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(54) **Title**: SUGAR-CONTAINING ADDITIVE AS ANTI-DUSTING AGENT

(57) **Abstract**: The present invention generally concerns a sugar-containing additive comprising (a) glycerol, (b) sugar-containing solution and (c) optionally raffinate derived from citric acid recovery industry, useful for controlling dust emission from particulate materials during manufacturing, handling, storage or transportation. Such particulate materials comprise fertilizers or mining products.

SUGAR-CONTAINING ADDITIVE AS ANTI-DUSTING AGENT

FIELD OF THE INVENTION

The present invention generally concerns a sugar-containing additive comprising (a) glycerol, (b) sugar-containing solution and (c) optionally raffinate derived from citric acid recovery industry, useful for controlling dust emission from particulate materials during manufacturing, handling, storage or transportation. Such particulate materials comprise fertilizers or mining products.

BACKGROUND OF THE INVENTION

Dust produced during the manufacturing, handling, transport, storage, crushing, and utilization of fining particulate-producing materials is a common problem for several industries.

Inorganic substances, such as salts of phosphates, nitrates, chlorides, sulfates, etc., are widely used as fertilizers in the agricultural area. Methods of manufacturing or processing these inorganic compounds into particles are also known. Regardless of method or nature of the compound, the resulting particulate materials can easily break into smaller particles (10 micra or smaller), often resulting in an undesirable level of particles fine enough to become airborne dust, particularly when handled, stored or transported.

Fertilizer dust dissemination poses safety, health, environmental, housekeeping and maintenance problems for the producers, distributors and consumers. For instance fertilizer dust has raised health concerns due to human and animal inhalation thereof. It is also a concern when fertilizer dust becomes airborne what can lead to the loss of agronomic and economic value, while potentially contributing to the contamination of surface water

ecosystems.

Depending upon the type of substrate, simple remediation like aspiration and water spray may be applied. Otherwise, the vast majority of commercially produced fertilizers are treated with an additive agent to reduce dust formation levels.

Besides the considerable amount of prior art references directly or indirectly related to anti-dust agents in the fertilizer industry, the majority refers to the use of complex synthesis compounds with a binder function, such as some quaternary compounds, or petroleum-based products.

Until this time, treatment of inorganic particulates, such as fertilizers, has focused on petroleum-based products, mineral oils, and waxes. To reduce the dust on fertilizer, a petroleum residue or hydrogenated mineral oil is typically sprayed onto the fertilizer in order to act as an anti-dusting agent (for instance, US 2002184933, filed by Montana Sulphur & Chemical Com (2002)). The application of the anti-dusting agent occurs generally during the drying step of the phosphate granules. This facilitates the complete coverage of the coating onto the fertilizer particle surface.

However, there are disadvantages in such treatment methods. With time, oils tend to volatilize and/or soak into the fertilizer and lose their effectiveness, while waxes and petroleum-based products are difficult to handle, and can require special heating equipment. Inorganic particulates coated with petroleum-based products can generate residues on handling equipment, and, in the case of coated fertilizers, typically result in the separation of scum upon dissolution of the fertilizer in water. In addition, such additives do not provide

biodegradable coatings.

The application of by-products from organic industries was little investigated to that end. For instance, some by-products derived from the paper making industry, such as lignosulfonate, or glycerin-containing by-products derived from the transesterification industry have already been proposed as dust controlling agents.

In this sense, urea and other fertilizers have been treated with lignosulfonates alone, or in combination with a co-additive, such as molasses. US5328497, filed by Georgia-Pacific Corp (1994) teaches preventing dusting and caking of fertilizer by using an aqueous solution containing lignosulphonate, sugar and urea. However, because aqueous solutions of urea and lignosulfonate have low volatility, they lose their effectiveness long after application.

Other proposed dust control methods for specific fertilizers include application of mixture solutions containing carbohydrates, molasses, gypsum, saccharides, starch, glycerin, polyethylene glycol, triethanolamine and even water. For instance, US7816561, filed by Yara International ASA (2008), discloses a method for improving the crushing strength and reducing the dust formation and the caking tendency of urea particles by using carbohydrates. JP56084315, filed by Mitsubishi Chem Ind (published in 1981), teaches a granulated fertilizer consisting of a mixture of gypsum powder and molasses, wherein the gypsum can be used suitably as a land improver, a component of bulk blend fertilizer, etc. JP1270583, filed by Lida Kogyosho KK (1989) refers to a granulated fertilizer formed from fine magnesium silicate powders mixed with an aqueous solution of a binder such as molasses. EP401550, filed by Kali Und Salz AG (1993),

teaches the inhibition of dusting in pellets or granules using a solution of molasses and concentrated alkaline earth metal chloride solution. FR2723085, filed by Meac SA (1996), describes a fertilizer product combining a mineral support with anti-dust additives, such as mineral or vegetal oils, molasses, amines and/or water. JP2001158685, filed by Oji Cornstarch KK (2001), teaches a granulated fertilizer consisting of iron and steel slag, and a binder comprising saccharides and a starch powder.

