C₁-C₆)alkoxy group;
- an aryl group optionally substituted by at least one halogen, or a trifluoromethyl group; or
- a heteroaryl group.

9. Compound according to anyone of claims 1 to 8 wherein R₂ represents:

- a radical (C₁-C₆)alkoxy selected from the group consisting of a methoxy group, an ethoxy group, and an isopropoxy group, or a phenoxy group, optionally substituted by a fluorine, such as a trifluoromethyl;
- a halogen selected from the group consisting of a fluorine and a chlorine,
- a R₄-N-R₅ unit or a S-(C₁-C₆)alkyl-NR₄R₅ unit wherein R₄ and R₅ represent a methyl or an ethyl group;
- a NHCOR₆ unit wherein R₆ represents a *tert*-butyl group;
- a radical selected in the group consisting of a thio-methyl group, a thio-ethyl group, a thio-benzyl group, a thio-pyridinyl group and a thio-phenyl group, optionally substituted by at least one fluorine or a trifluoromethyl group;
- a phenyl group optionally substituted by at least one bromine or a trifluoromethyl group; or
- a heteroaryl group selected from the group consisting of a furan or a triazol.

10. Compound according to anyone of claims 1 to 9 wherein said compound is selected from the group consisting of:

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-dimethylamino)pyridine-3-yl)-acrylonitrile, hydrochloride;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(ethylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3-bromophenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(3-bromophenyl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- 5 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3,4-dimethoxy)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- 10 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- 15 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- 20 - (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- 25 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(2-(dimethylamino)ethylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(4-fluorophenoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 30 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(ethylthio)benzonitrile;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;

- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- 5 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-cyano-2-(6-methoxy-1H-indol-3-yl)vinyl)-4-methoxybenzonitrile;
- (Z)-2-(1-acetyl-5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(1-acetyl-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 10 - (Z)-2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1-pivaloyl-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-methyl 3-(5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indol-1-yl)-3-oxopropanoate;
- (Z)-2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- 15 - (Z)-2-(4-methylpiperazin-1-yl)ethyl 5-bromo-3-(1-cyano-2-(4-methoxypyridin-3-yl)vinyl)-1H-indole-1-carboxylate;
- ((Z)-3-(2-(5-bromo-1-(2-(dimethylamino)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 20 - (Z)-tert-butyl 5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indole-1-carboxylate;
- (R,Z)-benzyl-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-4-oxobutanoate;
- (R,Z)-tert-butyl-5-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-2-(tert-butoxycarbonylamino)-5-oxopentanoate;
- 25 - (R,Z)-benzyl-2-amino-4-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-4-oxobutanoate;
- (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 30 - (Z)-3-(2-(5-bromo-1-(2-(4-methylpiperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (S,Z)-3-(2-(1-(3-aminobutanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;

- (Z)-3-(2-(1-(2-aminoacetyl)-5-methoxybenzonitrile hydrochloride; bromo-1H-indol-3-yl)-2-cyanovinyl)-4-
- (Z)-3-(2-(5-bromo-1-(2-(piperazin-1-yl)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- 5 - (Z)-3-(2-(5-bromo-1-(2-(2-methoxyethoxy)ethoxy)acetyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (S,Z)-3-(2-(1-(2-amino-3-hydroxypropanoyl)-5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile hydrochloride;
- (Z)-3-(2-(5-bromo-1-(5-oxopyrrolidine-2-carbonyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 10 - (R,Z)-3-(2-(5-bromo-1-(2,6-diaminohexanoyl)-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile dihydrochloride;
- (Z)-3-(5-bromo-3-(1-cyano-2-(5-cyano-2-methoxyphenyl)vinyl)-1H-indol-1-yl)-3-oxopropyl dihydrogen phosphate;

15 and their pharmaceutically acceptable salts.

11. Compound according to anyone of claims 1 to 10 wherein said compound is selected from the group consisting of:

- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- 20 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-dimethylamino)pyridine-3-yl)-acrylonitrile,
- 25 hydrochloride;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-phenoxyypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;

- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(ethylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3-bromophenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(3-bromophenyl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- 5 - (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(3,4-dimethoxy)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- 10 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- 15 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- 20 - (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(2-(dimethylamino)ethylthio)pyridin-3-yl)-acrylonitrile;
- 25 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(4-fluorophenoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- 30 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(ethylthio)benzonitrile;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;

- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- 5 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;

and their pharmaceutically acceptable salts.

