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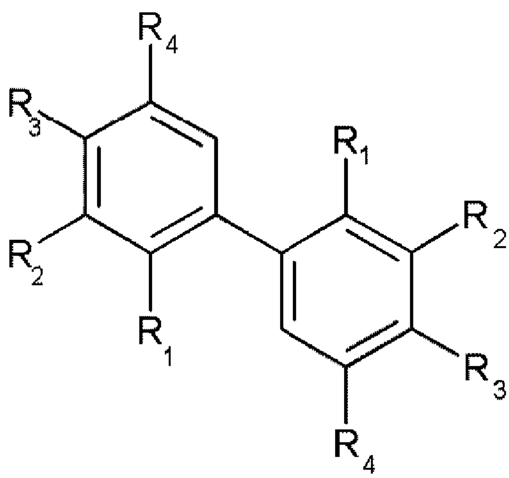
(54) Title: NEW PHENOLIC POLYMERS AND PREPARATION PROCESSES THEREOF



(I)

(57) Abrégé/Abstract:
The present invention concerns the use of a compound having the following formula (I), for the preparation of a polymer. The present invention also concerns the polymers obtained from polymerization of compound of formula (I), and their processes of preparation.

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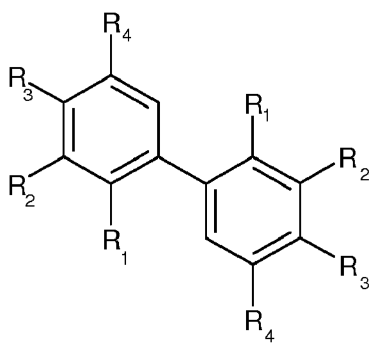
(54) Title: NEW PHENOLIC POLYMERS AND PREPARATION PROCESSES THEREOF



(I)

(57) Abstract: The present invention concerns the use of a compound having the following formula (I), for the preparation of a polymer. The present invention also concerns the polymers obtained from polymerization of compound of formula (I), and their processes of preparation.

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NEW PHENOLIC POLYMERS AND PREPARATION PROCESSES THEREOF

The present invention concerns the use of specific phenolic monomers for the preparation of polymers.

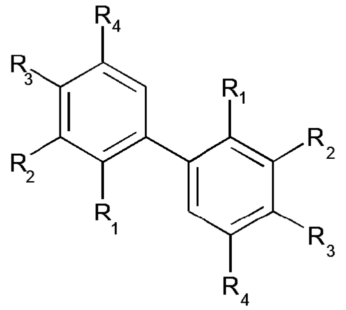
The present invention also relates to new phenolic polymers, in particular polyesters, polyamides, epoxy resins and unsaturated polyesters, and preparation processes thereof.

Aromatic compounds constitute basic chemicals to manufacture everyday life items. Indeed, they play a key role in pharmaceutical, perfumes, dyestuff and polymer industries. In plastic industry, aromatic units offer rigidity, hydrophobicity and fire resistance to the derived polymers. Aromatic polyesters, such as polyalkyleneterephtalate are widely commercially used, especially in food packaging and textile field due to their good thermomechanical properties. Aromatic polyamides, such as Kevlar constitute high performance polymers thanks to their high stability and rigidity. Finally, phenolic compounds constitute a widely used raw material. For instance, Bisphenol A is an important monomer for the synthesis of polycarbonates, epoxy resins and a popular plasticizer for thermoplastic polymers. These compounds are mainly petroleum based and derived from benzene, xylene and toluene.

Phenolic polymers are difficult to prepare as it is not easy to prepare appropriate monomers with a sufficient purity. The high purity of the monomers is a pre-requisite to the synthesis of high molar mass polymer.

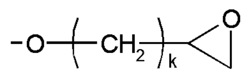
The aim of the present invention is to provide new phenolic thermoplastic polymers for use in numerous applications, as fibers, films, foams, composites, adhesives, coatings, etc... The latter exhibit high thermal stability, high glass transition temperature and high mechanical properties. In addition, the presence of remaining phenolic functions onto the polymer skeleton also brings other properties to these materials such as anti-bacterial activity.

The present invention relates to the use of a compound having the following formula (I):



(I)

wherein:

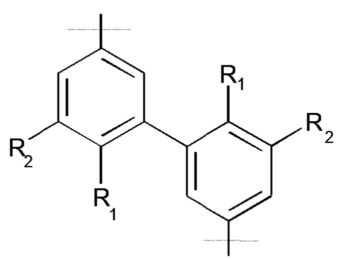
- R_1 is H or a OR_7 group, R_7 being H, a $(C_1\text{-}C_{10})$alkyl group or a $(C_2\text{-}C_6)$alkenyl group;
- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_3 is H or a radical of formula (II) , k being an integer varying from 1 to 6;
- R_4 is a $(C_1\text{-}C_6)$alkoxy group or a radical X chosen from the group consisting of: $(C_2\text{-}C_6)$alkenyl groups, $(C_1\text{-}C_{10})$alkyl group, -CHO, -COOH, $-CH_2OH$, and $-COOR_a$, R_a being a $(C_1\text{-}C_6)$alkyl group or a $(C_2\text{-}C_{12})$alkenyl group;

and wherein:

- when R_1 is H, then R_3 is a group of formula (II) and R_4 is a $(C_1\text{-}C_6)$alkoxy group, and
- when R_1 is a OR_7 group, then R_3 is H and R_4 is X as defined above,

for the preparation of a polymer.The present invention also relates to a compound obtained by polymerization of the compound of formula (I) as defined herein, comprising at least one repetitive unit U, wherein said unit U comprises a moiety having the following formula (III):

(III)



wherein:

- R_1 represents OR_7 group, R_7 being H or a $(C_1\text{-}C_{10})$alkyl group;
- R_2 represents a $(C_1\text{-}C_6)$alkoxy group.
-

The present invention also relates to a process for preparing the compound having the formula (IV), comprising at least one step of polymerization of:

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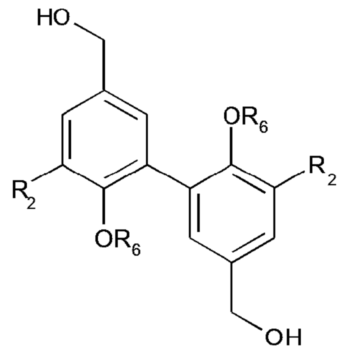
- a compound having the following formula (I-1):

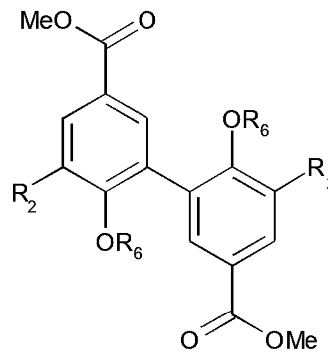
(I-1) 

wherein R_2 and R_6 are as defined herein,

- and a compound of formula (V) $R_bOOC-A_1-COOR_b$, wherein A_1 is as defined herein, and R_b is H or a (C_1-C_6)alkyl group.

The present invention also relates to a process for preparing the compound having the formula (IV-bis), comprising at least one step of polymerization of:

- a compound having the following formula (I-2):

(I-2) 

wherein R_2 and R_6 are as defined herein,

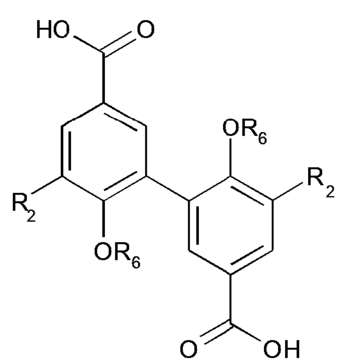
- and a compound of formula (VIII) :

$$HO-A_4-OH \qquad (VIII)$$

wherein A_4 is as above.

The present invention also relates to a process for preparing the compound having the formula (VI), comprising at least one step of polymerization of:

- a compound having the following formula (I-3):

(I-3) 

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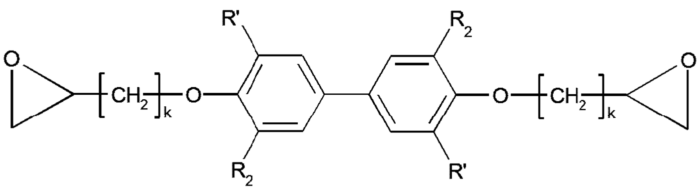
wherein R_2 and R_6 are as defined herein,

- and a diamine of formula (VII) $H_2N\text{-}A_2\text{-}NH_2$, A_2 being as defined herein.

The present invention also relates to a process for preparing the compound obtained by polymerization of the compound of formula (I) as defined herein, and of a monomer chosen from the group consisting of: diacids, diesters, diamines, and epoxy compounds. Said process comprising at least one step of polymerization of:

- a compound having the following formula (I-4):

(I-4) 

wherein:

. R_2 is a $(C_1\text{-}C_6)$alkoxy group,

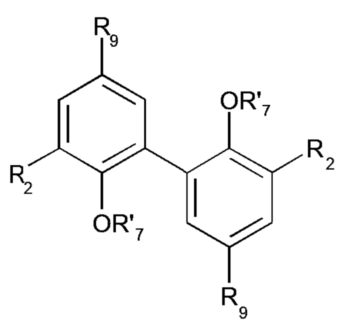
. k is an integer varying from 1 to 6,

. R' being a $(C_1\text{-}C_6)$alkoxy group;

- and a diamine of formula (X) $H_2N\text{-}A_3\text{-}NH_2$, A_3 being a radical of formula -B"$_1$-B"$_2$- wherein:

- B"$_1$ is a $(C_3\text{-}C_{12})$cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group, and
- B"$_2$ is a $(C_1\text{-}C_{10})$alkylene radical.

- The present invention also relates to a process for preparing the compound having the formula (XI-A) or (XI-B), comprising at least one step of polymerization of a compound having the following formula (I-5):

(I-5) 

wherein:

- R_2 is as defined herein;

- R'_7 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups and $(C_2\text{-}C_6)$alkenyl groups, and

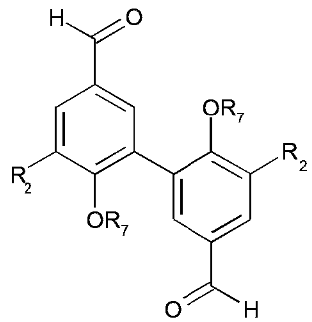
- R_9 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups, $(C_2\text{-}C_6)$alkenyl groups, and -$COOR_a$ groups, R_a being a $(C_2\text{-}C_{12})$alkenyl group,

wherein, when R_7 is an alkyl group, then R_9 is chosen from the $(C_2\text{-}C_6)$alkenyl groups and -$COOR_a$ groups, and when R_7 is an alkenyl group, then R_9 is an alkyl group.

The present invention also relates to a process for preparing the compound having the formula (XII), comprising at least one step of polymerization of:

- a compound having the following formula (I-6):

(I-6)

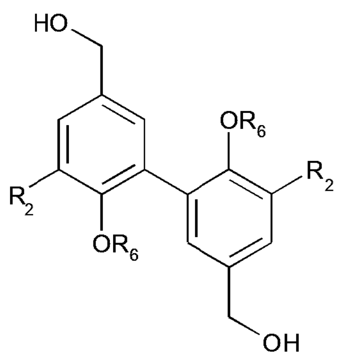


wherein R_2 and R_7 are as defined herein,

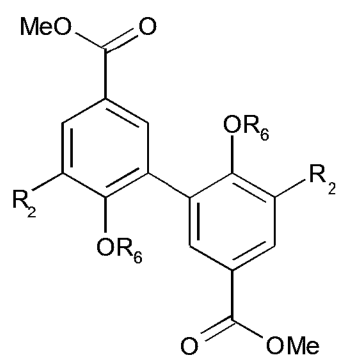
- and a diamine of formula (VII) $H_2N\text{-}A_2\text{-}NH_2$, A_2 being as defined herein.

The present invention is based on the fact that the compounds of formula (I) may be used as monomers suitable to be used for subsequent polymerization.

In one embodiment, the compound of formula (I) has one of the following formulae (I-1), (I-2), (I-3), (I-4), (I-5) or (I-6):



(I-1)



(I-2

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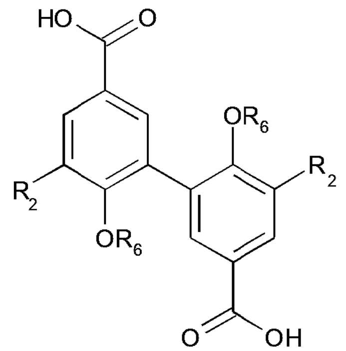
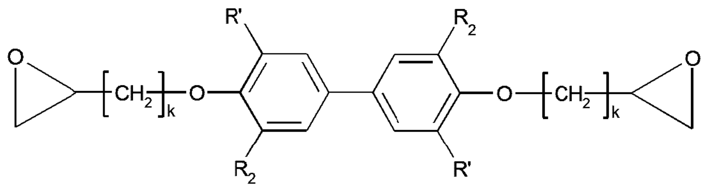
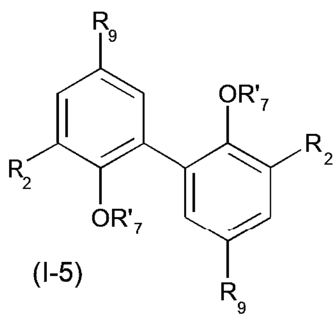


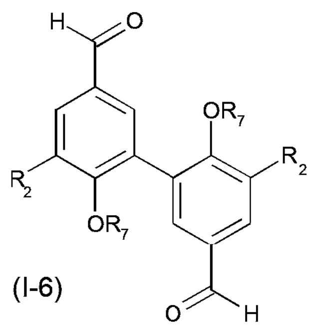
(I-3)



(I-4)



(I-5)



(I-6)

wherein:

- R_2 and k are as defined above in formula (I),
- R' is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is a $(C_1\text{-}C_6)$alkyl group;
- R_7 is as defined above in formula (I), preferably H;
- R'_7 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups and $(C_2\text{-}C_6)$alkenyl groups, and
- R_9 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups, $(C_2\text{-}C_6)$alkenyl groups, and $-COOR_a$ groups, R_a being a $(C_2\text{-}C_{12})$alkenyl group,

wherein, when R'_7 is an alkyl group, then R_9 is chosen from the $(C_2\text{-}C_6)$alkenyl groups and $-COOR_a$ groups, and when R'_7 is an alkenyl group, then R_9 is an alkyl group.

The present invention also relates to a polymer obtained by polymerization of the compound of formula (I) as defined above. Such polymer is obtained by implementing a polymerization step according to the polymerization methods well-known in the art of the compound of formula (I) as defined above.

