HU000035301T2

(19) **HU**

(11) Lajstromszám: **E 035 301**

(13) **T2**

MAGYARORSZÁG
Szellemi Tulajdon Nemzeti Hivatala

EURÓPAI SZABADALOM
SZÖVEGÉNEK FORDÍTÁSA

(21) Magyar ügyszám: **E 10 734701**
(22) A bejelentés napja: **2010. 07. 16.**

(51) Int. Cl.: ***C05G 3/08*** *(2006.01)*
C05G 3/00 *(2006.01)*

(96) Az európai bejelentés bejelentési száma:
EP 20100734701
(97) Az európai bejelentés közzétételi adatai:
EP 2456737 A1 **2011. 01. 27.**
(97) Az európai szabadalom megadásának meghirdetési adatai:
EP 2456737 B1 **2017. 04. 19.**

(86) A nemzetközi (PCT) bejelentési szám:
PCT/EP 10/004364
(87) A nemzetközi közzétételi szám:
WO 11009572

(30) Elsőbbségi adatok:
102009034433 **2009. 07. 23.** **DE**

(72) Feltaláló(k):
HUCKE, André, 06889 Wittenberg (DE)
NICLAS, Hans-Joachim, 12435 Berlin (DE)
REINHARDT, Petra, 06847 Dessau (DE)
RADICS, Ute, 06888 Dabrun (DE)

(73) Jogosult(ak):
SKW STICKSTOFFWERKE PIESTERITZ GmbH, 06886 Lutherstadt Wittenberg (DE)

(74) Képviselő:
Sworks Nemzetközi Szabadalmi Ügyvivői Iroda Kft., Budapest

(54) **Kompozíciók, amelyek karbamidalapú trágyából, ureázinhibitorként foszforsav-amid származékból és paraffinalapú viaszból állnak, és eljárás azok előállítására**

EP 2456737

Description

Prior art

The invention relates to a fertiliser composition containing urea-based prills or granules, at least one phosphoric acid amide derivative as a urease inhibitor on the surface of the prills or granules, and a formulating agent that comprises paraffin-based waxes and vegetable triglycerides for impregnating the surface of the prills or granules.

Urea is a naturally biogenic metabolic product which is cleaved by the enzyme urease into ammonia and carbon dioxide. The reaction proceeds in an extremely quick and efficient manner and is therefore the cause of N losses in the use of urea-based fertilisers. These losses are particularly high when the soil does not have enough sorption capacity to absorb the thus free ammonia in the form of ammonium ions. This results in considerable amounts of nitrogen being lost each year from agricultural land, and this contributes to both adverse effects on the environment and an increased demand for fertilisers.

The fact that urea is the nitrogen fertiliser that has, in terms of percentage, the highest N content and is by far the most widely used N fertiliser around the world makes it easy to understand why viable solutions for reducing N losses caused by urease are being sought. A number of solutions have been proposed for achieving this objective. In this connection, these solutions include covering urea prills or granules with acid in order to trap resulting ammonia by means of salt formation, or coating said urea prills or granules with substances which result in urea being released in a decelerated manner and thus make it possible to "buffer" the produced ammonia without difficulty.

The use of urease inhibitors is an effective option for significantly decelerating the enzymatic hydrolysis of urea which proceeds extremely quickly under normal conditions. By slowing down this enzyme reaction, the fertiliser can penetrate deeper soil layers in the undecomposed state.

This results in ammonia losses being almost entirely eliminated as a result of the sorption potential of the soil layers above those deeper soil layers by comparison with that of the

ground surface. Furthermore, in this manner, urea and urea-containing fertilisers can be used for light soil sites without there being any losses.

The literature discloses that particular organic, but also inorganic, compounds are capable of inhibiting the urease-catalysed hydrolysis of urea (cf. S. Kiss, M. Simihăian, Improving Efficiency of Urea Fertilizers by Inhibition of Soil Urease Activity, Kluwer Academic Publishers (2002)).