12. Compound according to anyone of claims 1 to 11 wherein said compound is selected from the group consisting of:

- 10 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-chloropyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- 15 - (E)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-methoxy-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-ethoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-isopropoxypyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(methylthio)pyridin-3-yl)-acrylonitrile;
- 20 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(phenylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(benzylthio)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(4-fluorophenoxy)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(dimethylamino)pyridin-3-yl)-acrylonitrile;
- 25 - (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(diethylamino)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(4-(trifluoromethyl)phenyl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-((4-fluorophenyl)thio)pyridin-3-yl)-acrylonitrile;
- 30 - (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-(pyridine-2-ylthio)pyridin-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-bromo-1H-indol-3-yl)-acrylonitrile;
- (Z)-3-(4-(1H-1,2,4-triazol-1-yl)pyridin-3-yl)-2-(5-chloro-1H-indol-3-yl)-acrylonitrile;
- (Z)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;

- (E)-2-(5-bromo-1H-indol-3-yl)-3-(4-(furan-3-yl)pyridin-3-yl)-acrylonitrile;
- (Z)-2-(5-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)-acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- (E)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-methoxybenzonitrile;
- 5 - (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(dimethylamino)benzonitrile;
- (Z)-2-(6-bromo-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-fluoro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-2-(6-chloro-1H-indol-3-yl)-3-(4-methoxypyridin-3-yl)acrylonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(furan-3-yl)pyridine-1-oxide;
- 10 - (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-methoxypyridine-1-oxide;
- (Z)-3-(2-(5-chloro-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;
- (Z)-3-(2-(5-bromo-1H-indol-3-yl)-2-cyanovinyl)-4-(trifluoromethoxy)benzonitrile;

and their pharmaceutically acceptable salts.

15 13. Compound according to anyone of claims 1 to 12 or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile, for use as a drug.

14. A pharmaceutical composition comprising as an active ingredient one compound according to anyone of claims 1 to 12 or (Z)-3-(4-ethoxypyridin-3-yl)-2-(5-methoxy-1H-indol-3-yl)-acrylonitrile.

20 15. Pharmaceutical composition according to claim 14 for use in the treatment of cancer.

16. Pharmaceutical composition according to claim 14 or 15, further comprising an additional antitumoral drug, preferably selected from the group consisting of an anti-mitotic agent, an inhibitor of topoisomerases I or II, a DNA alkylating agent, an anti-metabolic agent, a targeted agent such as a kinase inhibitor and/or a therapeutical antibody designed to mediate cytotoxicity against the cancer cells or to modulate one of their key biological functions.

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17. Pharmaceutical composition according to anyone of claims 14 to 16, for use for treating cancer in combination with radiotherapy, hyperthermia and/or other antitumoral therapies, or before, simultaneously and/or after surgery (e.g., tumor resection).

18. A kit comprising (a) a compound according to anyone of claims 1-12; and (b) an additional antitumoral drug as a combined preparation for simultaneous, separate or sequential use, in particular in the treatment of cancer.

5

19. Pharmaceutical composition according to claim 14 for use in the treatment of viral infections, particularly, HIV infection, HTLV infection or HPV infection.

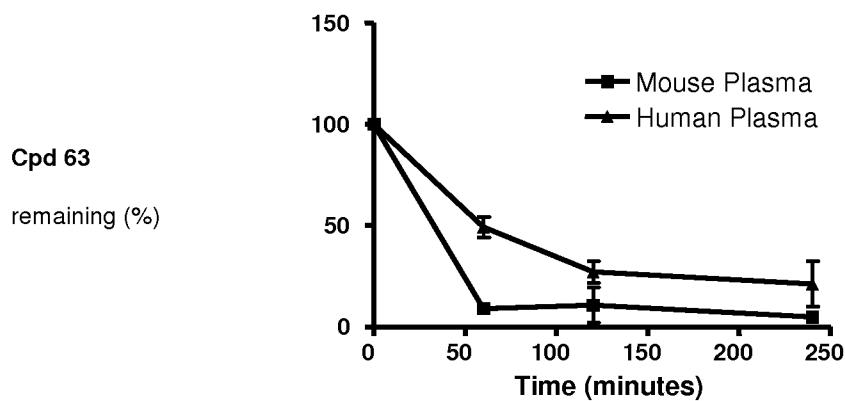
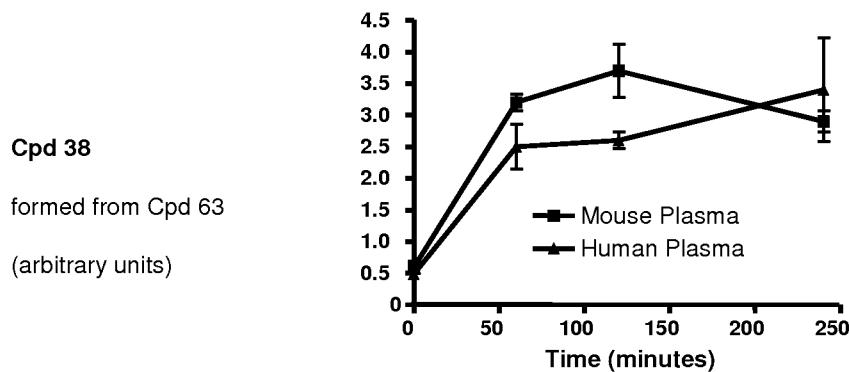
20. Pharmaceutical composition according to claim 14 for use in the treatment of lung disease, particularly the treatment of pulmonary arterial hypertension.