The present invention also relates to a polymer obtained by polymerization of the compound of formula (I) as defined above, and of a monomer chosen from the group consisting of: diacids, diesters, diamines, and epoxy compounds.

In one embodiment, the diacids and the diesters are selected from the compounds having the following formula (V):

$$R_bOOC\text{-}A_1\text{-}COOR_b \qquad (V)$$

wherein:

- R_b is H or $(C_1\text{-}C_6)$alkyl group; and
- A_1 is chosen from the group consisting of:
  - a $(C_2\text{-}C_{10})$alkylene radical;
  - a $(C_3\text{-}C_{12})$cycloalkylene radical, optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group;
  - a $(C_2\text{-}C_{30})$alkenylene radical;
  - an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group;
  - a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S and N, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group; and
  - a radical of formula $\text{-}B_1\text{-}B_2\text{-}B_3\text{-}$ wherein:
    - B_2 is a $(C_3\text{-}C_{12})$cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group, and
    - B_1 and B_3, identical or different, are chosen from the $(C_2\text{-}C_{15})$alkylene radicals;
  - a radical of formula $\text{-}B_4\text{-}B_5\text{-}$, wherein B_4 and B_5, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with one or several substituents chosen from the $(C_1\text{-}C_6)$alkoxy groups.

In one embodiment, the diamines are selected from the compounds having the following formula (VII):

$$H_2N\text{-}A_2\text{-}NH_2 \qquad (VII)$$

wherein A_2 is chosen from the group consisting of:

- a $(C_2\text{-}C_{10})$alkylene radical;

- a $(C_3\text{-}C_{12})$cycloalkylene radical, optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group;
- a $(C_2\text{-}C_{30})$alkenylene radical;
- an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group;
- a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S, and N, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group; and
- a radical of formula $-B'_1\text{-}B'_2\text{-}B'_3-$ wherein:
  - B'_2 is a $(C_1\text{-}C_{10})$alkylene radical, and
  - B'_1 and B'_3, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group;

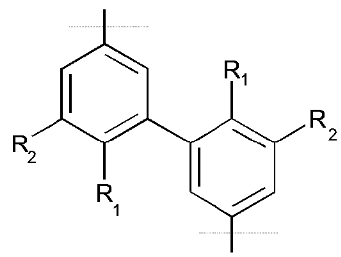
In another embodiment, the diamines are selected from the compounds having the following formula (X):

$$H_2N\text{-}A_3\text{-}NH_2 \qquad (X)$$

wherein A_3 is a radical of formula $-B''_1\text{-}B''_2-$ wherein:

- B''_1 is a $(C_3\text{-}C_{12})$cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group, and
- B''_2 is a $(C_1\text{-}C_{10})$alkylene radical.

The present invention also relates to a polymer obtained by polymerization of the compound of formula (I) as defined above, comprising at least one repetitive unit U, said unit U comprising a moiety having the following formula (III):



(III)

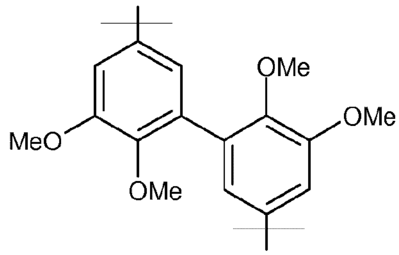
wherein:

- R_1 represents OR_7 group, R_7 being H or a $(C_1\text{-}C_{10})$alkyl group; and
- R_2 represents a $(C_1\text{-}C_6)$alkoxy group.

The repetitive unit U as defined above may comprise other moieties or other functional group(s) linked to the moiety of formula (III).

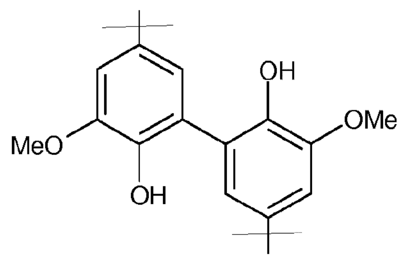
In one embodiment, in the formula (III) above-mentioned, R_1 and R_2, identical or different, are chosen from the $(C_1\text{-}C_6)$alkoxy groups. In particular, R_1 and R_2 represent a methoxy group.

In one embodiment, the present invention relates to a polymer as defined above comprising at least one repetitive unit U, wherein said unit U comprises a moiety having the formula (III-a):



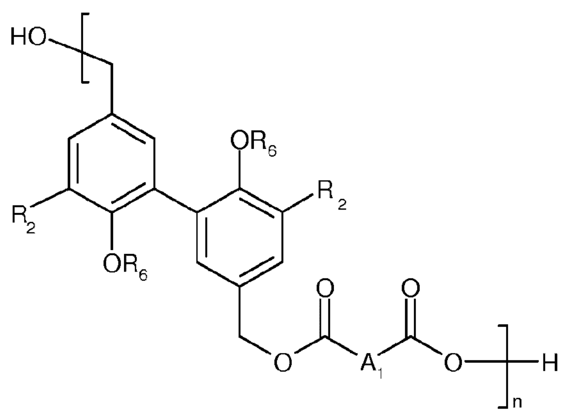
(III-a)

In one embodiment, the present invention relates to a polymer as defined above comprising at least one repetitive unit U, wherein said unit U comprises a moiety having the formula (III-b):



(III-b)

The present invention also relates to a compound having the following formula (IV):



(IV)

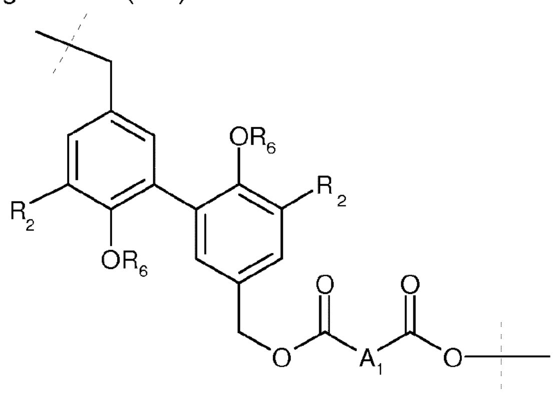
wherein:

- A_1 is as defined above in formula (V);
- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is a $(C_1\text{-}C_6)$alkyl group; and
- n is an integer varying from 1 to 130.

According to a preferred embodiment, in formula (IV), n is greater than 2, preferably greater than 5, and in particular greater than 10.

The compounds of formula (IV) are compounds which are susceptible to be obtained by polymerization of a compound of formula (I) and a diacid or a diester.

In the compound having the formula (IV) as defined above, the repetitive unit U has the following formula (U-1):

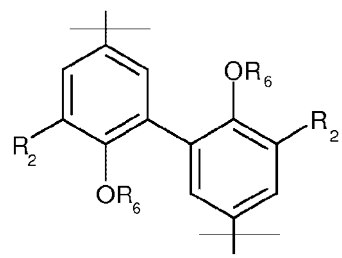


(U-1)

wherein OR_6 corresponds to the R_1 group of the moiety of formula (III), and A_1, R_6 and R_2 are as defined above.

In this compound, the repetitive units U comprise the moiety of formula (III) as defined above, which is linked on one side to a methylene radical and on the other side to a $-CH_2-O-C(O)-A_1-C(O)-O-$ radical.

The compound of formula (IV) is a polymer which possesses n units U having the formula (U-1), which comprise the moiety of formula (III-1):

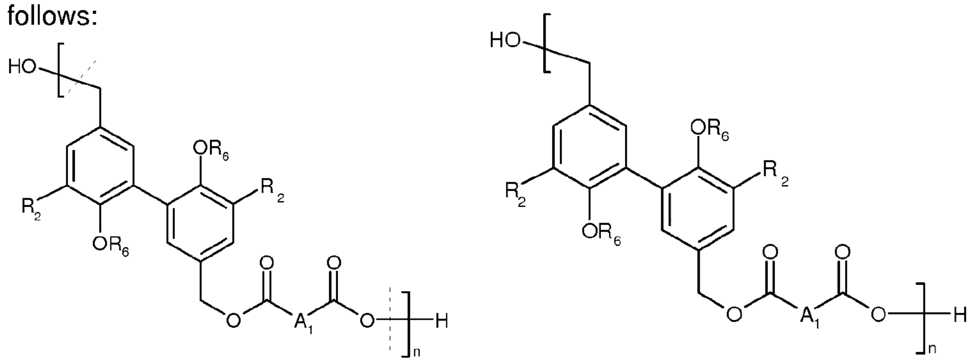


(III-1)

wherein R_2 and R_6 are as defined above.

As used herein, the bond wherein the sign is present, means that said bond is linked to another moiety, for example another functional group.

For example, the polymer having the following formula (IV) may be written as follows:

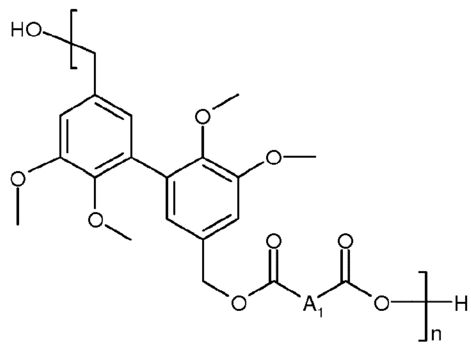


(IV)

In one embodiment, in formula (IV), R_2 is a methoxy group.

In one embodiment, in formula (IV), R_6 is a methyl group.

In one embodiment, the present invention concerns a compound having the following formula (IV-1):



(IV-1)

wherein A_1 and n are as defined above.

In one embodiment, in formulae (IV) and (IV-1), A_1 is a $(C_2\text{-}C_{10})$alkylene radical, more particularly an octylene radical or an ethylene radical.

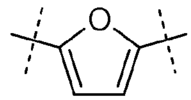
In one embodiment, in formulae (IV) and (IV-1), A_1 is a $(C_3\text{-}C_{12})$cycloalkylene radical, optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group.

In one embodiment, in formulae (IV) and (IV-1), A_1 is a $(C_2\text{-}C_{30})$alkenylene radical. In particular, A_1 represents $-(CH_2)_9-CH=CH-(CH_2)_9-$ or $-CH=CH-$.

In one embodiment, in formulae (IV) and (IV-1), A_1 is an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group. In particular, A_1 represents a phenylene radical.

In one embodiment, in formulae (IV) and (IV-1), A_1 is a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S and N, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group.

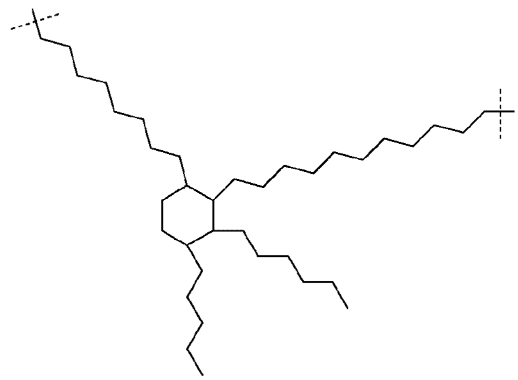
In particular, A_1 represents:



In one embodiment, in formulae (IV) and (IV-1), A_1 is a radical of formula $-B_1-B_2-B_3-$ wherein:

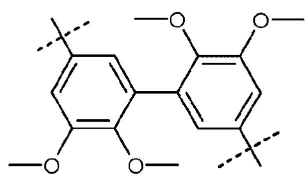
- B_2 is a (C_3-C_{12})cycloalkylene radical, in which one or more carbon atom(s) is substituted by at least one (C_1-C_{10})alkyl group, and
- B_1 and B_3, identical or different, are chosen from the (C_8-C_{12})alkylene radicals.

In particular, A_1 is:



In one embodiment, in formulae (IV) and (IV-1), A_1 is a radical of formula $-B_4-B_5-$, wherein B_4 and B_5, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with one or several substituents chosen from the (C_1-C_6)alkoxy groups.

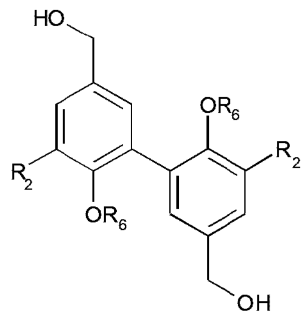
In particular, A_1 is:



In one embodiment, in formulae (IV) and (IV-1), n is an integer varying from 2 to 130. According to a preferred embodiment, in formula (IV) or (IV-1), n is greater than 5, and in particular greater than 10.

The present invention also concerns a process for preparing the compound having formula (IV) or (IV-1), said process comprising at least one step of polymerization of:

- a compound having the following formula (I-1):



(I-1)

wherein R_2 and R_6 are as defined above,

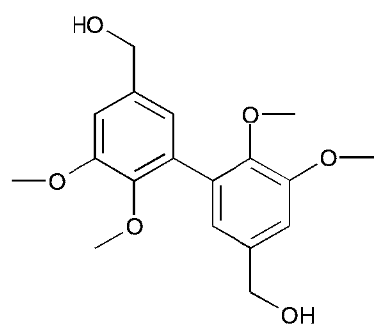
- and a compound of formula (V) as defined above.

In one embodiment, the polymerization step is carried out in the presence of a catalyst chosen from the group consisting of: 5,7-triazabicyclo[4.4.0]dec-5-ene (TBD), zinc acetate (ZnAc), $Ti(OBu)_4$, dibutyl tin oxide (DBTO), and mixtures thereof.

In one embodiment, the polymerization step is carried out at a temperature comprised between 80°C and 250°C, preferably between 120°C and 200°C.

Typically, the catalyst may be used from 0.1% to 10% molar, preferably from 0.5% to 5% molar. Most preferably, the catalyst is $Ti(OBu)_4$, and is used at 0.5% molar.

In one embodiment, the compound having the following formula (I-1) has the following formula (I-1-1):



(I-1-1)

In another embodiment, the compound of formula (V) has the following formula (V-1):

$$HOOC\text{-}A_1\text{-}COOH \qquad (V\text{-}1)$$

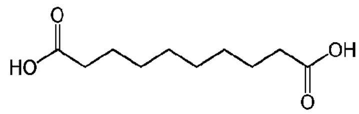
wherein A_1 is as defined above.

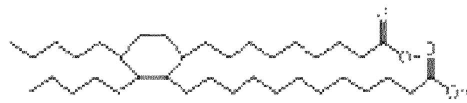
In another embodiment, the compound of formula (V) has the following formula (V-2):

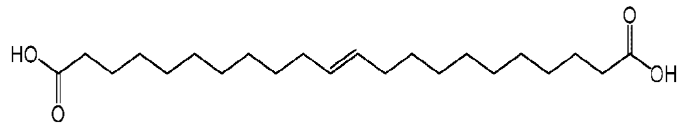
$$R_bOOC\text{-}A_1\text{-}COOR_b \qquad (V\text{-}2)$$

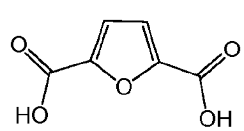
wherein A_1 is as defined above, and R_b is a $(C_1\text{-}C_6)$alkyl group.