The discovery of phosphoric acid ester diamides (DD 122 177) resulted in compounds being found that are extremely effective urease inhibitors. A range of derivatives of phosphoric acid triamide, including the parent substance, have a similar effectiveness (cf. e.g. US 4,540,428; US 4,676,822; US 4,696,693; US 4,537,614; US 4,517,004; EP 0 119 487), N-(n-butyl)thiophosphoric acid triamide (NBTPT) having been previously commercialised as the only representative for said range of derivatives (IMC AGRICO Corp., product name Agrotain®).

It is advantageous to market fertilisers that are treated at the factory with a suitable phosphoric acid amide derivative for supressing the urease-catalysed hydrolysis of urea. As a prerequisite, the relevant urease inhibitor has to be stable for the period between the fertiliser being produced and the fertiliser being applied, i.e. the active ingredient should remain unchanged even under changing climatic conditions (temperature, humidity) in or on the fertiliser for at least three months. Many of the eligible phosphoric acid amide derivatives are however relatively susceptible to hydrolysis, and this limits in particular the duration of action and thus the applicability of said derivatives.

Furthermore, solid fertilisers to which urease inhibitors have been added, and also fertilisers that do not contain any additives, have to be provided as granules that are stable, abrasion-resistant and can be stored in bulk in non-climate-controlled warehouses for several months without any caking.

In order to combine a urease inhibitor with the urea, the inhibitor is added to urea melts during the process for forming prills or granules. However, in the process, many inhibitors decompose owing to the high temperatures and the particular conditions of the melts or are not storage stable in the finished prills or granules.

Simply mixing the prills or granules with the urease inhibitor is not a suitable approach, since this does not produce a uniform distribution in the fertiliser and can lead to the granules and inhibitor becoming separated during transport processes. Furthermore, the inhibitor is not sufficiently protected from moisture and other environmental influences. In the case of commercially used N-(n-butyl)thiophosphoric acid triamide (NBTPT), the industrially produced active ingredient has a wax-like and pasty consistency owing to impurities, and so the option of mixing said ingredient with the fertiliser is excluded from the outset.

Given that the surface of a fertiliser has to be conditioned in order to protect against caking or water absorption, the active ingredient can be applied together with the conditioning agent.

The layer of conditioning agent applied to the surface protects the solid fertiliser particles from environmental influences, e.g. from the absorption of moisture from the ambient air, during transportation and storage in non-climate-controlled spaces.

This protective layer is absolutely necessary for maintaining the quality of the solid fertiliser for several months even in unfavourable climatic conditions. What is referred to as the "critical moisture content" of the products varies depending on the chemical composition of the solid fertiliser and the form thereof, for example in the form of prills or granules. The critical moisture content of the fertiliser is a temperature-dependent characteristic variable. It is the moisture content, at a defined temperature, at which no more moisture is absorbed and the product is no longer dry. The critical moisture content is 70-75 % (30 °C) for granulated urea and 75 % (30 °C) for ammonium sulphate (Fertilizer Manual, page 485, Kluwer Academic Publishers (1998)). Mixtures of different fertilisers usually have a lower critical moisture content. For example, the critical moisture content of a mixed fertiliser consisting of urea and ammonium sulphate in a ratio of between 1:1 and 3:1 is 55 % (30 °C). This means that this fertiliser absorbs much less water.

Granules of this kind absolutely have to be covered with a hydrophobising layer, i.e. conditioned. At the same time, the conditioning agent can prevent the fertiliser from caking.

A range of different substances are used as conditioning agents, e.g. mineral oils, paraffin oils and paraffin waxes, longer-chain alkyl amines and alkylaryl sulfonates (E. A. Bijpost, J. G. Korver: Proceedings of the International Fertilizer Society 584 (2006)). Given that an

effective anticaking agent usually has insufficient hydrophobising properties and vice versa, combinations of a plurality of substances are used.

US 5 256 181 A describes coating urea with ionic and covalently crosslinked sulfonated polymers. WO 00/58317 A1 discloses (thio)phosphoryl triamides as urease inhibitors. DE 103 42 551 A1 describes a method for producing urea-based fertiliser granules containing dicyandiamide and 1,2,4-triazole as a nitrification inhibitor. GB 2 164 640 A discloses coating, binding and sealant materials for fertilisers and other substances. WO 2007/016788 A1 relates to slow-release urea fertilisers comprising a coating consisting of epoxidised fatty acid triglyceride oils. US 3 252 786 A discloses slow release urea fertilisers comprising a coating consisting of petroleum wax.

