(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 December 2002 (27.12.2002)

PCT

(10) International Publication Number
WO 02/102740 A1

(51) International Patent Classification[7]: C05C 9/00, 1/00, C05D 1/02

(21) International Application Number: PCT/CZ02/00036

(22) International Filing Date: 17 June 2002 (17.06.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PUV 12101-01 18 June 2001 (18.06.2001) CZ

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(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DZ, EC, EE, ES, FI, GB, GE, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/102740 A1

(54) Title: LIQUID BIOTECHNOLOGICAL FERTILISER

(57) Abstract: For applications as nutrient for field plants, vegetables, fruit trees and vines, and for mass agriculture production as well as for small growers and garden keepers there is prepared a liquid fertiliser based on liquid residues from a separation of ferment spirit, citric acid and a sodium glutamate, the fertiliser in accordance with the invention comprising from 10 up to 50 % of mass of organic combustible substance matter of the liquid residues and up to 20 % of mass of potassium sulphate and/or potassium chloride, the content of potassium oxide in the fertiliser being within the range from 2 to 15 % of mass. Also according to the invention the said fertiliser may comprise at least 10 % of mass of urea, up to 50 % of mass of ammonium nitrate, the content of nitrogen in the fertiliser being within the range from 5 to 25 % of mass and/or up to 30% of magnesium nitrate, the content of magnesium oxide in the fertiliser being within the range from 0,2 to 8,0 % of mass.

LIQUID BIOTECHNOLOGICAL FERTILISER

Technical Field

The invention relates to a liquid biotechnological fertiliser based on by-products of industrial fermentation procedures applying sugar beet or sugar cane molasses as a culture substrate for micro-organisms, especially a fertiliser based on liquid residues from a separation of ferment spirit, citric acid and a sodium glutamate.

Background of the Invention

Some by-products of industrial fermentation procedures utilising sugar beet or sugar cane molasses as a culture substrate for micro-organisms, can be recycled back to soil when utilised in a form of a fertiliser. Among them there are ranked liquid residues from industrial biotechnologies, such as production of ferment spirit and citric acid, sodium glutamate and other products of biotechnology.

The said liquid residues are in a form of a colloid solution with a high content of dry matter reaching up 70 % of mass. About 85 % of mass of the dry matter are combustible organic substances. From the point of view of application as a fertiliser for plant nourishment, the said matter is a nutrient substance with an organic character of bond of plant nutrients, containing all mineral matters necessary for plant nutrition. Research works have revealed that this nutrient substance manifest very positive properties as far as plant nutrition is concerned. A typical composition of the substance is 40,0 % of mass of dry matter, 2,50 % of mass of nitrogen, 0,015 % of mass of phosphorus in a form of phosphorus oxide, 4,00 % of mass of potassium in a form of a potassium oxide, 0,15 % of mass of magnesium in a form of magnesium oxide, 1,0 % of mass of calcium in a form of calcium oxide, 0,10 % of mass of sulphur, 0,015 % of mass of iron, 0,003 % of mass of manganese, 0,002 % of mass of zinc, 0,0005 % of mass of copper, 0,0003 % of mass of boron and 0,00003 % of mass of molybdenum. The nutrients

being predominantly of natural origin are for plants very easily acceptable and therefore are all utilised by the plants without any rests. This is important especially as far as nitrogen is concerned or ecology taken into account. On the contrary, by current fertilisers substantial part of amount of nitrogen remains unused. Unused nitrogen later enters underground water, which are thus undesirably polluted by nitrogen oxides. At present the fermentation residues, usually containing 40 to 50 % of mass of dry matter are used for direct fertilisation as auxiliary substance improving soil parameters as far as the fertility is concerned. It is a drawback of such a direct fertilisation that the high content of micro-nutrients is accompanied by a relatively low content of nitrogen and potassium. By intensive process of fertilisation soil may receive an excess amount of potassium and micro-nutrients.