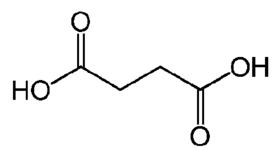
In one embodiment, preferred compounds of formula (V-1) are chosen from the following compounds:

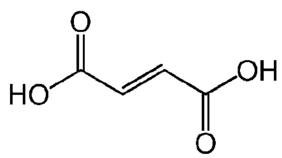


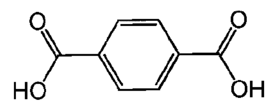


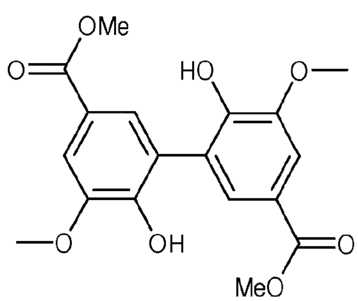




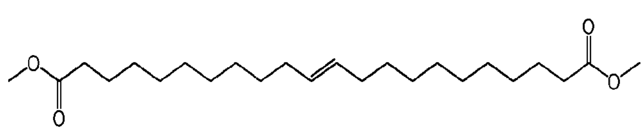


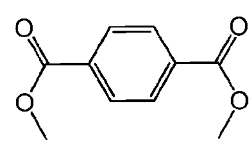


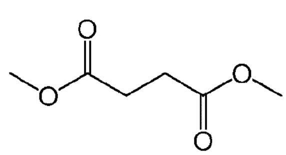


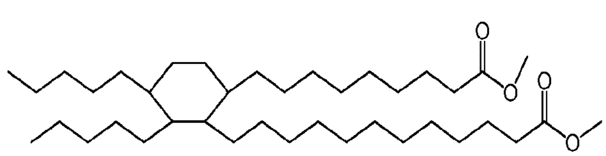


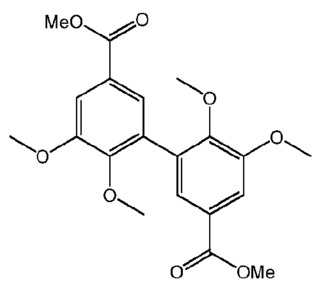
In one embodiment, preferred compounds of formula (V-2) are chosen from the following compounds:

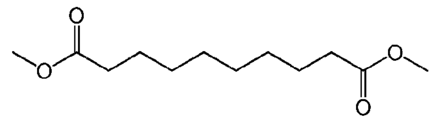


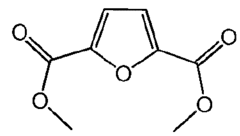




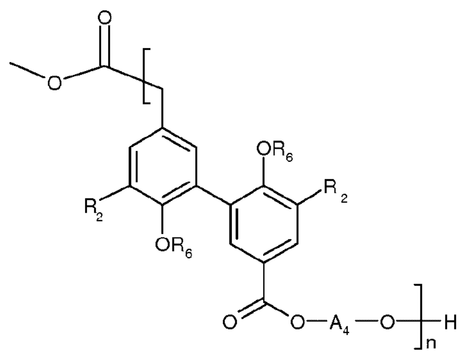








The present invention also relates to a compound having the following formula (IV-bis):



(IV-bis)

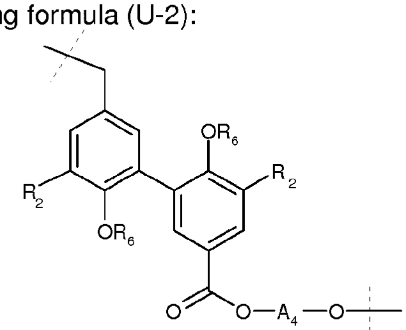
wherein:

- A_4 is a $(C_2\text{-}C_{10})$alkylene radical;
- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is a $(C_1\text{-}C_6)$alkyl group; and
- n is an integer varying from 1 to 40.

According to a preferred embodiment, in formula (IV-bis), n is greater than 2, preferably greater than 5, and in particular greater than 10.

The compounds of formula (IV-bis) are polymers which are susceptible to be obtained by polymerization of a compound of formula (I) and a diol.

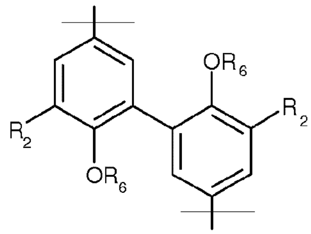
In the compound having the formula (IV-bis) as defined above, the repetitive unit U has the following formula (U-2):



(U-2)

wherein OR_6 corresponds to the R_1 group of the moiety of formula (III), A_4, R_6 and R_2 being as defined above.

According to the invention, the compound of formula (IV-bis) is a polymer which possesses n units U having the formula (U-2), which comprise the moiety of formula (III-1):



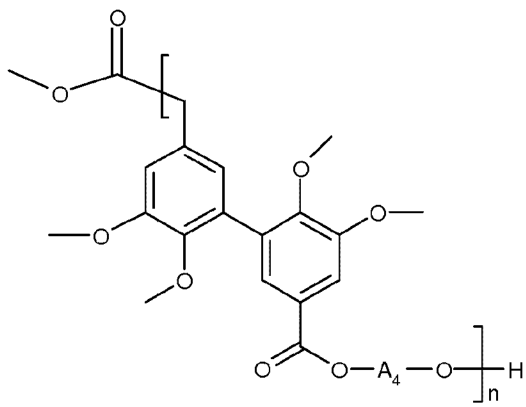
(III-1)

wherein R_2 and R_6 are as defined above.

In one embodiment, in formula (IV-bis), R_2 is a methoxy group.

In one embodiment, in formula (IV-bis), R_6 is a methyl group.

In one embodiment, the present invention relates to a compound having the following formula (IV-bis-1):



(IV-bis-1)

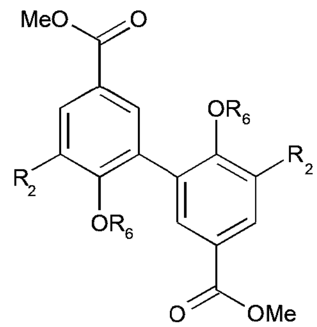
wherein A_4 and n are as defined above.

The compound of formula (IV-bis-1) corresponds to a polymer of formula (IV-bis) wherein: R_2 is methoxy and R_6 is methyl.

In one embodiment, in formulae (IV-bis) and (IV-bis-1), A_4 represents a decylene radical.

The present invention also concerns a process for preparing the compound having the formula (IV-bis) or (IV-bis-1) as defined above, comprising at least one step of polymerization of:

- a compound having the following formula (I-2):



(I-2)

wherein R_2 and R_6 are as defined above,

- and a compound of formula (VIII):

$$HO\text{-}A_4\text{-}OH \qquad \text{(VIII)}$$

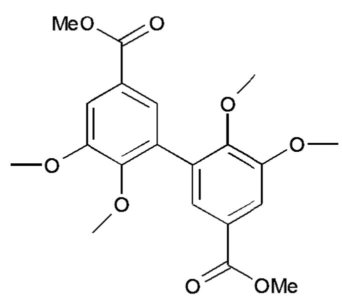
wherein A_4 is as defined above.

In one embodiment, the polymerization step is carried out in the presence of a catalyst chosen from the group consisting of: 5,7-triazabicyclo[4.4.0]dec-5-ene (TBD), zinc acetate (ZnAc), $Ti(OBu)_4$, dibutyl tin oxide (DBTO), and mixtures thereof.

In one embodiment, the polymerization step is carried out at a temperature comprised between 80°C and 250°C, preferably between 120°C and 200°C.

Typically, the catalyst may be used from 0.1% to 10% molar, preferably from 0.5% to 5% molar. Most preferably, the catalyst is $Ti(OBu)_4$, and is used at 0.5% molar.

In one embodiment, the compound having the following formula (I-2) has the following formula (I-2-1):



(I-2-1)

The compound of formula (I-2-1) corresponds to a compound of formula (I-2) wherein R_2 is methoxy and R_6 is methyl.

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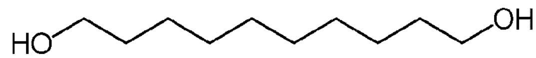
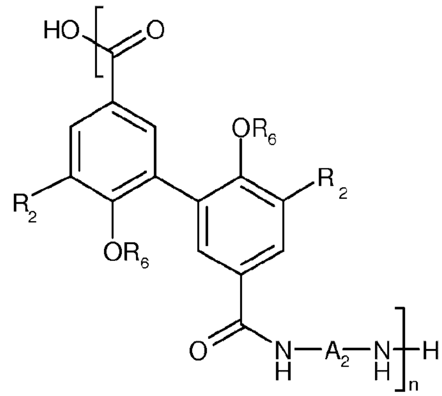
In another embodiment, the compound of formula (VIII) is:



The present invention also relates to a compound having the following formula (VI):



(VI)

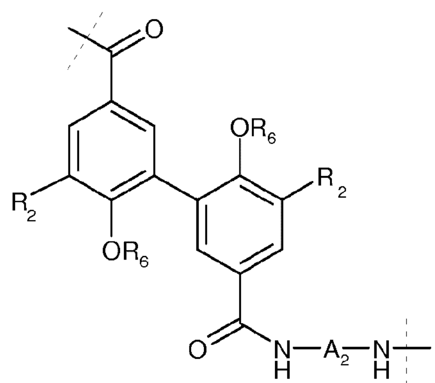
wherein:

- A_2 is as defined above in formula (VII);
- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is a $(C_1\text{-}C_6)$alkyl group; and
- n is an integer varying from 1 to 100.

According to a preferred embodiment, in formula (VI), n is greater than 2, preferably greater than 5, and in particular greater than 10.

The compounds of formula (VI) are polymers which are susceptible to be obtained by polymerization of a compound of formula (I) and a diamine.

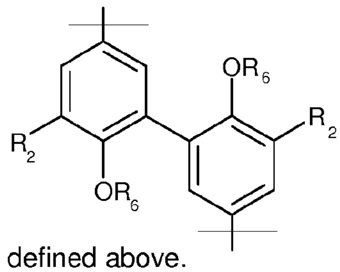
In the polymer having the formula (VI) as defined above, the repetitive unit U has the following formula (U-3):



(U-3)

wherein OR_6 corresponds to the R_1 group of the moiety of formula (III), A_2, R_6 and R_2 being as defined above.

According to the invention, the polymer of formula (VI) possesses n units U having the formula (U-3), which comprise the moiety of formula (III-1):



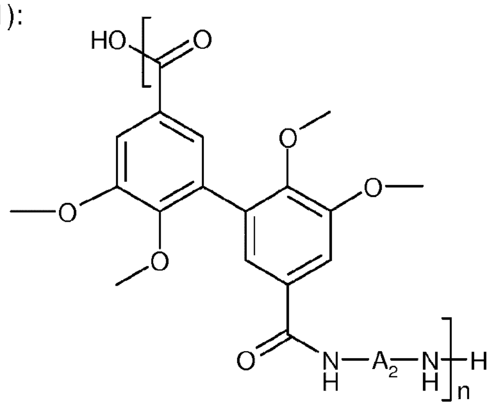
(III-1)

wherein R_2 and R_6 are as defined above.

In one embodiment, in formula (VI), R_2 is a methoxy group.

In one embodiment, in formula (VI), R_6 is a methyl group.

In one embodiment, the present invention relates to a polymer having the following formula (VI-1):

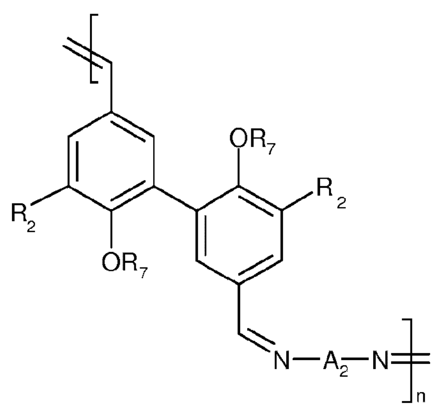


(VI-1)

wherein A_2 and n are as defined above.

The polymer of formula (VI-1) corresponds to a polymer of formula (VI) wherein R_2 is methoxy and R_6 is methyl.

The present invention also relates to a compound having the following formula (XII):



(XII)

wherein:

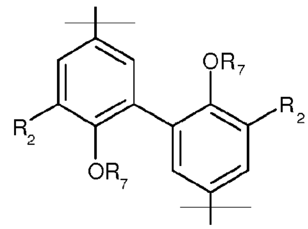
- A_2 is as defined above in formula (VII);
- R_7 is as defined above in formula (I);
- R_2 is a $(C_1\text{-}C_6)$alkoxy group; and

- n is an integer varying from 1 to 100.

According to a preferred embodiment, in formula (XII), n is greater than 2, preferably greater than 5, and in particular greater than 10.

The compounds of formula (XII) are polymers which are susceptible to be obtained by polymerization of a compound of formula (I-6) and a diamine.

According to the invention, the polymer of formula (VI) possesses n units U having the formula (U-3-1), which comprise the moiety of formula (III-1-1):



(III-1-1)

wherein R_2 and R_7 are as defined above.

In one embodiment, in formula (VI), R_2 is a methoxy group.

In one embodiment, in formula (VI), R_7 is H.

In one embodiment, in formulae (XII), (VI) and (VI-1), A_2 is a $(C_2$-$C_{10})$alkylene radical, more particularly a hexylene radical or a decylene radical.

In one embodiment, in formulae (XII), (VI) and (VI-1), A_2 is a $(C_3$-$C_{12})$cycloalkylene radical, optionally substituted by at least one $(C_1$-$C_{10})$alkyl group.

In one embodiment, in formulae (XII), (VI) and (VI-1), A_2 is a $(C_2$-$C_{30})$alkenylene radical.

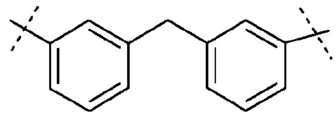
In one embodiment, in formulae (XII), (VI) and (VI-1), A_2 is an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1$-$C_{10})$alkyl group, in particular a phenylene.

In one embodiment, in formulae (XII), (VI) and (VI-1), A_2 is a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S, and N, optionally substituted in ortho, meta or para with a $(C_1$-$C_{10})$alkyl group.