The conditioning agents used should be toxicologically safe and biodegradable at acceptable application rates. Furthermore, said conditioning agents have to be available at a low cost and it has to be possible to apply said conditioning agents with little effort.

Mineral oils are often used as hydrophobising agents; however, said mineral oils are neither toxicologically safe nor readily biodegradable owing to the content of polycyclic aromatic hydrocarbons. Therefore, readily biodegradable and toxicologically safe vegetable oils are also being increasing used. However, these oils are prone to oxidation and polymerisation reactions owing to the double bonds therein and are often ineffective hydrophobising agents as a result of the polar ester groups, and therefore vegetable oils are used in combination with paraffins (WO 0138263; US 6355083).

In addition to having anticaking and hydrophobising properties, the relevant conditioning agents also have to be applied on the fertiliser in as uniform and extensive a manner as possible in order to achieve the desired effect.

It is therefore important to find a conditioning agent by means of which all the requirements are met. However, additional problems arise when applying an active ingredient, e.g. a urease inhibitor, together with the conditioning agent on the surface of the urea-based fertiliser. On the one hand, the active ingredient itself has to be uniformly distributed on the fertiliser and it has to be possible to store said active ingredient in an unchanged state for at least three months. On the other hand, the presence of the active ingredient must not have an adverse effect on the anticaking and hydrophobising effect of the conditioning agent.

For example, in the case of phosphoric acid amide-based urease inhibitors, longer-chain alkyl amines used as anticaking agents are unsuitable because amines nucleophilically attack said inhibitors and accelerate the degradation of the active ingredients. Water-based anticaking agents, e.g. aqueous polyvinyl alcohol solutions, are not suitable either because, by the time the fertiliser has dried to the required extent, the phosphoric acid amide has already been partially hydrolysed. Furthermore, free ammonia in the fertiliser and additives used have a negative effect on the stability of the active ingredient. In addition to having an anticaking and hydrophobising effect, the conditioning agent therefore has to also protect the active ingredient from both humidity and damaging influences resulting from the fertiliser.

Owing to the excellent inhibitive effect thereof and despite having limited stability, phosphoric acid amide derivatives are the urease inhibitors that are selected for nitrogen stabilisation of urea-based fertilisers.

In the case of N-(n-butyl)thiophosphoric acid triamide (NBTPT), a liquid formulation consisting of N-methylpyrrolidone and glycols is used (trade name AGROTAIN®). Leaving aside the fact that the use of N-methylpyrrolidone is questionable in terms of toxicity (suspected carcinogenic and teratogenic effect), the active ingredient on granules treated with this formulation is only storage stable to a limited extent and is rapidly degraded in particular at increased temperatures. Furthermore, the glycols used often contain some water or readily absorb water, and this has a further negative impact on the stability of NBTPT. Moreover, the glycols do not protect the prills or the granules themselves against water absorption and caking, and this diminishes the storage properties of the fertiliser. The same applies to the use of higher-boiling amines which have been proposed as additives for increasing the stability of NBTPT on urea-based fertilisers (DE 10 2007 062 614).

Subject matter of the invention

The object of the present invention was therefore to find a formulating agent for applying phosphoric acid amide derivatives to the surface of urea-based prills or granules that does not have the mentioned disadvantages of the prior art.

Description of the invention

This object was achieved according to the invention by a formulating agent that comprises paraffin-based waxes and vegetable triglycerides being used to impregnate the surface of the granules of urea-containing fertilisers. It has in particular surprisingly been found that by using a formulating agent that comprises paraffin-based waxes and vegetable triglycerides not only is it possible to apply a plurality of differently substituted phosphoric acid amide derivatives to the surface of urea-containing fertilisers in a simple and uniform manner, but said derivatives also have surprisingly good stability even when the fertilisers are stored for a relatively long time under practical conditions, and are also protected against abrasion. Therefore, even fertilisers which contain N-(n-butyl)thiophosphoric acid triamide (NBTPT) that is susceptible to hydrolysis, but to which the stabilising agents (higher-boiling amines) described in DE 10 2007 062 614 have not been added, can be stored for a long time without any significant active ingredient degradation. Under optimum conditions, even storage times of up to a year do not present any problems (cf. NBTPT example 4). The phosphoric acid amide derivatives according to the invention have excellent storage stability on urea-based fertilisers even in non-climate-controlled warehouses.