US3353949, filed by Cyanamid Co. (1967), teaches that a granular fertilizer is treated with a liquid conditioner additive selected form water-soluble sugars, such as glucose, dextrose and black strap molasses, which permits ready occlusion of nutrients. US5383952, filed by Kali & Salz AG (1995), discloses a process for preventing dusting in fertilizer granules during the loading or transporting of granulates, comprising: adding to said granulates a dust-binding, liquid mixture consisting of molasses and another liquid selected from the group consisting of glycerin, polyethylene glycol, triethanolamine and the mixtures thereof. While liquid treatment compositions, such as these, may reduce the fertilizer dust levels, the liquid compositions coated on the fertilizer particles tend to promote caking of the granular fertilizer particles, another inconvenience to be avoided.

For specific organomineral fertilizer manufactured from fire extinguishing powder waste, binding materials derived from distillery industry were also proposed (CZ11701, filed by Jaroslav et al. (2002) and WO06056602, filed by Valoragri SA (2006)).

Numerous attempts to reduce dustiness of inorganic fertilizers, however, through improvements in the

fertilizer manufacturing process, have been largely unsuccessful. These methods have a number of disadvantages as well. Aqueous solutions and emulsions tend to accelerate the formation of fertilizer dust and exacerbate the fertilizer particles caking tendencies.

While these conditioning agents provided an improvement in dust control over oils, waxes, and oil/wax blends, they do not provide the degree of binding required for effective long-term dust control. Other liquids also have been used for fertilizer dust control including lignosulfonate solutions, amines, surfactants, waxes, wax emulsions and water alone, but have not proved completely satisfactory.

One prevalent problem is that the use of aqueous treatment solutions tends to exacerbate the caking problem often encountered with inorganic fertilizers. The use of other by-products did not solve the problem completely, as it generally refers to the use of by-products derived from sugar cane or sugar beet industries, such as vinasses or molasses, with uncontrolled amount of sugar, whose content and quality depend on the particular method of extraction, maturity of the sugar cane or sugar beet, the amount of sugar extracted, and the method of extraction or specifically adapted for only one type of fertilizer.

Similarly, dust produced during the handling, transport, storage, crushing, and utilization of coal, petroleum coke, minerals or products from mining industry in general, is not only a nuisance, it is a major health and safety issue. Fires, explosions, and black lung cost the petroleum, mining, utility and steel industries millions of dollars annually due to lost production, medical expenses, lost equipment, and high insurance premiums.

In addition to dust generation, erosion and loss of substrate is another common problem found on surfaces that are prone to particulate generation, particularly those subject to vehicular, pedestrian or other sorts of traffic.

Dust from mining industry is produced and airborne by two major mechanisms: impact or wind erosion. The impact can produce a substantial amount of airborne particulate matter. Fine particulates also are produced during stacking, crushing, milling, breaking, or reclaiming operations.

One method that has been used to control such dust is by spraying the mining product with water. Water is effective to prevent dusting; however, it evaporates quickly. Therefore, the mining product must be sprayed almost continuously in order to be an effective anti-dusting agent. This continuous spraying is cumbersome and costly, and the droplets of water in the spray often do not even capture the finest, most hazardous particulates. Furthermore, not all mining product can be wetted using water, and, in some uses, moisture level restrictions will be exceeded if too much water is used. Also, an economic penalty may result because it is less efficient to burn high moisture mining product. Surfactants or hydroscopic salts such as magnesium chloride or calcium chloride can be added to the water to improve wettability in some instances; however, the problem of evaporation remains.

Another method used to control dust generation is spraying the area with an oil based composition. Although quite effective at suppressing dust generation for extended periods of time, this method is not environmentally sensitive. In addition to the harm it can impose on the environment, it may pose a significant long term clean-up

problem and even potential health hazards. Moreover, the oil treated substrates may adhere to vehicles attempting to travel over the treated substrate, generating unwanted clean-up, excess wear on mechanical equipment, and accelerated breakdown of the treated surface.

The prior art also teaches some compositions consisting of mixture solutions containing molasses, sugars or by-products thereof, but have not proved completely satisfactory. For instance, US 4582511, filed by Shell Oil Company (1986), US 5536429 or US 6790245, filed by Benetech, Inc. (1996 or 2004), WO 04073928, filed by Archer-Daniels-Midland Company (2004), EP 2228420, filed by Japan Corn Starch Co., LTD. (2010).