In one embodiment, in formulae (XII), (VI) and (VI-1), A_2 is a radical of formula -B'$_1$-B'$_2$-B'$_3$- wherein:

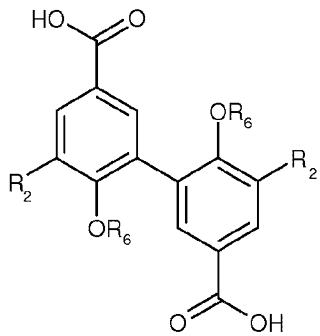
- B'$_2$ is a $(C_1$-$C_{10})$alkylene radical, and
- B'$_1$ and B'$_3$, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1$-$C_{10})$alkyl group.

In particular, A_2 is:



The present invention also relates to a process for preparing a polymer having the formulae (VI) or (VI-1) as defined above, comprising at least one step of polymerization of:

- a compound having the following formula (I-3):



(I-3)

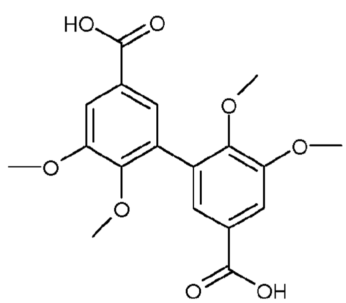
wherein R_2 and R_6 are as defined above,

- and a diamine of formula (VII) $H_2N\text{-}A_2\text{-}NH_2$, A_2 being as defined above.

In one embodiment, the polymerization step is carried out at a temperature comprised between 60°C and 250°C, preferably between 80°C and 240°C.

In one embodiment, the polymerization step is carried out in presence of an equimolar quantity of the compounds of formula (I-3) and the diamine of formula (VII).

In one embodiment, the compound having the following formula (I-3), used in the above-mentioned process, has the following formula (I-3-1):



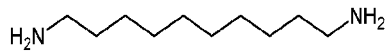
(I-3-1)

In another embodiment, the compound of formula (VII) has the following formula (VII-1):

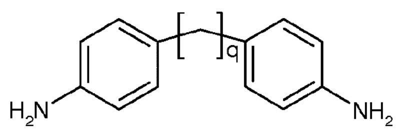
$$H_2N\text{-}(CH_2)_p\text{-}NH_2 \qquad \text{(VII-1)}$$

wherein p is an integer comprised from 1 to 20, preferably from 2 to 12.

In an embodiment, the compound of formula (VII-1) is chosen from the following compounds:

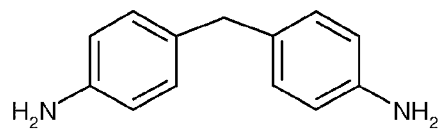


In another embodiment, the compound of formula (VII) has the following formula (VII-2):


(VII-2)

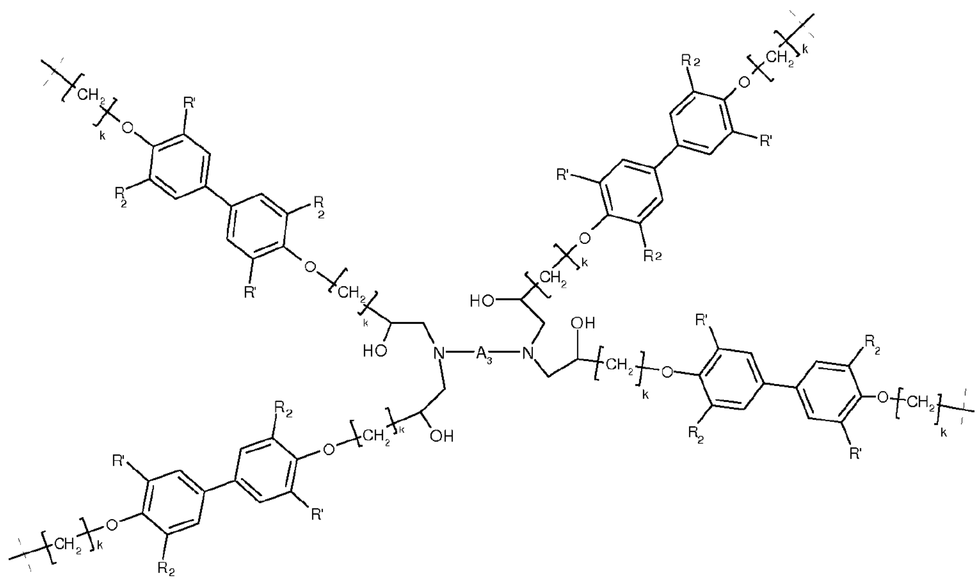
wherein q is an integer comprised from 1 to 20, preferably from 1 to 10.

In one embodiment, the compound of formula (VII-2) is as follows:



The present invention also relates to a process for preparing a polymer having the formulae (XII) as defined above, comprising at least one step of polymerization of a compound having the formula (I-6) as defined above, and a diamine of formula (VII) $H_2N\text{-}A_2\text{-}NH_2$, A_2 being as defined above.

The present invention also relates to a polymer having a repetitive unit comprising a moiety having the following formula (IX):


(IX)

wherein:

. R_2 is as defined above,

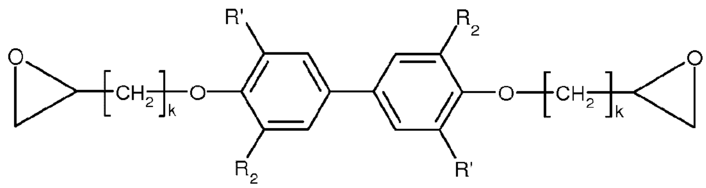
. k is an integer varying from 1 to 6,

. R' is a $(C_1\text{-}C_6)$alkoxy group, and

. A_3 is as defined above in formula (X).

The present invention also relates to the process for preparing a polymer comprising repetitive units containing a moiety having the formula (IX) as defined above, comprising at least one step of polymerization of:

- a compound having the following formula (I-4):



(I-4)

wherein:

. R_2 is as defined above,

. k is an integer varying from 1 to 6,

. R' is a $(C_1\text{-}C_6)$alkoxy group;

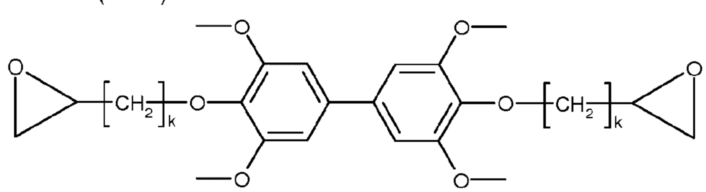
- and a diamine of formula (X) $H_2N\text{-}A_3\text{-}NH_2$, A_3 being as defined above,

A_3 being preferably a radical of formula -B"$_1$-B"$_2$- wherein:

- B"$_1$ is a $(C_3\text{-}C_{12})$cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group, and
- B"$_2$ is a $(C_1\text{-}C_{10})$alkylene radical.

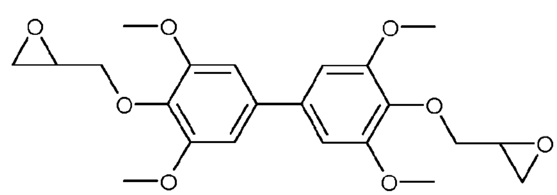
In one embodiment, the polymerization step is carried out at a temperature comprised between 60°C and 250°C, preferably between 80°C and 200°C.

In the process of the invention, a preferred compound of formula (I-4) has the following formula (I-4-1):

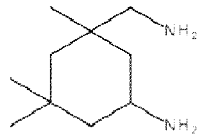


(I-4-1)

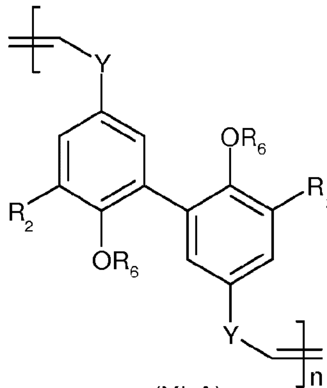
k being a defined above, such as for example the following compound:



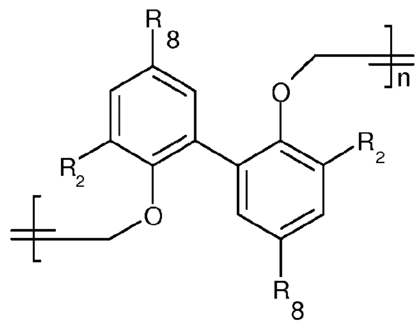
In the process of the invention, a preferred diamine of formula (X) has the following formula:



The present invention also relates to a compound having the following formula (XI-A) or (XI-B):



(XI-A)

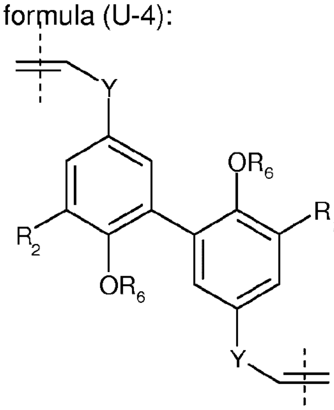


(XI-B)

wherein:

- R_2 is a (C_1-C_6)alkoxy group;
- R_6 is a (C_1-C_{10})alkyl group,
- Y is chosen from the group consisting of: a bond, a (C_1-C_{10})alkylene group, -C(O)O-R_c- and -R_c-O(O)C, R_c being a (C_1-C_{10})alkylene radical;
- R_8 is a (C_1-C_6)alkoxy group or a (C_1-C_{10})alkyl group; and
- n is an integer varying from 10 to 120.

In the compound having the formula (XI-A) as defined above, the repetitive unit U has the following formula (U-4):



(U-4)

wherein OR_6 corresponds to the R_1 group of the moiety of formula (III), Y and R_2 being as defined above.

According to the invention, the compound of formula (XI-A) is a polymer which possesses n units U having the formula (U-4), which comprise the moiety of formula (III-1) as defined above.

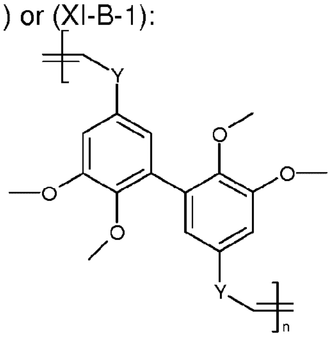
In one embodiment, in formulae (XI-A) and (XI-B), R_2 is a methoxy group.

In one embodiment, in formulae (XI-A) and (XI-B), R_6 is a methyl group.

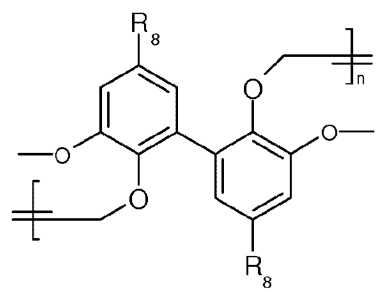
In one embodiment, in formulae (XI-A) and (XI-B), R_8 is a $(C_1\text{-}C_6)$alkoxy group, in particular a methoxy group.

In one embodiment, in formulae (XI-A) and (XI-B), R_8 is a $(C_1\text{-}C_{10})$alkyl group, in particular a methyl group.

In one embodiment, the present invention relates to a polymer having the following formula (XI-A-1) or (XI-B-1):



(XI-A-1)



(XI-B-1)

wherein Y, R_8 and n are as defined above.

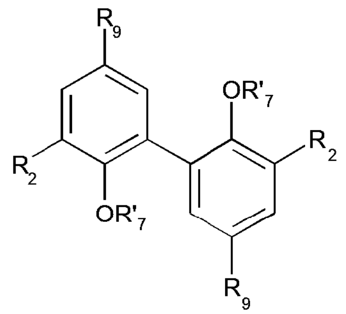
In one embodiment, in formulae (XI-A) and (XI-A-1), Y is a bond.

In one embodiment, in formulae (XI-A) and (XI-A-1), Y is a $(C_1\text{-}C_{10})$alkylene group, in particular a methylene group.

In one embodiment, in formulae (XI-A) and (XI-A-1), Y is a radical $-COOR_c-$ or $-R_cOOC-$, R_c being as defined above and being in particular a nonylene radical.

In one embodiment, in formulae (XI-B) and (XI-B-1), R_8 is a $(C_1\text{-}C_{10})$alkyl group, in particular a methyl group.

The present invention also relates to a process for preparing the compound having the formulae (XI-A) or (XI-B), comprising at least one step of polymerization of a compound having the following formula (I-5):



(I-5)

wherein:

- R_2 is as defined above;

- R'_7 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups and $(C_2\text{-}C_6)$alkenyl groups, and

- R_9 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups, $(C_2\text{-}C_6)$alkenyl groups, and $-COOR_a$ groups, R_a being a $(C_2\text{-}C_{12})$alkenyl group,

wherein, when R'_7 is an alkyl group, then R_9 is chosen from the $(C_2\text{-}C_6)$alkenyl groups and $-COOR_a$ groups, and when R'_7 is an alkenyl group, then R_9 is an alkyl group.

In one embodiment, the polymerization step is carried out in the presence of a Grubbs catalyst. These Grubbs catalysts are a series of transition metal carbene complexes used in particular as catalysts for olefin metathesis. The main advantage of these catalysts is their compatibility with different functional groups. The activity of these catalysts in acyclic diene metathesis polymerization (ADMET) has been widely demonstrated in a large number of publications. Such catalysts are well known from the skilled person.

Typically, the catalyst may be used from 0.1% to 10% molar, preferably from 0.5% to 5% molar. Most preferably, the catalyst is used at 2% molar.

In one embodiment, the polymerization step is carried out at a temperature comprised between 60°C and 130°C, preferably between 80°C and 120°C.

In one embodiment, in the formula (I-5) above-mentioned, R_2 is a methoxy group.

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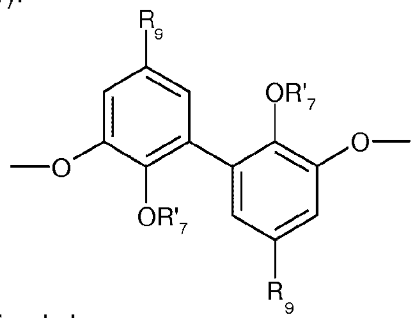
In the process of the invention, a preferred compound of formula (I-5) has the following formula (I-5-1):



(I-5-1)

R_9 and R'_7 being a defined above.

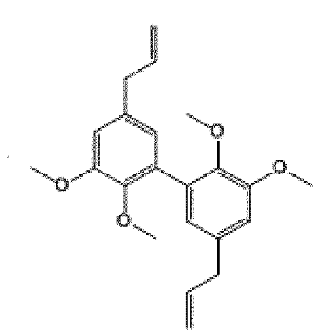
In one embodiment, in formulae (I-5) and (I-5-1), R'_7 is a $(C_1\text{-}C_{10})$alkyl group, in particular a methyl group.