Liquid residues from separation of ferment spirit were originally processed into residue coal. By means of leaching and evaporation crystallisation it was further processed into a blend of crystalline potassium salts, suitable as a field fertiliser. More sophisticated and updated technology of a production of a crystalline fertiliser from molasses stillage through salting process by means of citric and phosphorus acids and subsequent vacuum crystallisation is the subject matter of the US patent No. 4604125. The above methods present a drawback consisting in complicated manufacturing procedures accompanied by a high energy consumption, making the final product rather expensive. Furthermore the salting-out technology step results in further organic wastes, which have to be disposed off. There are also known fertilisers described in papers JP 53 044 367 a JP 47 029 155. Such fertilisers exist in a form of a thick non-fluid paste, even of a gum character, prepared by adding several components containing nitrogen, phosphorus and potassium into alcohol fermentation residues. The resulting products is difficult to be applied as such as it does not allow for utilisation of current agricultural mechanisms and moreover is stable only for several weeks. In the utility model CZ 6905 there is discussed a fertiliser consisting of dry solid granules, manufactured by a process comprising fluidised-bed drying and granulation of a thick paste,

which is obtained by mixing inorganic agro-chemicals and liquid residues. Such a rather complicated technology with high energy consumption results in a very expensive product. According the patent paper CZ 278603, being a priority document for German paper DE 4324823 and paper WO 97/262228, the composition of liquid residues from a production of fermentation spirit, so called molasses residues, is with respect to basic nutrients corrected by addition of solutions of ammonia salts of phosphorous acid or ammonia nitrate or ammonia sulphate. The achieved effect is significantly limited as the higher concentration of ions of this soluble inorganic salts results in disintegration of a colloid system. There appear precipitates making application by a current agriculture mechanisms for liquid fertilisers hardly possible, if not even impossible. Significant improvement has been achieved by a solution described in the utility model CZ 8534. According to this paper the colloid solution of fermentation residues is fortified by nitrogen comprised in an organic matter, in urea. Urea creates a non-polar solution and does not disrupt colloidal stability and fluidity of the final product

It is an object of the invention to prepare a liquid fertiliser allowing for more simple but more effective utilisation of properties of fermentation residues for plant nutrition.

Disclosure and Object of the Invention

The foregoing problems are solved by a liquid biotechnological fertiliser based on by-products of industrial fermentation procedures applying sugar beet or sugar cane molasses as a culture substrate for micro-organisms especially based on liquid residues from a separation of ferment spirit, citric acid and a sodium glutamate, the fertiliser in accordance with the invention comprising from 10 up to 50 % of mass of organic combustible substance matter of the liquid residues and up to 20 % of mass of potassium sulphate and/or potassium chloride, the content of potassium oxide in the fertiliser being within the range from 2 to 15 % of mass. Also according to the invention the said fertiliser may comprise at least 10 % of mass of urea. Further in

accordance with the invention the said fertiliser may comprise up to 50 % of mass of ammonium nitrate, the content of nitrogen in the fertiliser being within the range from 5 to 25 % of mass. Still further in accordance with the invention the fertiliser may comprise up to 30 % of mass of magnesium nitrate, the content of magnesium oxide in the fertiliser being within the range from 0,2 to 8,0 % of mass. stabilised

In the liquid fertiliser having a composition in accordance with the invention the organic bond of the original plant-derived potassium is stabilised through the addition of free potassium ions and of amiric urea nitrogen. This stabilisation allows for adjustment of the concentration of nitrogen and magnesium over a wide range without formation of precipitates and loss of fluidity of the final fertiliser. The original material, the liquid fermentation residue having a form of a colloidal solution, is in accordance with the invention further enriched with mineral nitrogen from ammonium nitrate and with magnesium from magnesium nitrate. The fertiliser, though having a high content of dry matter, has a character of a liquid, the liquid being stable by temperatures deep under zero degree of Celsius and capable of long-time storage. The fertiliser may be applied by means if standard means of agriculture mechanisms. Preferably fine spraying, ensuring uniform fertilisation of soil should be utilised. As far as agro-chemical effects are concerned the fertiliser shows significantly improved properties when compared with own original components. The comprised organic component has a favourable influence upon bio-sorption of nutrients of the utilised agro-chemicals representing the substantial part of the fertiliser dry matter. Organic bonds of the fertiliser nutrients favourably influence also a yield and quality of agriculture plants, improve soil parameters and regeneration of organic substances in the soil. By application of the said fertiliser there is decreased a content of hazardous elements in the soil and in plants and to increase of macro-nutrients both in the soil and the cultivated plant dry matter.