In the fertiliser compositions according to the invention, not only do the active ingredients have good storage stability, but the urea-based fertiliser itself also stays fit for storage even under practical climatic conditions. The fertiliser is protected from the influence of humidity by means of the formulation according to the invention. In the case of granulated fertilisers, the granule structure remains intact and the granules are not prone to caking or hardening, which means that the fertiliser remains pourable.

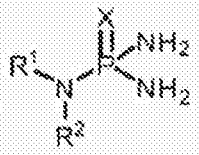
A formulating agent that also contains vegetable triglycerides in addition to waxes consisting of n-paraffins and isoparaffins has proven to be particularly suitable for formulation purposes. Paraffins are understood to mean alkanes or mixtures of alkanes having 18-75 carbon atoms. In the context of the invention, the paraffin chain lengths are preferably in the range of C_{18} to C_{40}, particularly between C_{20} and C_{32}. In a preferred embodiment of the invention, the formulating agent consists of 25-35 % n-paraffins, 40-55 % isoparaffins and 15-20 % vegetable triglycerides. The paraffin wax used is available at a low cost and is both toxicologically safe and biodegradable. Glycerides of linoleic fatty acid, linolenic fatty acid, oleic fatty acid, palmitic fatty acid and stearic fatty acid are preferably used as the vegetable triglycerides.

Another surprising finding was that adding vegetable resins or the derivatives thereof to the paraffin-based wax makes possible a particularly uniform covering of the urea-containing fertiliser with the formulating agent and the urease inhibitor, and this has a positive impact on the storage properties.

In this case, what proved particularly advantageous was adding abietic acid derivatives esterified with polyvalent alcohols, preferably esterified with pentaerythritol. For example, in urea/ammonium sulphate granules, adding esterified abietic acid to the conditioning agent reduces the water absorption by more than half (see example 7).

Other, non-toxic and physiologically suitable additives, carriers, emulsifiers, dispersants or extenders (optionally in combination in each case) can be used for formulation purposes.

The phosphoric acid amide derivatives used according to the invention as urease inhibitors have the general formula (I):



(I)

in which:
X = oxygen or sulfur;
R^1 and R^2, independently of one another, represent hydrogen, in each case substituted or unsubstituted C_1-C_8 alkyl, C_3-C_8 cycloalkyl/heterocycloalkyl, C_6-C_{10} aryl, C_5-C_{10} heteroaryl, $COOR^3$ where $R^3 = R^1$, R^2.

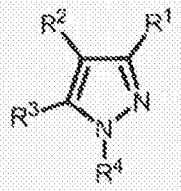
Salts, tautomers, polymorphs and metal complexes of compounds of the general formula (I) which have a urease-inhibiting effect can also be used.

In a preferred embodiment of the invention, compounds of the general structure (I), where X = O, R^1 = H and R^2 = 2-nitrophenyl or substituted 2-nitrophenyl, are used as urease inhibitors.

In order to further reduce the amount of nitrogen lost, nitrification inhibitors are used which inhibit the further degradation of ammonium into nitrate that can be washed away easily.

The nitrification inhibitor is selected from one or more of the following compounds:

a) pyrazole derivatives of the general formula (II), or salts or complex compounds thereof:



(II)

in which
R^1, R^2, R^3, independently of one another, represent hydrogen, halogen, C_1-C_8 alkyl or C_3-C_8 cycloalkyl, and R^4 = hydrogen, C_1-C_8 alkyl, CH_2NHCOR^5, $CH_2OC(O)R^5$, CH_2OR^5 where R^5 = hydrogen, C_1-C_8 alkyl, C_6-C_{10} aryl,

b) 1H-1,2,4-triazoles, or salts or complex compounds thereof,
c) dicyandiamide.