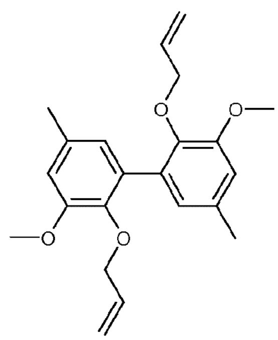
In one embodiment, in formulae (I-5) and (I-5-1), R'_7 is a $(C_2\text{-}C_6)$alkenyl group, in particular a $-CH_2\text{-}CH{=}CH_2$ group.

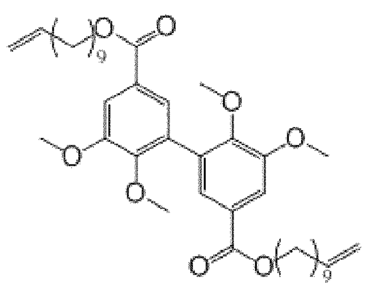
In one embodiment, in formulae (I-5) and (I-5-1), R_9 is a $(C_2\text{-}C_6)$alkenyl group, in particular a $-CH_2\text{-}CH{=}CH_2$ group or a $-CH{=}CH_2$ group.

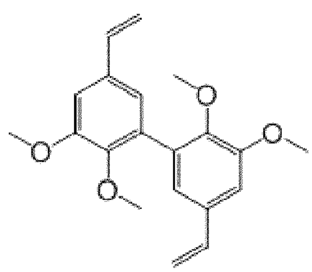
In one embodiment, in formulae (I-5) and (I-5-1), R_9 is a $-COOR_a$ group, in particular a $-COO\text{-}(CH_2)_9\text{-}CH{=}CH_2$ group.

Preferred compounds of formula (I-5) are chosen from the group consisting of:









As used herein, the term "$(C_x\text{-}C_y)$alkyl" means a saturated aliphatic hydrocarbon group, which may be straight or branched, having x to y carbon atoms in the chain.

Preferred alkyl groups have 1 to about 12, preferably 1 to 10, and more preferably 1 to 6, carbon atoms in the chain. The following alkyl groups may be cited as example: methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, dodecyl.

As used herein, the term "(C_x-C_y)alkylene" (or "alkylidene") refers to a divalent saturated aliphatic hydrocarbon radical, comprising from x to y carbon atoms, having preferably from 1 to 20, in particular 1 to 12 carbon atoms, and more preferably 2 to 10 carbon atoms. When said radical is linear, it may be represented by the formula $(CH_2)_m$ wherein m is an integer varying from 1 to 12, and preferably from 2 to 10. The following alkylene may be cited as example: methylene, ethylene, propylene, butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, dodecylene.

As used herein, the term "(C_x-C_y)alkenyl" means an aliphatic hydrocarbon group containing a carbon-carbon double bond and which may be straight or branched having x to y carbon atoms in the chain. Preferred alkenyl groups have 2 to 12 carbon atoms in the chain; and more preferably about 2 to 10 or 2 to 6 carbon atoms in the chain. Exemplary alkenyl groups include for example ethenyl, propenyl, *n*-butenyl, *i*-butenyl, 3-methylbut-2-enyl, *n*-pentenyl, heptenyl, octenyl, nonenyl, decenyl.

As used herein, the term "alkenylene" means a hydrocarbon radical having at least one carbon-carbon double bond (straight chain or branched) wherein a hydrogen atom is removed from each of the terminal carbons such as ethenylene, propenylene, and the like.

As used herein, the term "(C_x-C_y)aryl" refers to an aromatic monocyclic or bicyclic hydrocarbon ring system having from x to y carbon atoms, preferably from 6 to 14, and more preferably 6 to 10, carbons atoms, wherein any ring atom capable of substitution may be substituted by a substituent. Examples of aryl moieties include, but are not limited to, phenyl, naphthyl, and anthracenyl.

As used herein, the term "arylene" refers to a radical derived from arene wherein two hydrogen atoms from the cycle have been deleted. Among the arylene radicals, the phenylene radical may be cited.

As used herein, the term "cycloalkyl" represents a non-aromatic monocyclic or bicyclic ring system having in particular from 3 to 12 carbon atoms. For example, cyclobutyl, cyclopentyl, cyclohexyl, cyclooctyl may be cited.

As used herein, the term "cycloalkylene" refers to a divalent, saturated or partially unsaturated, non-aromatic monocyclic, bicyclic ring system having in particular from 3 to 12 carbon atoms, such as cyclobutylene, cyclopentylene, cyclohexylene.

As used herein, the term "heteroaryl" means a 5- to 14-, preferably a 5- to 10-, membered aromatic or partially saturated hetero mono- or bi-cyclic ring which consists of from 1 to 4 heteroatoms independently selected from the group consisting of sulfur atoms, oxygen atoms and nitrogen atoms including, but not limited to, pyrazolyl, furyl, thienyl, oxazolyl, tetrazolyl, thiazolyl, imidazolyl, thiadiazolyl, pyridyl, pyrimidinyl, pyrrolyl, thiophenyl, pyrazinyl, pyridazinyl, isooxazolyl, isothiazolyl, triazolyl, furazanyl, indolinyl, benzothienyl, benzofuranyl, benzoimidazolinyl, quinolinyl, tetrahydroquinolinyl, and the like.

As used herein, the term "hereroarylene" refers to a divalent heteroaryl as defined above.

As used herein, the term "alkoxy" means an alkyl-O- group wherein the alkyl group is as herein described. Exemplary alkoxy groups include methoxy, ethoxy, *n*-propoxy, *i*-propoxy, *n*-butoxy and heptoxy.

As used herein, the compounds of the invention such as those having one of the formulae (IV), (IV-bis), (VI), (XI-A) or (XI-B), may also be named 'polymers', especially as they comprise the repetition of n repetitive units.

The invention is described in the foregoing by way of non-limiting examples.

EXAMPLES

Suppliers

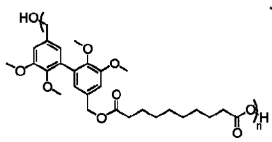
Triazobycyclodecene, Zinc acetate, Dibutyltin oxide, Titanium butoxide, Grubbs 1st generation catalyst, Grubbs 2nd generation catalyst, Hoveyda Grubbs 1st generation catalyst, Hoveyda Grubbs 2nd generation catalyst, Succinic acid, Dimethyl succinate, Dimethyl terephthalate, 4,4'-methylenedianiline were purchased at Sigmal Aldrich. Sebacic acid and 1,6-diaminohexane were bought at Alfa Aesar. 2,5-furandicarboxylic acid, 1,1-diaminodecane and dimethylsebacate were supplied by TCI. Polarclean (methyl-5-(dimethylamino)-2-methyl-5-oxopentanoate) and Pripol were respectively supplied at Solvay and Croda. Maleic acid, terephtalic acid and Isophorone diamine were respectively purchased at Merck, Prolabo and Fisher.

Example 1: Preparation of polyesters (P1 to P8) by esterification

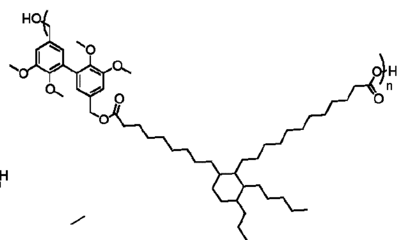
General procedure

Diol (1 equivalent) and diester (or diacid) (1 equivalent) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 0.5 mol% of titanium butoxide

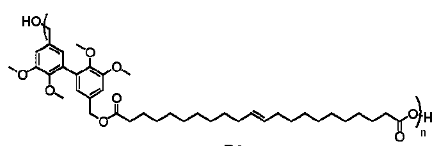
The following polymers were prepared according to this procedure:



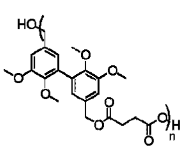
P1



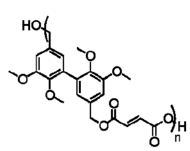
P2



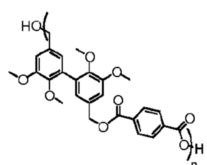
P3



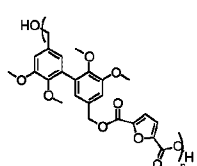
P4



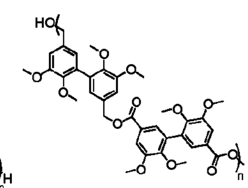
P5



P6



P7



P8

P1 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.28 g of sebacid acid (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide 0.5mol%.

P2 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.75 g of Pripol (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide 0.5mol%.

P3 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.51 g of C22 diacid (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide 0.5mol%.

P4 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.16 g of succinic acid (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide 0.5mol%.

P5 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.16 g of maleic acid (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide 0.5mol%.

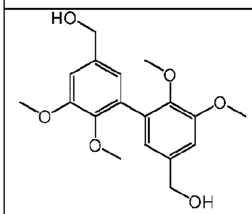
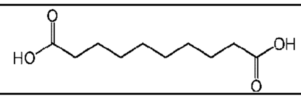
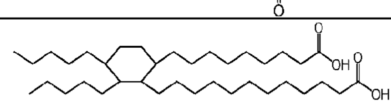
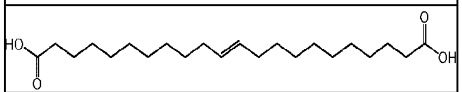
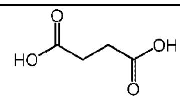
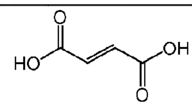
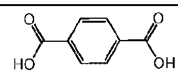
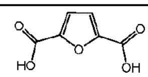
P6 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.23 g of terephtalic acid (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide 0.5mol%.

P7 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.18 g of 2,5-furandicarboxylic acid (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200°C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide 0.5mol%.

Table 1: Thermomechanical properties of polymers from methylated divanillyl diol and different diacids

Diol	Diacid	Catalyst	T_g (°C)[a]	TD5% (°C)[b]	Polymer
		$TiOBu_4$ 0,5%	19	297	**P1**
			-5	284	**P2**
			13	260	**P3**
			90	270	**P4**
			97	240	**P5**
			113	260	**P6**
			140	260	**P7**

[a] *T_g (glass transition temperature) determined by DSC second heating cycle*
[b] *TD5% (Temperature of 5% degradation) determined by TGA.*

Differential Scanning Calorimetry (DSC) measurements were performed on DSC Q100 (TA Instruments). The sample was heated from −70 °C to 200 °C at a rate of 10 °C.min^{-1}. Consecutive cooling and second heating run were also performed at 10 °C.min^{-1}. The glass transition temperatures (Tg) were calculated from the second heating run.

Thermogravimetric analyses (TGA) were performed on TGA-Q50 system from TA instruments at a heating rate of 10 °C.min^{-1} under air between 20 °C and 800 °C. TD5%= Temperature at which 5% of the material is degraded.

<u>Example 2</u>: Preparation of polyester P1 by transesterification

General procedures

Methylated divanillic diol (1 equivalent) and dimethyl sebacate (1 equivalent) were stirred at 160 °C for 2 h under nitrogen flow and at 200 °C under vaccum for 6 h in the presence of 2 mol% of catalyst (titanium butoxide, zinc acetate or dibutyltin oxide) or in the presence of 0.5 mol% of titanium butoxide.

According to another variant, methylated divanillic diol (1 equivalent) and dimethyl sebacate (1 equivalent) were stirred at 120 °C for 24 h in the presence of 10 mol% of TBD.

Polymers from methylated divanillyl diol and methyl sebacate (P1) using different catalysts (see table 2 below)

- **TBD10%**

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.32 g of dimethyl sebacate (1,39 mmol) were stirred at 120°C for 24 h in the presence of 19.3 mg of TBD - 5%mol per ester function)

- **$TiOBu_4$ 0.5%**

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.32 g of dimethyl sebacate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

- **$TiOBu_4$ 2%**

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.32 g of dimethyl sebacate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 9.6 mg of Titanium butoxide (1mol% catalyst relative per ester function).

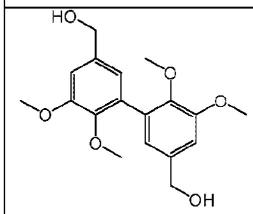
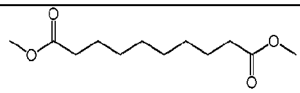
- **ZnAc 2%**

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.32 g of dimethyl sebacate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 6 mg of ZnAc (1mol% catalyst relative per ester function).

- **DBTO 2%**

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.32 g of dimethyl sebacate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 6.9 mg of DBTO (1mol% catalyst relative per ester function).

Table 2: Properties of polymers from methylated divanillyl diol and methyl sebacate using different catalysts

Diol	Methylsebacate (diester)	Catalyst (% by mol)	T_g (°C)[a]	TD5% (°C)[c]	$\overline{M}_n$[b] (g/mol)[b]	$Đ$
		TBD 10%	14	299	33000	1.6
		$TiOBu_4$ 0,5%	34	319	65000	2.1
		$TiOBu_4$ 2%	36	301	30000	2
		ZnAc 2%	45	311	43000	1.8
		DBTO 2%	25	319	44000	1.9

[a] determined by DSC second heating cycle
[b] determined by SEC in DMF/DMSO 80/20
[c] determined by TGA. (TD5%: Temperature of 5% degradation)

Size exclusion chromatography (SEC) analysis was performed at room temperature in DMF/DMSO using simultaneous UV and refraction index detections. The elution times were converted to molar mass using a calibration curve based on low dispersity ($Đ = \overline{M}_n/\overline{M}_w$) polystyrene (PS) standards.

Differential Scanning Calorimetry (DSC) measurements were performed on DSC Q100 (TA Instruments). The sample was heated from −70 °C to 200 °C at a rate of 10 °C.min^{-1}. Consecutive cooling and second heating run were also performed at 10 °C.min^{-1}. The glass transition temperatures (Tg) were calculated from the second heating run.

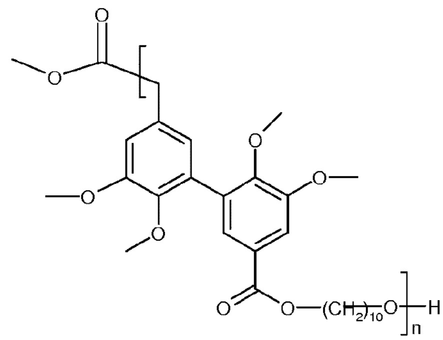
Thermogravimetric analyses (TGA) were performed on TGA-Q50 system from TA instruments at a heating rate of 10 °C.min-1 under air between 20 °C and 800 °C. TD5%= Temperature of 5% degradation.