Description of Preferred Embodiments

The invention is further described by way of examples of its practical application.

Example 1

Adding an aqueous solution of potassium sulphate into a liquid fermentation residue there was prepared a fertiliser containing 33 % of mass of organic combustible matter of the liquid fermentation residue and 2 % of mass of the potassium sulphate. Total content of potassium oxide within the fertiliser amounted to 5 % of mass. The fertiliser is suitable also for applications meeting demands of natural farming.

Example 2

In a basic mixture of original raw materials prepared as described in the Example 1 by dissolving urea and homogenising the new mixture there was prepared a fertiliser comprising 25 % of mass of organic combustible matter of the liquid fermentation residue and 25 % of mass of urea. Total content of nitrogen amounted to 13 % of mass and content of potassium oxide was 3,5 % of mass.

Example 3

In a basic mixture of original raw materials prepared as described in the Example 1

by dissolving urea and ammonium nitrate and homogenising the obtained new mixture there was prepared a fertiliser comprising 17 % of mass of organic combustible matter of the liquid fermentation residue and 28 % of mass of urea and 15 % of mass of ammonium nitrate. Total content of nitrogen amounted to 20 % of mass and content of potassium oxide was 2,0 % of mass.

Example 4

By dissolving magnesium nitrate in a basic mixture of original raw materials prepared as described in the Example 1 and subsequent homogenisation there was prepared a fertiliser comprising 24 % of mass of organic combustible matter of the liquid fermentation residue and 20 % of mass of urea and 8 % of mass of ammonium nitrate. Total content of nitrogen amounted to 12 % of mass, content of potassium oxide was 3,0 % of mass and content of magnesium oxide was 3,0 % of mass.

Any above stated presented content of any component presented in % of mass relates to a total mass of the final product.

Industrial applications

The liquid fertiliser in accordance with the invention is applicable as nutrient for field plants. vegetables, fruit trees and vines, and for mass agriculture production as well as for small growers and garden keepers. The fertiliser may be also used for decomposition of organic materials, like straw and composts.

CLAIMS

1. Liquid biotechnological fertiliser based on by-products of industrial fermentation procedures applying sugar beet or sugar cane molasses as a culture substrate for micro-organisms, especially a fertiliser based on liquid residues from a separation of ferment spirit, citric acid and a sodium glutamate, **characterised in** that it comprises from 10 up to 50 % of mass of organic combustible substance matter of the liquid residues and up to 20 % of mass of potassium sulphate and/or potassium chloride, the content of potassium oxide in the fertiliser being within the range from 2 to 15 % of mass.

2. Liquid fertiliser according to claim 1, **characterised in** that it comprises at least 10 % of mass of urea.

3. Liquid fertiliser according to claim 2, **characterised in** that it further comprises up to 50 % of mass of ammonium nitrate, the content of nitrogen in the fertiliser being within the range from 5 to 25 % of mass.

4. Liquid fertiliser according to any preceding claim, **characterised in** that it comprises up to 30 % of mass of magnesium nitrate, the content of magnesium oxide in the fertiliser being within the range from 0,2 to 8,0 % of mass.

INTERNATIONAL SEARCH REPORT

	tional Application No
	PCT/CZ 02/00036

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C05C9/00 C05C1/00 C05D1/02

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C05C C05D C05F

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 299 06 019 U (ZDENEK BERAN DIPL ING ;LEAR A S (CZ)) 17 June 1999 (1999-06-17) the whole document ---	1-4
X	DATABASE WPI Section Ch, Week 198233 Derwent Publications Ltd., London, GB; Class C04, AN 1982-69335E XP002214789 & JP 57 111294 A (TAGI KAGAKU KK), 10 July 1982 (1982-07-10) abstract --- -/--	1-4

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 September 2002	10/10/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	RODRIGUEZ FONTAO, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CZ 02/00036

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE WPI Section Ch, Week 198646 Derwent Publications Ltd., London, GB; Class A97, AN 1986-301569 XP002214790 & JP 61 222980 A (TAKI KAGAKU KK), 3 October 1986 (1986-10-03) abstract	1
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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