The invention also relates to a method for producing the fertiliser composition according to the invention, which method is characterised in that
a) prills or granules of a urea-containing fertiliser are impregnated with a suspension of the melted paraffin-based formulating agent and a urease inhibitor
or
b) prills or granules of a urea-based fertiliser are impregnated with the melted paraffin-based formulating agent and then impregnated with a urease inhibitor,
and in that, optionally, in an upstream or downstream step, a further layer of the paraffin-based formulating agent is applied.

The paraffin-based formulating agent is melted at 40-90 °C and is used in an amount of 0.05-1 %, preferably 0.1-0.5 %, and the urease inhibitor is used in an amount of 0.01-1 %, preferably 0.02-0.2 %, based on the weight of the urea-containing fertiliser.

According to the same method, a nitrification inhibitor can be applied at the same time together with the urease inhibitor or in a separate layer.

The fertiliser compositions according to the invention can be produced in mixing units, in fluidised bed apparatuses or on conveyor belts. Subsequent treatment with an anticaking agent or further additives, for example, is possible.

Until the fertiliser composition according to the invention is applied to a surface used for agricultural purposes, the urease inhibitors contained therein are storage stable for a period of at least three months.

The urea-based fertilisers in the context of the invention firstly include urea itself, which may be provided as prills, granules or in any other compacted form. In addition to urea, the urea-based fertiliser may also contain further nitrogen fertilisers such as ammonium sulphate or ammonium nitrate. In addition to this, further nutrients such as phosphorus or potassium and also active ingredients such as nitrification inhibitors (e.g. dicyandiamide, 1,2,4-triazole, 3-methylpyrazole) or crop protection agents may also be contained. In addition to this, the urea-based fertiliser may also contain additives such as coupling agents, anti-dusting agents or anticaking agents.

The present invention is explained in a non-limiting manner with reference to the following examples and thus merely for illustration purposes.

Examples

In the following examples:

NBTPT = N-(n-butyl)thiophosphoric acid triamide
2NPT = N-(2-nitrophenyl)phosphoric acid triamide
4Me2NPT = N-(4-methyl-2-nitrophenyl)phosphoric acid triamide
iPrPDPC = isopropyl(diaminophosphoryl)carbamate
3MPD = 3-methypyrazole derivative
DCD = dicyandiamide
TZ = 1,2,4-triazole

Comparative example 1

- Separate application of the wax and active ingredient on the surface of the fertiliser

In a mixing drum, 15 kg of granulated urea was heated to 40-50 °C and 38 g (0.25 %) of wax melted at 80 °C was added, while mixing, in a thin jet. After 5 minutes, the urease inhibitor was applied as a powder and the treated granules were mixed without any further heating for 30 minutes.

Comparative example 2

- Simultaneous application of the wax and active ingredient on the surface of the fertiliser
  In a mixing drum, 15 kg of granulated urea was heated to 40-50 °C and 38 g (0.25 %) of wax melted at 80 °C together with the urease inhibitor suspended therein was added, while mixing, in a thin jet. Mixing was then carried out without any further heating for 30 minutes.

Comparative example 3

- Active ingredient distribution on the fertiliser
  The uniform distribution of the urease inhibitor on the surface of the fertiliser granules was tested by means of HPLC.

Base fertiliser	*Active ingredient*		*Active ingredient content (experimental value)*
20 kg urea, granulated	0.2 % NBTPT	Measurement 1: Measurement 2: Measurement 3: Measurement 4:	0.184 % 0.182 % 0.184 % 0.182 %
60 kg urea, granulated	0.05 2NPT	Measurement 1: Measurement 2: Measurement 3: Measurement 4:	0.047 % 0.047 % 0.052 % 0.052 %
75 kg urea, granulated, with DCD/TZ	0.075% 2NPT	Measurement 1: Measurement 2: Measurement 3:	0.074 % 0.078 % 0.079 %

Comparative example 4

- Sealed storage (room temperature) of 1 kg of urea formulations produced according to example 1 containing the following active ingredients