<u>Example 3</u>: Preparation of polyester P9 by transesterification

General procedure

Methylated dimethyl vanillate (1 equivalent) and 1,10-decanediol (1 equivalent) were stirred at 160 °C for 2 h under nitrogen flow and at 200 °C under vaccum for 6 h in the presence of 2 mol% of catalyst (titanium butoxide, zinc acetate or dibutyltin oxide) or in the presence of 0.5 mol% of titanium butoxide.

According to another variant, methylated dimethyl vanillate (1 equivalent) and 1,10-decanediol (1 equivalent) were stirred at 120 °C for 24 h in the presence of 10 mol% of TBD.



Polymers obtained from methylated dimethylvanillate and decanediol using different catalysts

- **$TiOBu_4$ 2%**

0.5 g methylated dimethyldivanillate (1,28 mmol) and 0.23 g of 1,10-decanediol (1,28 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 8.7 mg of Titanium butoxide (1mol% catalyst relative per ester function).

- **DBTO 2%**

0.5 g methylated dimethyldivanillate (1,28 mmol) and 0.23 g of 1,10-decanediol (1,28 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 6.3 mg of DBTO (1mol% catalyst relative per ester function).

- **TBD 10%**

0.5 g methylated dimethyldivanillate (1,28 mmol) and 0.23 g of 1,10-decanediol (1,28 mmol) (1,39 mmol) were stirred at 120°C for 24 h in the presence of 17.8 mg of TBD -5%mol per ester function)

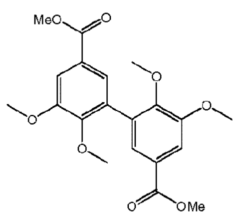
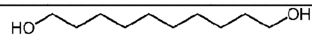
- **ZnAc 2%**

0.5 g methylated dimethyldivanillate (1,28 mmol) and 0.23 g of 1,10-decanediol (1,28 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 4.7 mg of ZnAc (1mol% catalyst relative per ester function).

- **$TiOBu_4$ 0.5%**

0.5 g methylated dimethyldivanillate (1,28 mmol) and 0.23 g of 1,10-decanediol (1,28 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.2 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

Table 3: Properties of polymers obtained from methylated dimethylvanillate and decanediol using different catalysts

Methylated dimethyldivanilate	Decanediol	Catalyst (mol%)	T_g (°C)[a]	TD5% (°C)[c]	$\bar{M}_n$ (g/mol)[b]	Đ
		$TiOBu_4$ 2%	38	273	11000	1.3
		DBTO 2%	43	319	12000	1.6
		TBD 10%	36	253	3000	1.2
		ZnAc 2%	13	205	3000	1.0
		$TiOBu_4$ 0,5%	32	300	20000	1.7

[a] *determined by DSC second heating cycle*
[b] *determined by SEC in DMF/DMSO 80/20*
[c] *determined by TGA. Temperature of 5% degradation*

Differential Scanning Calorimetry (DSC) measurements were performed on DSC Q100 (TA Instruments). The sample was heated from −70 °C to 200 °C at a rate of 10 °C.min^{-1}. Consecutive cooling and second heating run were also performed at 10 °C.min^{-1}. The glass transition temperatures (Tg) were calculated from the second heating run.

Thermogravimetric analyses (TGA) were performed on TGA-Q50 system from TA instruments at a heating rate of 10 °C.min^{-1} under air between 20 °C and 800 °C. TD5%= Temperature of 5% degradation.

Size exclusion chromatography (SEC) analysis was performed at room temperature in DMF/DMSO using simultaneous UV and refraction index detections. The elution times were converted to molar mass using a calibration curve based on low dispersity ($Đ = \bar{M}_n/\bar{M}_w$) polystyrene (PS) standards.

<u>Example 4</u>: Preparation of polyester P'1 to P'8 by transesterification

The general procedure is identical to example 1.

The polymers P'1 to P'8 possess a structure similar to the one of polymers P1 to P8, except that the value of the repetitive units (n) differs, leading to polymers with various properties.

P'1 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.32 g of dimethyl sebacate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

P'2 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.79 g of Pripol ester (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

P'3 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.54 g of C22 diester (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

P'4 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.20 g of dimethyl succinate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

P'6 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.27 g of dimethyl terephtalate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

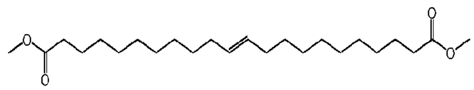
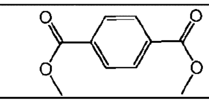
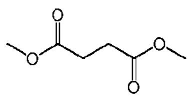
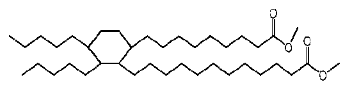
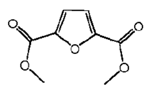
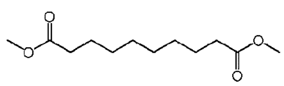
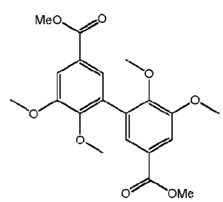
P'7 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.26 g of 2,5-furandicarboxylic acid (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

P'8 synthesis

0.5 g of methylated divanillyl diol (1,39 mmol) and 0.54 g of methylated dimethyldivanillate (1,39 mmol) were stirred at 160°C for 2 h under nitrogen flow and at 200 °C under vacuum for 6h in the presence of 2.4 mg of Titanium butoxide (0.25mol% catalyst relative per ester function).

Table 4: Thermomechanical properties of polymers from of methylated divanillyl diol and different methyldiesters (with catalyst $TiOBu_4$ 0.5%)

Diester	T_g (°C) [a]	TD5% (°C) [c]	E' (GPa) [b]	Polymers
	5	308	2.0	P3'
	101	310	2.0	P6'
	68	302	5.1	P4'
	-5	347	0.1	P2'
	140	342	1.4	P7'
	38	319	8.1	P1'
	102	305	1.3	P8'

[a] *Determined by DSC second heating cycle*
[b] *Determined by DMA 3 points flexion*
[c] *Determined by TGA. Temperature of 5% degradation*

Differential Scanning Calorimetry (DSC) measurements were performed on DSC Q100 (TA Instruments). The sample was heated from −70 °C to 200 °C at a rate of 10 °C.min^{-1}. Consecutive cooling and second heating run were also performed at 10 °C.min^{-1}. The glass transition temperatures (Tg) were calculated from the second heating run.

Thermogravimetric analyses (TGA) were performed on TGA-Q50 system from TA instruments at a heating rate of 10 °C.min^{-1} under air between 20 °C and 800 °C. TD5%= Temperature of 5% degradation.

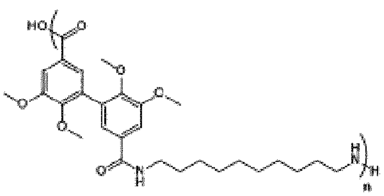
The mechanical properties were measured with a dynamic mechanical thermal analyzer DMA RSA 3 (TA instrument). The sample temperature was modulated from -80 °C to 220 °C, depending on the sample at a heating rate of 5 °C/min. The measurements were perfonrmed in a 3-point bending mode at a frequency of 1 Hz, an initial static force varying between 0.1 and 0.5 N and a strain sweep of 0.1%.

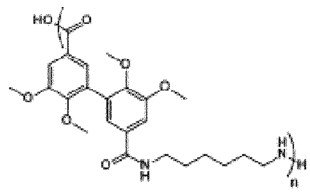
<u>Example 5</u>: Preparation of polyamides P10 to P12

General procedure

Equimolar amount of diacids and diamines were dissolved in ethanol and the mixture was stirred slowly for 30 min at 80°C to allow the formation of ammonium salt. The salt was obtained as a fine powder after elimination of the solvent and dried under vacuum. The salt was warmed at 230°C for 4h.

The following polyamides were synthesized:


P10


P11

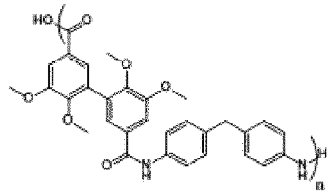
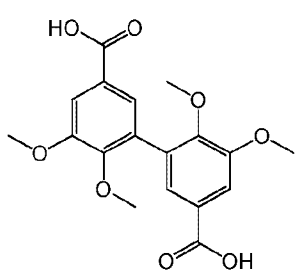
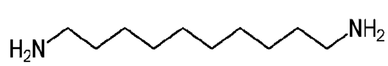
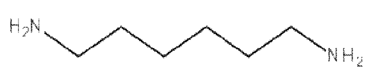
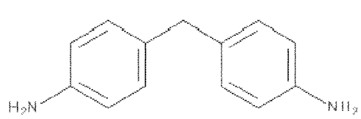

P12

Table 5: Thermomechanical properties of polyamides synthesized from methylated divanillic diacid and different diamines

Diacid	Diamine	Tg (°C)[a]	Name
		124	**P10**
		136	**P11**
		157	**P12**

[a] *Determined by DSC second heating cycle*

Differential Scanning Calorimetry (DSC) measurements were performed on DSC Q100 (TA Instruments). The sample was heated from −70 °C to 200 °C at a rate of 10 °C.min^{-1}. Consecutive cooling and second heating run were also performed at 10 °C.min^{-1}. The glass transition temperatures (Tg) were calculated from the second heating run.

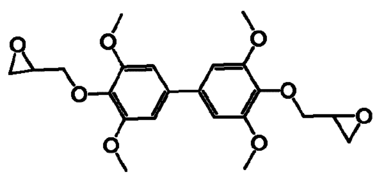
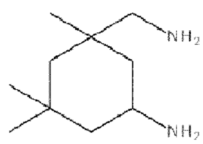
Example 6: Preparation of epoxy resin synthesis

General procedure

Bisepoxide and diamine were mixed together in ethanol. After evaporation of the solvent the mixture is poured into a matrix and warmed at 80°C for 4 h.

Table 6: Thermomechanical properties of Epoxy resins

Ratio Epoxy group /H of amine = 1

Bisepoxy	Diamine	Tα (°C)[a]	Tg[b] (°C)	E' (GPa) 25°C[b]	TD5% (°C)	TD30% (°C)
		112	126	1.1	312	337

[a] *obtained from DMA*
[b] *obtained from DSC*

DMA RSA 3 (TA instrument). The sample temperature was modulated from -80°C to 220°C, depending on the sample at a heating rate of 5°C/min. The measurements were perfonrmed in a 3-point bending mode at a frequency of 1 Hz, an initial static force varying between 0.1 and 0.5 N and a strain sweep of 0.1%.

Differential Scanning Calorimetry (DSC) measurements were performed on DSC Q100 (TA Instruments). The sample was heated from −70°C to 200°C at a rate of 10°C.min^{-1}. Consecutive cooling and second heating run were also performed at 10°C.min^{-1}. The glass transition temperatures (Tg) were calculated from the second heating run.

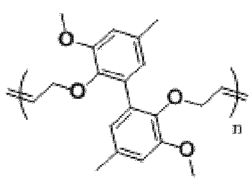
Thermogravimetric analyses (TGA) were performed on TGA-Q50 system from TA instruments at a heating rate of 10°C.min^{-1} under air between 20°C and 800°C. TD5%= Temperature of 5% degradation.

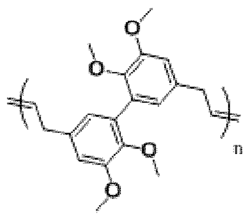
<u>Example 7</u>: Preparation of unsaturated polyesters

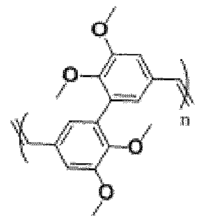
General procedure

Unsaturated dimer (0.22 mmol) was dissolved in 1 mL of Polarclean. Grubbs catalyst (2% mol) was added to the flask. The flask was heated at 80°C under vacuum for 18h. Then 1 mL of ethyl vinyl ether was introduced to the flask to quench the reaction. The final polymer was diffolved into 1 mL of THF and reprecipitated in cold methanol.

The following polymers were synthesized:


P14


P15


P16

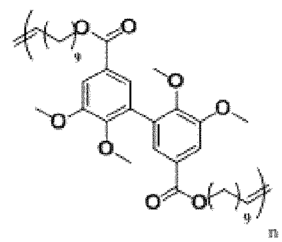
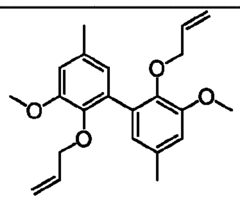
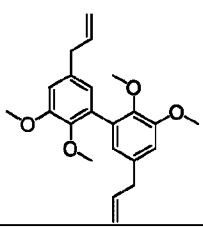
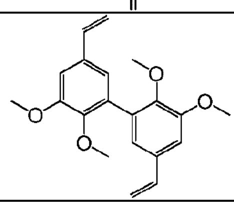
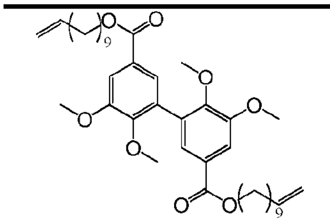
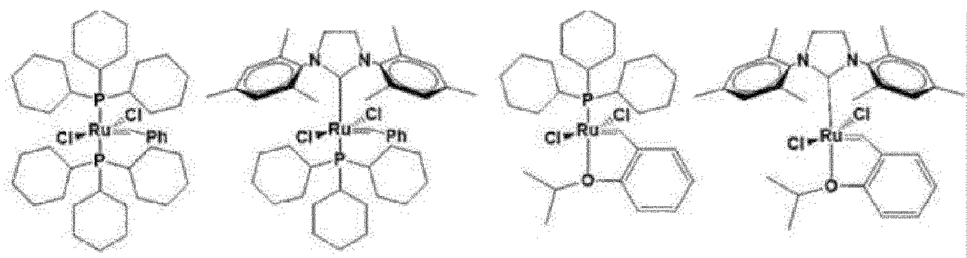

P17

Table 7: Thermomechanical properties of polyesters by ADMET resins

Monomer	*Catalyst*	$\bar{M}_n$ *(g/mol)*	*Đ*	T_g *(°C)*[a]	*TD5% (°C)*	*Polymer*
	HG1	7000	1.1	17	250	P14
	HG2	40000	1.7	50.4	330	P15
	HG2	29000	1.7	160	380	P16

	HG2	10000	1.6	4.0	310	P17

The catalysts mentioned in table 7 are the following:



G1 Grubbs 1st generation catalyst	**G2** Grubbs 2nd generation catalyst	**HG1** Hoveyda-Grubbs 1st generation catalyst	**HG2** Hoveyda-Grubbs 2nd generation catalyst

Differential Scanning Calorimetry (DSC) measurements were performed on DSC Q100 (TA Instruments). The sample was heated from −70°C to 200°C at a rate of 10°C.min^{-1}. Consecutive cooling and second heating run were also performed at 10°C.min^{-1}. The glass transition temperatures (Tg) were calculated from the second heating run.