10
21. Pharmaceutical composition according to claim 14 for use in the treatment of pathologies associated with dysregulation of MKlp2 or for use in the treatment of pathologies in which the MKlp2 pathway is dysregulated.

15

22. Use of a compound according to anyone of claims 1-12 as a pharmacological research tool.

1/2

**Figure 1****Figure 2**

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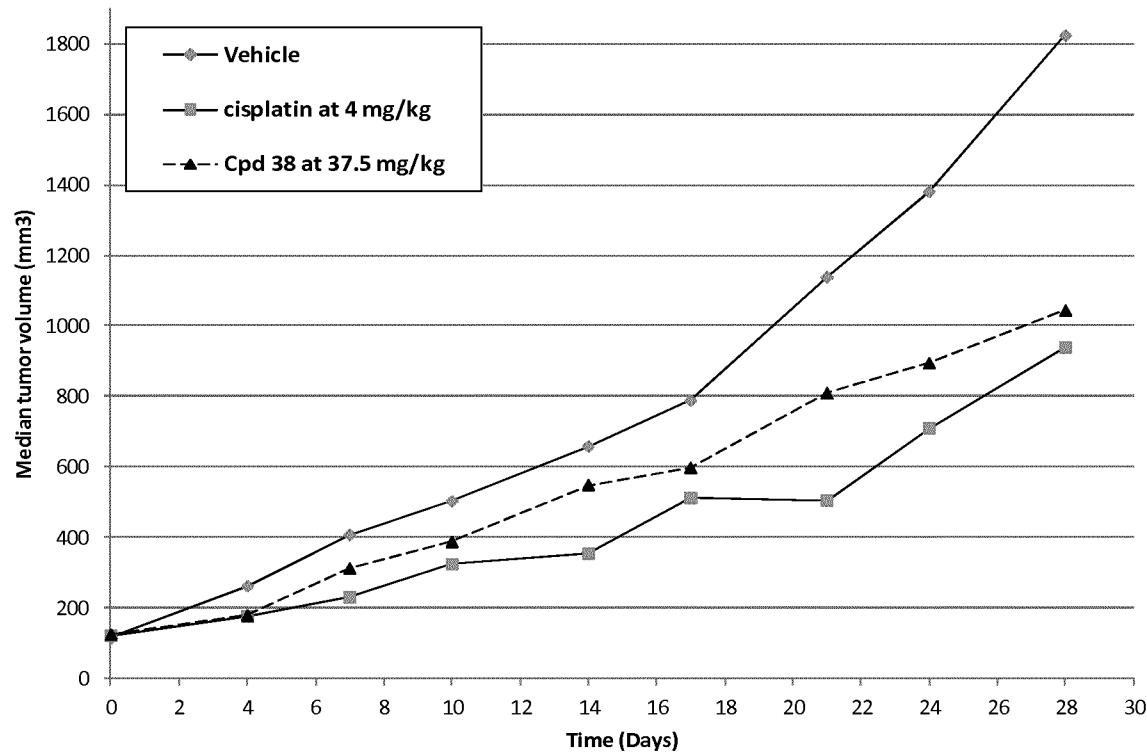