Base fertiliser	*Active ingredient starting content*	*Active ingredient degradation after 3 months*
Urea, granulated	0.09 % NBTPT	0 %
Urea, granulated	0.023 % 2NPT	2 %
Urea, granulated	0.033 % 2NPT	0 %
Urea, granulated	0.046 % 2NPT	6 %
Urea, granulated	0.035 % 2NPT 0.046 % 3MPD	3 % 0 %
Urea, granulated	0.023 % 4Me2NPT	2 %
Urea, granulated	0.036 % 4Me2NPT	3 %
Urea, granulated	0.04 6% 4Me2NPT	0 %
Urea, granulated	0.092 % iPrDPC	8 %
Urea, granulated, with DCD/TZ	0.035 % 2NPT	0 %
Urea, granulated, with DCD/TZ	0.046 % 4Me2NPT	0 %

Comparative example 5

- Open storage (non-climate-controlled storage space at changing temperature/humidity) of 5 kg of urea formulations produced according to examples 1 and 2

Base fertiliser	*Active ingredient starting content*	*Active ingredient degradation after 3 months*
Urea, granulated	0.046 % 2NPT	5 %
Urea, granulated	0.046 % 2NPT	8 %

Comparative example 6

- Open storage (non-climate-controlled storage space at changing temperature/humidity) of 350 t of a urea formulation produced according to example 2
  Base fertiliser: urea granules
  Active ingredient: 0.03 % N-(2-nitrophenyl)phosphoric acid triamide (2NPT)

	Active ingredient content 2NPT		
	After 3 months	*After 7 months*	*After 8 months*
Degradation in 20 cm depth	7 %	23 %	
Degradation in 50 cm depth	10 %	13 %	
Degradation in 80 cm depth	7 %	10 %	
Degradation in 2 m depth	0 %	0 %	0 %

Example 7

The hydrophobising effect of the conditioning agent according to the invention on urea-ammonium sulphate granules (50 % urea / 50 % ammonium sulphate) was identified in a water absorption test at a defined temperature and humidity.

For this purpose, in repeat determination, 50 g of the granules made hydrophobic by 0.3 % conditioning agent was weighed out each time in small crystallising dishes and stored in a climatic cabinet and the water absorption was determined gravimetrically.

Water absorption after 24 hours at 25 °C and 80 % humidity

Conditioning agent	*Mass increase (water absorption)*
unconditioned	32.8 %
Mixture of n-paraffins and isoparaffins and triglyceride	5.4 %

Mixture of n-paraffins and isoparaffins; triglyceride and esterified abietic acid	2.2 %

Water absorption after 2 weeks at 25 °C and 60 % humidity

Conditioning agent	*Mass increase (water absorption)*
unconditioned	27.2 %
Mixture of n-paraffins and isoparaffins	15.2 %
Mixture of n-paraffins and isoparaffins and triglyceride	3.6 %
Mixture of n-paraffins and isoparaffins; triglyceride and esterified abietic acid	2.5 %

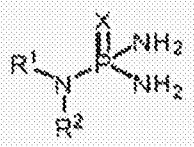
Szabadalmi igénypontok

1. Trágyakompozíció, amely tartalmaz karbamidalapú prill szemcséket vagy granulátumot, legalább egy foszforsav-amid származékot ureáz inhibitorként a prill szemcsék vagy granulátum felületén, és formuláló szert, amely tartalmaz paraffinalapú viaszokat és növényi triglicerideket a prill szemcsék vagy granulátum felületének impregnálására.

2. Az 1. igénypont szerinti trágyakompozíció, ahol a paraffinalapú viaszok tartalmaznak 25-35 % n-paraffinokat és 40-55 % izoparaffinokat, és a paraffinok szénszáma C_{18} és C_{40} közötti van, előnyösen C_{20} és C_{32} között és, ahol linol zsírsav, linolén zsírsav, olaj zsírsav, palmitin zsírsav és stearin zsírsav gliceridjei vannak használva növényi triglicerideként 15-20 %-ban.