Thermogravimetric analyses (TGA) were performed on TGA-Q50 system from TA instruments at a heating rate of 10°C.min^{-1} under air between 20°C and 800°C. TD5%= Temperature of 5% degradation.

Size exclusion chromatography (SEC) analysis was performed at room temperature in DMF/DMSO using simultaneous UV and refraction index detections. The elution times were converted to molar mass using a calibration curve based on low dispersity ($Đ = \overline{M}_n/\overline{M}_w$) polystyrene (PS) standards.

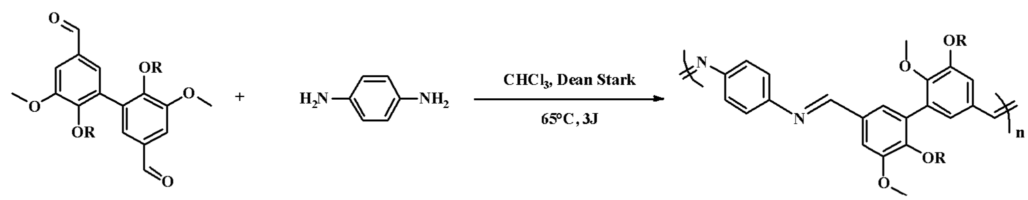
<u>Example 8</u>: Preparation of polyimines

The polyimines of formula (XII) as mentioned above are prepared by reacting divanilline with a diamine.

The monomers are mixed in stoichiometric amounts in the presence of a solvent (toluene, CH_3Cl) (5 mg/mL). The mixture of the monomers in the solvent is heated at reflux for 3 days in a Dean-Stark apparatus.

Then, the polymer thus obtained is washed with methanol and fractionated with a Soxhlet extractor.

The following reaction is carried out:



R being H.

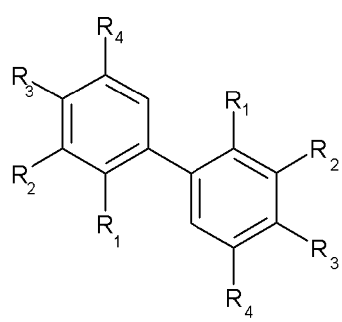
The polymer thus obtained has a Mn of 3 525 g.mol^{-1} and $Đ$= 1.4.

The same method could be carried out by using microwaves.

***

In some aspects, embodiments of the present invention as described herein include the following items:

1. Use of a compound having the following formula (I):

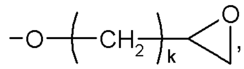


(I)

wherein:

- R_1 is H or a OR_7 group, R_7 being H, a (C_1-C_{10})alkyl group or a (C_2-C_6)alkenyl group;

- R_2 is a (C_1-C_6)alkoxy group;

- R_3 is H or a radical of formula (II) , k being an integer varying from 1 to 6;

- R_4 is a (C_1-C_6)alkoxy group or a radical X chosen from the group consisting of: (C_2-C_6)alkenyl groups, (C_1-C_{10})alkyl group, -COOH, $-CH_2OH$, and $-COOR_a$, R_a being a (C_1-C_6)alkyl group or a (C_2-C_{12})alkenyl group;

and wherein:

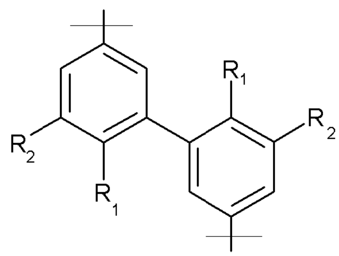
- when R_1 is H, then R_3 is a group of formula (II) and R_4 is a (C_1-C_6)alkoxy group, and

- when R_1 is a OR_7 group, then R_3 is H and R_4 is X as defined above,

for the preparation of a polymer.

2. A compound obtained by polymerization of the compound of formula (I) as defined in item 1, and of a monomer chosen from the group consisting of: diacids, diesters, diamines, and epoxy compounds.

3. A compound obtained by polymerization of the compound of formula (I) as defined in item 1, comprising at least one repetitive unit U, wherein said unit U comprises a moiety having the following formula (III):



(III)

wherein:

- R_1 represents OR_7 group, R_7 being H or a (C_1-C_{10})alkyl group;
- R_2 represents a (C_1-C_6)alkoxy group.

4. The compound of item 2 or 3, having the following formula (IV):

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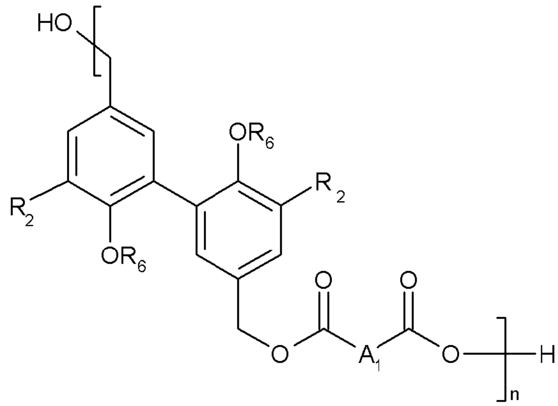


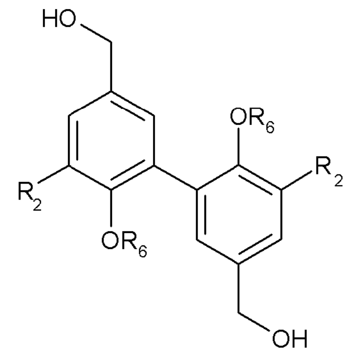
(IV)

wherein:

- A_1 is chosen from the group consisting of:
  - a $(C_2\text{-}C_{10})$alkylene radical;
  - a $(C_3\text{-}C_{12})$cycloalkylene radical, optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group;
  - a $(C_2\text{-}C_{30})$alkenylene radical;
  - an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group;
  - a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S and N, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group; and
  - a radical of formula $-B_1\text{-}B_2\text{-}B_3-$ wherein:
    - B_2 is a $(C_3\text{-}C_{12})$cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group, and
    - B_1 and B_3, identical or different, are chosen from the $(C_2\text{-}C_{15})$alkylene radicals; and
  - a radical of formula $-B_4\text{-}B_5-$, wherein B_4 and B_5, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with one or several substituents chosen from the $(C_1\text{-}C_6)$alkoxy groups;
- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is $(C_1\text{-}C_6)$alkyl group; and
- n is an integer varying from 1 to 130.

5. A process for preparing the compound according to item 4, comprising at least one step of polymerization of:

- a compound having the following formula (I-1):



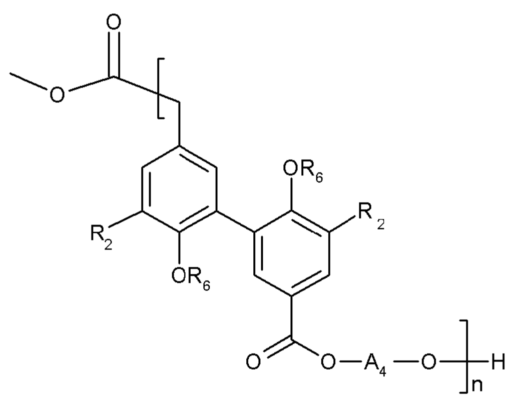
(I-1)

wherein R_2 and R_6 are as defined in item 4,

- and a compound of formula (V) $R_bOOC\text{-}A_1\text{-}COOR_b$, wherein A_1 is as defined in item 4, and R_b is H or a $(C_1\text{-}C_6)$alkyl group.

6. The process of item 5, wherein the polymerization step is carried out in the presence of a catalyst chosen from the group consisting of: 5,7-triazabicyclo[4.4.0]dec-5-ene (TBD), zinc acetate (ZnAc), $Ti(OBu)_4$, dibutyl tin oxide (DBTO), and mixtures thereof.

7. The compound of item 2 or 3, having the following formula (IV-bis):



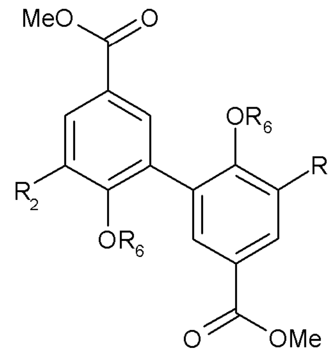
(IV-bis)

wherein:

- A_4 is a $(C_2\text{-}C_{10})$alkylene radical;
- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is $(C_1\text{-}C_6)$alkyl group; and
- n is an integer varying from 1 to 40.

8. A process for preparing the compound according to item 7, comprising at least one step of polymerization of:

- a compound having the following formula (I-2):



(I-2)

wherein R_2 and R_6 are as defined in item 7,

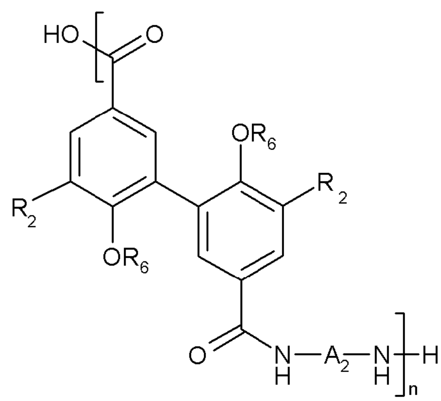
- and a compound of formula (VIII) :

$$HO\text{-}A_4\text{-}OH \qquad (VIII)$$

wherein A_4 is as defined in item 7.

9. The process of item 8, wherein the polymerization step is carried out in the presence of a catalyst chosen from the group consisting of: 5,7-triazabicyclo[4.4.0]dec-5-ene (TBD), zinc acetate (ZnAc), $Ti(OBu)_4$, dibutyl tin oxide (DBTO), and mixtures thereof.

10. The compound of item 2 or 3, having the following formula (VI):



(VI)

wherein:

- A_2 is chosen from the group consisting of:
  - a $(C_2\text{-}C_{10})$alkylene radical;
  - a $(C_3\text{-}C_{12})$cycloalkylene radical, optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group;
  - a $(C_2\text{-}C_{30})$alkenylene radical;

○ an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group;

○ a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S, and N, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group; and

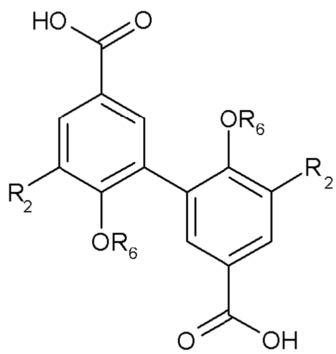
○ a radical of formula $-B'_1\text{-}B'_2\text{-}B'_3-$ wherein:

- B'_2 is a $(C_1\text{-}C_{10})$alkylene radical, and
- B'_1 and B'_3, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group;

- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is $(C_1\text{-}C_6)$alkyl group; and
- n is an integer varying from 1 to 100.

11. A process for preparing the compound according to item 10, comprising at least one step of polymerization of:

- a compound having the following formula (I-3):



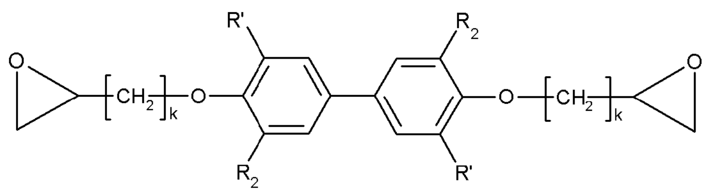
(I-3)

wherein R_2 and R_6 are as defined in item 10,

- and a diamine of formula (VII) $H_2N\text{-}A_2\text{-}NH_2$, A_2 being as defined in item 10.

12. A process for preparing the compound according to item 2, comprising at least one step of polymerization of:

- a compound having the following formula (I-4):



(I-4)

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wherein:

. R_2 is a (C_1-C_6)alkoxy group,

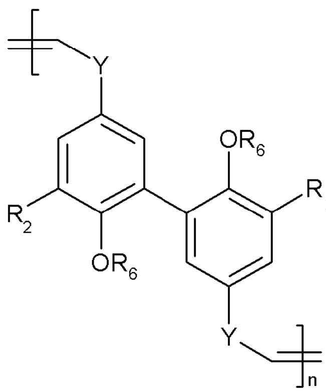
. k is an integer varying from 1 to 6,

. R' being a (C_1-C_6)alkoxy group;

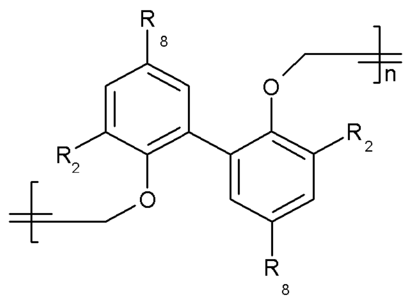
- and a diamine of formula (X) $H_2N-A_3-NH_2$, A_3 being a radical of formula -B"$_1$-B"$_2$- wherein:

  - B"$_1$ is a (C_3-C_{12})cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one (C_1-C_{10})alkyl group, and
  - B"$_2$ is a (C_1-C_{10})alkylene radical.

13. The compound of item 3, having the following formula (XI-A) or (XI-B):



(XI-A)

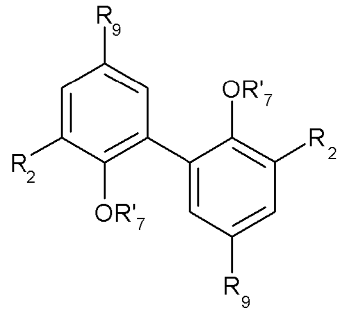


(XI-B)

wherein:

- R_2 is a (C_1-C_6)alkoxy group;
- R_6 is a (C_1-C_{10})alkyl group,
- Y is chosen from the group consisting of: a bond, a (C_1-C_{10})alkylene radical, a radical -C(O)O-R_c- and -R_c-O(O)C-, R_c being a (C_1-C_{10})alkylene radical;
- R_8 is a (C_1-C_6)alkoxy group or a (C_1-C_{10})alkyl group; and
- n is an integer varying from 10 to 120.