Figure 3

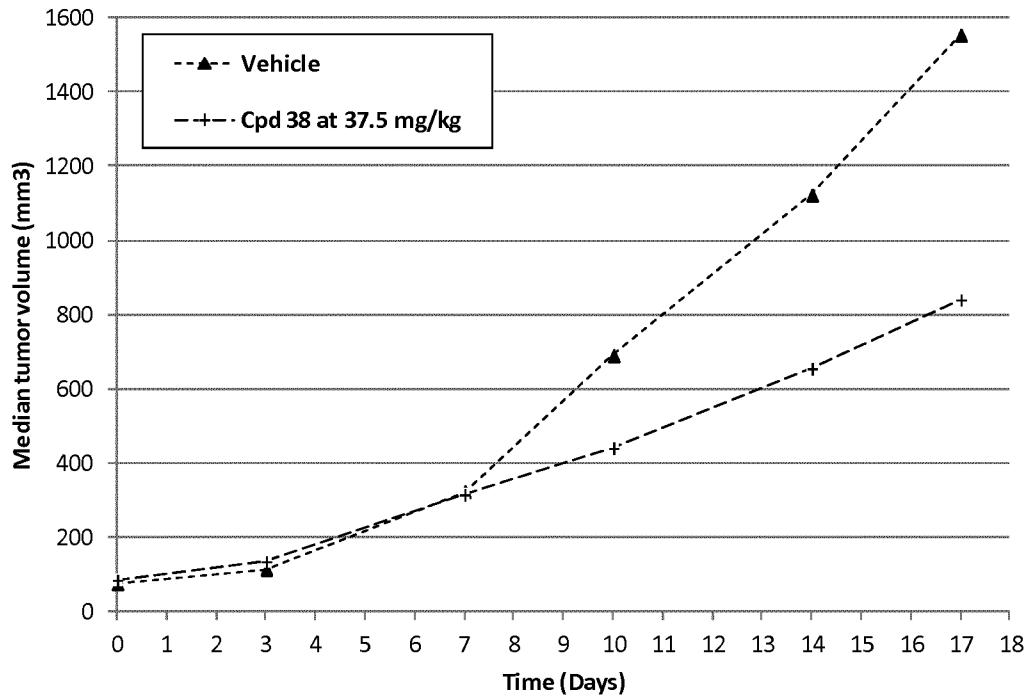


Figure 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/075776

A. CLASSIFICATION OF SUBJECT MATTER				
INV.	C07D209/18	C07D401/06	C07D401/14	C07D405/14
	A61K31/4196	A61K31/4439	A61P11/00	A61P31/12
	C07F9/09	C07F9/40		A61P35/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C07D C07F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WO 2010/150211 A2 (CENTRE NAT RECH SCIENT [FR]; GUILLOU CATHERINE [FR]; KOZIELSKI FRANK []) 29 December 2010 (2010-12-29) cited in the application claim 1 examples 31, 47 table 2</p> <p>-----</p>	1-22



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 January 2014	17/01/2014

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
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Authorized officer

Miniejew, Catherine

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/075776

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-22(partially)

subject-matter related to the compounds wherein R2 is a radical (C1-C6)alkoxy, (C3-C6)cycloalkoxy, aryloxy, heteroaryloxy, (C1-C6)alkyl-aryloxy, (C1-C6)alkyl-heteroaryloxy, said radicals being optionally substituted by at least one halogen; or a radical thio-(C1-C6)alkyl, thio-aryl, thio-heteroaryl, thio-(C1-C6)alkyl-aryl or thio-(C1-C6)-alkyl-heteroaryl, said radicals being optionally substituted by at least one halogen or by a (C1-C6)alkoxy group

2. claims: 1-22(partially)

subject-matter related to the compounds wherein R2 is a R4-N-R5 unit, a O-(C1-C6)alkyl-NR4R5 unit or a S-(C1-C6)alkyl-NR4R5 unit wherein R4 and R5 represent H, a (C1-C6)alkyl group, or R4 and R5 taken together form a 3- to 7-membered ring, optionally interrupted by one or several heteroatoms, with the proviso that at least one among R4 and R5 is not H

3. claims: 1-22(partially)

subject-matter related to the compounds wherein R2 is a NHCOR6 unit wherein R6 represents (C1-C6)alkyl group

4. claims: 1-22(partially)

subject-matter related to the compounds wherein R2 is an aryl group optionally substituted by at least one halogen, a trifluoromethyl group, or a (C1-C3)alkoxy group; or a heteroaryl group, eventually substituted by a halogen, a trifluoromethyl group or a (C1-C3)alkoxy group

5. claims: 1-22(partially)

subject-matter related to the compounds wherein R2 is halogen

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/075776

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010150211 A2	29-12-2010	CA 2766106 A1 CN 102481285 A EP 2266562 A1 EP 2445497 A2 JP 2012531399 A WO 2010150211 A2	29-12-2010 30-05-2012 29-12-2010 02-05-2012 10-12-2012 29-12-2010