3. Az 1. vagy 2. igénypont szerinti trágyakompozíció, ahol abietin sav, amely pentaeritrittel van észteresítve, van adva a paraffinalapú viaszhoz.

4. Az 1. igénypont szerinti trágyakompozíció , ahol az ureáz inhibitor az általános szerkezetű (I) vegyület



(I)

,

amelyben:

X = oxigén vagy kén;

R^1 és R^2, egymástól függetlenül, hidrogén, minden esetben szubsztituált vagy szubsztituálatlan C_1-C_8 alkil, C_3-C_8 cikloalkil/heterocikloalkil, C_6-C_{10} aril, C_5-C_{10} heteroaril, $COOR^3$, ahol $R^3 = R^1, R^2$,

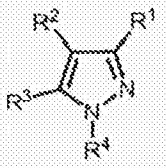
és az általános képletű (I) vegyületek sói, tautomerei, polimorfái és fémkomplexei, amelyeknek van ureázgátló hatása.

5. Trágyakompozíció, amely tartalmaz ureáz inhibitort a 4. igénypont szerint, ahol az általános szerkezetben (I), X = O, $R^1 = H$ és R^2 = 2-nitrofenil vagy szubsztituált 2-nitrofenil.

6. Az 1-5. igénypontok bármelyike szerinti trágyakompozíció, azzal jellemezve, hogy legalább egy nitrifikáció inhibitort tartalmaz további hatóanyagként olyan mennyiségben, amely hatásos nitrifikáció gátlására.

7. A 6. igénypont szerinti trágyakompozíció 6, azzal jellemezve, hogy a nitrifikáció inhibitor a következő vegyületek közül egyből vagy többől van kiválasztva:

a) általános képletű (II) pirazol származékok , vagy annak sói vagy komplex vegyületei:



(II)

amelyben

R^1, R^2, R^3, egymástól függetlenül, hidrogén, halogén, C_1-C_8 alkil vagy C_3-C_8 cikloalkil, és R^4 = hidrogén, C_1-C_8 alkil, CH_2NHCOR^5, $CH_2OC(O)R^5$, CH_2OR^5, ahol R^5 = hidrogén, C_1-C_8 alkil, C_6-C_{10} aril,

b) 1 H-1,2,4 triazolok, vagy annak sói vagy komplex vegyületei,

c) diciándiamid.

8. Eljárás az 1. igénypont szerinti trágyakompozíció előállítására, azzal jellemezve, hogy

a) karbamidalapú trágya prill szemcséi vagy granulátuma az 1-3. igénypontok szerinti olvadt paraffinalapú formuláló szer és a 4. vagy 5. igénypont szerinti ureáz szuszpenziójával vannak impregnálva,
vagy

b) karbamidalapú trágya prill szemcséi vagy granulátuma az 1-3. igénypontok szerinti olvadt paraffinalapú formuláló szerrel és azután a 4. vagy 5. igénypont szerinti ureáz inhibitorral vannak impregnálva, és opcionálisan előző vagy rákövetkező lépésben, a paraffinalapú formuláló szer további rétege van felvíve.

9. A 8. igénypont szerinti eljárás, azzal jellemezve, hogy a formulálás keverőegységekben, fluidágyas berendezésekben vagy szállítószalagokon van megvalósítva.

10. Eljárás trágyakompozíciók előállítására a 8. vagy 9. igénypont szerint, azzal jellemezve, hogy az olvadt paraffinalapú formuláló szer hőmérséklete 40-90 °C és 0,05-1 %, előnyösen 0,1-0,5 % mennyiségben van használva, a karbamidalapú trágyakompozíció tömegére vonatkoztatva, és a 4. vagy 5. igénypont szerinti ureáz inhibitor 0,01-1 %, előnyösen 0,02-0,2 % mennyiségben van használva.

11. Eljárás trágyakompozíciók előállítására a 8-10. igénypont szerint, azzal jellemezve, hogy együtt az ureáz inhibitorral vagy külön rétegben, a 6. vagy 7. igénypont szerinti nitrifikáció inhibitor van felvíve vagy már hozzá van adva a karbamidtartalmú trágya olvadékához az alakítóeljárás előtt.