14. A process for preparing the compound according to item 13, comprising at least one step of polymerization of a compound having the following formula (I-5):



(I-5)

wherein:

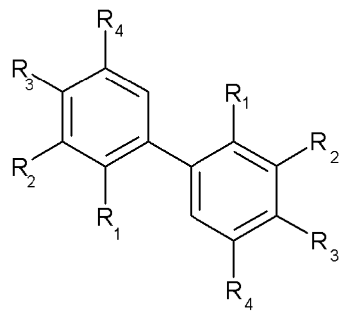
- R_2 is as defined in item 13;
- R'_7 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups and $(C_2\text{-}C_6)$alkenyl groups, and
- R_9 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups, $(C_2\text{-}C_6)$alkenyl groups, and $-COOR_a$ groups, R_a being a $(C_2\text{-}C_{12})$alkenyl group,

wherein, when R'_7 is an alkyl group, then R_9 is chosen from the $(C_2\text{-}C_6)$alkenyl groups and $-COOR_a$ groups, and when R'_7 is an alkenyl group, then R_9 is an alkyl group.

15. The process of item 14, wherein the polymerization step is carried out in the presence of a Grubbs catalyst.

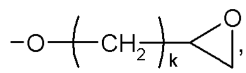
CLAIMS

1. Use of a compound having the following formula (I):



(I)

wherein:

- R_1 is H or a OR_7 group, R_7 being H, a $(C_1$-$C_{10})$alkyl group or a $(C_2$-$C_6)$alkenyl group;
- R_2 is a $(C_1$-$C_6)$alkoxy group;
- R_3 is H or a radical of formula (II) , k being an integer varying from 1 to 6;
- R_4 is a $(C_1$-$C_6)$alkoxy group or a radical X chosen from the group consisting of: $(C_2$-$C_6)$alkenyl groups, $(C_1$-$C_{10})$alkyl group, -COOH, $-CH_2OH$, and $-COOR_a$, R_a being a $(C_1$-$C_6)$alkyl group or a $(C_2$-$C_{12})$alkenyl group;

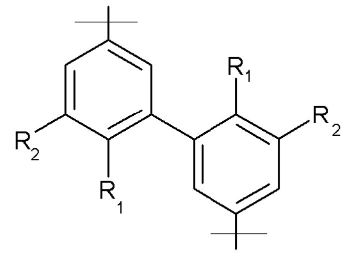
and wherein:

- when R_1 is H, then R_3 is a group of formula (II) and R_4 is a $(C_1$-$C_6)$alkoxy group, and
- when R_1 is a OR_7 group, then R_3 is H and R_4 is X as defined above,

for the preparation of a polymer.

2. A compound obtained by polymerization of the compound of formula (I) as defined in claim 1, and of a monomer chosen from the group consisting of: diacids, diesters, diamines, and epoxy compounds.

3. A compound obtained by polymerization of the compound of formula (I) as defined in claim 1, comprising at least one repetitive unit U, wherein said unit U comprises a moiety having the following formula (III):

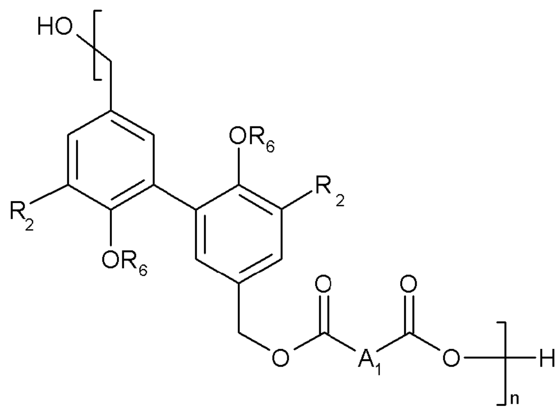


(III)

wherein:

- R_1 represents OR_7 group, R_7 being H or a $(C_1\text{-}C_{10})$alkyl group;
- R_2 represents a $(C_1\text{-}C_6)$alkoxy group.

4. The compound of claim 2 or 3, having the following formula (IV):



(IV)

wherein:

- A_1 is chosen from the group consisting of:
  - o a $(C_2\text{-}C_{10})$alkylene radical;
  - o a $(C_3\text{-}C_{12})$cycloalkylene radical, optionally substituted by at least one $(C_1\text{-}C_{10})$alkyl group;
  - o a $(C_2\text{-}C_{30})$alkenylene radical;
  - o an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group;
  - o a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S and N, optionally substituted in ortho, meta or para with a $(C_1\text{-}C_{10})$alkyl group; and

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○ a radical of formula $-B_1-B_2-B_3-$ wherein:

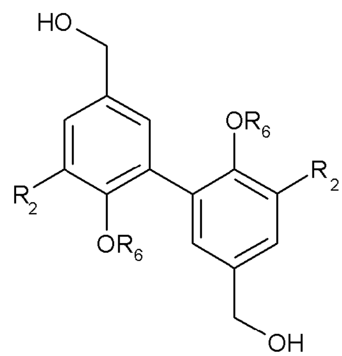
- B_2 is a (C_3-C_{12})cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one (C_1-C_{10})alkyl group, and
- B_1 and B_3, identical or different, are chosen from the (C_2-C_{15})alkylene radicals; and

○ a radical of formula $-B_4-B_5-$, wherein B_4 and B_5, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with one or several substituents chosen from the (C_1-C_6)alkoxy groups;

- R_2 is a (C_1-C_6)alkoxy group;
- R_6 is (C_1-C_6)alkyl group; and
- n is an integer varying from 1 to 130.

5. A process for preparing the compound according to claim 4, comprising at least one step of polymerization of:

- a compound having the following formula (I-1):



(I-1)

wherein R_2 and R_6 are as defined in claim 4,

- and a compound of formula (V) $R_bOOC-A_1-COOR_b$, wherein A_1 is as defined in claim 4, and R_b is H or a (C_1-C_6)alkyl group.

6. The process of claim 5, wherein the polymerization step is carried out in the presence of a catalyst chosen from the group consisting of: 5,7-triazabicyclo[4.4.0]dec-5-ene (TBD), zinc acetate (ZnAc), $Ti(OBu)_4$, dibutyl tin oxide (DBTO), and mixtures thereof.

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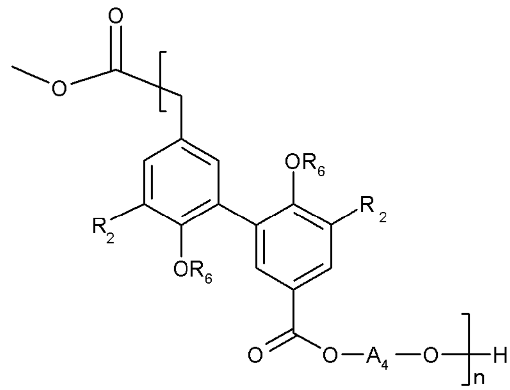
7. The compound of claim 2 or 3, having the following formula (IV-bis):



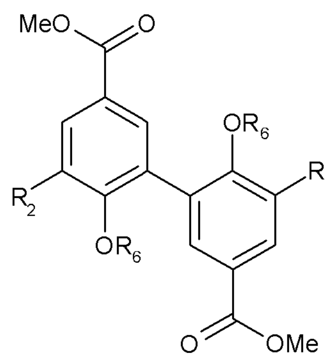
(IV-bis)

wherein:

- A_4 is a $(C_2\text{-}C_{10})$alkylene radical;
- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is $(C_1\text{-}C_6)$alkyl group; and
- n is an integer varying from 1 to 40.

8. A process for preparing the compound according to claim 7, comprising at least one step of polymerization of:

- a compound having the following formula (I-2):



(I-2)

wherein R_2 and R_6 are as defined in claim 7,

- and a compound of formula (VIII) :

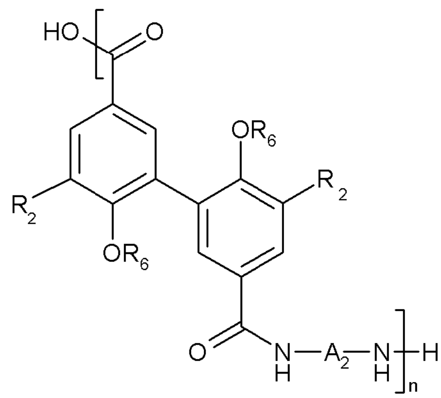
HO-A_4-OH (VIII)

wherein A_4 is as defined in claim 7.

9. The process of claim 8, wherein the polymerization step is carried out in the presence of a catalyst chosen from the group consisting of: 5,7-

triazabicyclo[4.4.0]dec-5-ene (TBD), zinc acetate (ZnAc), $Ti(OBu)_4$, dibutyl tin oxide (DBTO), and mixtures thereof.

10. The compound of claim 2 or 3, having the following formula (VI):



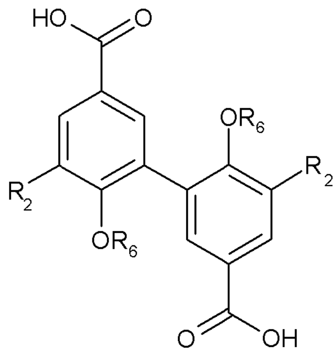
(VI)

wherein:

- A_2 is chosen from the group consisting of:
    - a (C_2-C_{10})alkylene radical;
    - a (C_3-C_{12})cycloalkylene radical, optionally substituted by at least one (C_1-C_{10})alkyl group;
    - a (C_2-C_{30})alkenylene radical;
    - an arylene radical comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a (C_1-C_{10})alkyl group;
    - a heteroarylene radical comprising from 5 to 14 carbon atoms and at least one heteroatom chosen from O, S, and N, optionally substituted in ortho, meta or para with a (C_1-C_{10})alkyl group; and
    - a radical of formula $-B'_1-B'_2-B'_3-$ wherein:
        - B'_2 is a (C_1-C_{10})alkylene radical, and
        - B'_1 and B'_3, identical or different, are chosen from the arylene radicals comprising from 6 to 14 carbon atoms, optionally substituted in ortho, meta or para with a (C_1-C_{10})alkyl group;
- R_2 is a (C_1-C_6)alkoxy group;
- R_6 is (C_1-C_6)alkyl group; and
- n is an integer varying from 1 to 100.

11. A process for preparing the compound according to claim 10, comprising at least one step of polymerization of:

- a compound having the following formula (I-3):



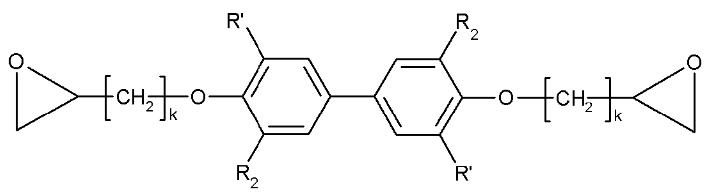
(I-3)

wherein R_2 and R_6 are as defined in claim 10,

- and a diamine of formula (VII) H_2N-A_2-NH_2, A_2 being as defined in claim 10.

12. A process for preparing the compound according to claim 2, comprising at least one step of polymerization of:

- a compound having the following formula (I-4):



(I-4)

wherein:

. R_2 is a (C_1-C_6)alkoxy group,

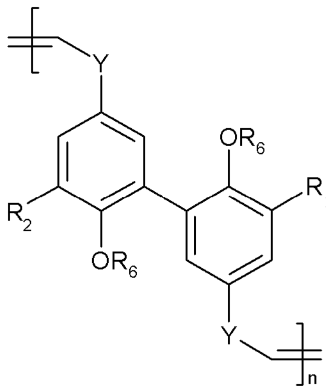
. k is an integer varying from 1 to 6,

. R' being a (C_1-C_6)alkoxy group;

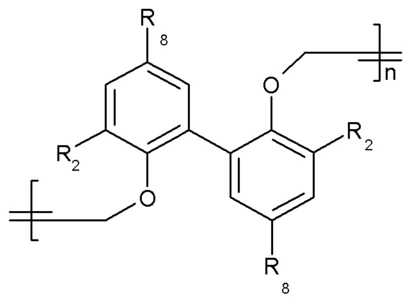
- and a diamine of formula (X) H_2N-A_3-NH_2, A_3 being a radical of formula -B''$_1$-B''$_2$- wherein:

- B''$_1$ is a (C_3-C_{12})cycloalkylene radical, in which one or more carbon atom(s) is optionally substituted by at least one (C_1-C_{10})alkyl group, and
- B''$_2$ is a (C_1-C_{10})alkylene radical.

13. The compound of claim 3, having the following formula (XI-A) or (XI-B):



(XI-A)

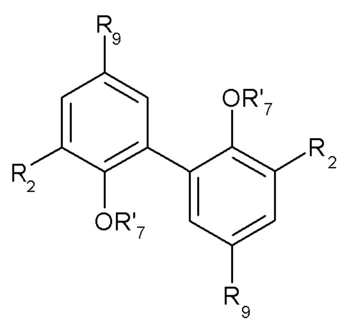


(XI-B)

wherein:

- R_2 is a $(C_1\text{-}C_6)$alkoxy group;
- R_6 is a $(C_1\text{-}C_{10})$alkyl group,
- Y is chosen from the group consisting of: a bond, a $(C_1\text{-}C_{10})$alkylene radical, a radical $-C(O)O-R_c-$ and $-R_c-O(O)C-$, R_c being a $(C_1\text{-}C_{10})$alkylene radical;
- R_8 is a $(C_1\text{-}C_6)$alkoxy group or a $(C_1\text{-}C_{10})$alkyl group; and
- n is an integer varying from 10 to 120.

14. A process for preparing the compound according to claim 13, comprising at least one step of polymerization of a compound having the following formula (I-5):



(I-5)

wherein:

- R_2 is as defined in claim 13;
- R'_7 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups and $(C_2\text{-}C_6)$alkenyl groups, and
- R_9 is chosen from the group consisting of: $(C_1\text{-}C_{10})$alkyl groups, $(C_2\text{-}C_6)$alkenyl groups, and $-COOR_a$ groups, R_a being a $(C_2\text{-}C_{12})$alkenyl group,

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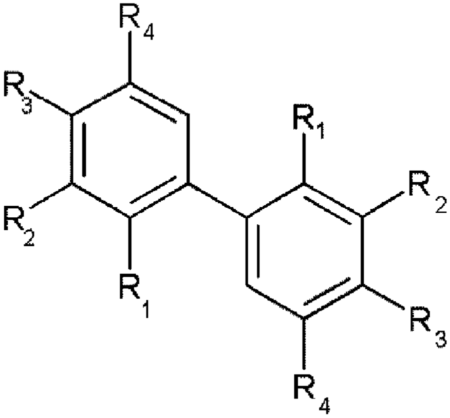
wherein, when R'_7 is an alkyl group, then R_9 is chosen from the $(C_2\text{-}C_6)$alkenyl groups and $-COOR_a$ groups, and when R'_7 is an alkenyl group, then R_9 is an alkyl group.

15. The process of claim 14, wherein the polymerization step is carried out in the presence of a Grubbs catalyst.



(I)