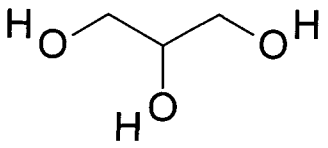
Thus, there remains a need in the art for a biodegradable anti-dusting additive which effectively reduces the level of dust emission from inorganic fertilizers or mining industry and that can be used for a large range of inorganic fertilizers, or mining products in general.

DESCRIPTION OF THE INVENTION

In order to overcome the inconveniences related to the dust emission from fertilizers or mining industry, specially related to pollution and toxicological effects, a specific sugar-containing additive was developed to be used as anti-dusting agent for fertilizers and mining industry in general, which controls powder emission in several stages, for instance manufacturing, handling, storage, transportation, impact, wind erosion, stacking, crushing, milling, breaking, or reclaiming operations.

The additive according to the present invention comprises (a) glycerol, (b) sugar-containing solution and (c) optionally raffinate derived from citric acid recovery industry.

Glycerol (a), also known as glycerin, 1,2,3-propanetriol or 1,2,3-trihydroxypropane, is a trihydroxy sugar alcohol that is an intermediate in carbohydrate and lipid metabolism:



The sugar-containing solution (b) may be obtained from several sources, for instance corn, sugar cane, cassava, potato, wheat, rice, etc. In a particular embodiment such a solution may be syrup, i.e. a viscous liquid with a sugar content. Such a component also includes enzymatic or acid conversion syrup, independently from the conversion grade.

Sugar, according to the present invention, is selected from carbohydrates or saccharides in general, including monosaccharides, disaccharides, oligosaccharides, polysaccharides; or mixture thereof. For instance, the solution (b) comprises monosaccharide such as glucose (dextrose), fructose (levulose), galactose, xylose or ribose; disaccharides such as sucrose, maltose or lactose; oligosaccharides such as raffinose or stachyose; polysaccharides such as or starch, amylose, amylopectin, cellulose, chitin; hydrolysates (for instance inverted sugar), derivatives or mixtures thereof.

According to the present invention the sugar-containing solution (b) may be a viscous concentrated solution of sugar, in water or other liquids (for instance alcohols). Such a solution may also include other ingredients such as coloring agents, flavors or thickening agents.

In a particular embodiment component (b) contains about 40% equivalent dextrose in relation to about 80%

total solids. For instance, such an ingredient is commercialized as Glucogill 40/82 by the Cargill group in Brazil.

Raffinate (c) is an aqueous solution effluent (for instance syrup or liquor) from fermentation processes (residuary or not). Raffinate (c) is an aqueous solution comprising at least citric acid, inorganic matter (such as minerals), proteic matter and sugar matter.

Typically, sugar matter includes carbohydrate selected from fructose, dextrose, maltose and/or polyol selected from arabitol, erythritol, or mixtures thereof. The inorganic matter is measured by analyzing ashes and typically includes nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, copper, zinc, boron, sodium or mixtures thereof.

In a particular embodiment, raffinate (c) may be a by-product derived from the citric acid recovery process, for instance as disclosed in the patent US 4,994,609, assigned to Cargill Inc. (1991), incorporated herein as reference. The raffinate (c) ingredients ratio depends on the performance of the recovery industry. In this case, a by-product without commercial application is used as raw material to the manufacture of a commercial product, also avoiding cost with waste treatment.

The sugar-containing additive useful as anti-dust agent comprises:

(a) from about 10 to about 90%, preferably about 40% glycerol,

(b) from about 10 to about 90%, preferably about 60% glucose syrup.

(c) optionally raffinate from a citric acid recovery process.

When raffinate is included in the sugar-

containing additive according to the present invention, the glycerol amount is correspondently reduced, i.e. a part of glycerin is replaced by raffinate.

As a second aspect, the present invention also concerns a process for manufacturing an anti-dusting additive comprising the following steps of:

(i) mixing glycerol (a) with sugar-containing solution (b) until complete homogenization;

(ii) evaporation of raffinate component (a) up to about 50-65% solids and mixing the resulting evaporate into (i);

(iii) controlling the viscosity by addition of sugar-containing solution (b) if necessary, considering a minimum of about 100 and a maximum of about 100,000 cP (at 25^{0}C), particularly about 500 to about 10,000, more particularly about 1,600 to about 2,500.

Steps (ii) and (iii) may be optionally according to the requirements of the final application.

The resulting anti-dusting additive according to the present invention presents the following characteristics:

(a) % Brix (sugar parameter) from about 60 to about 80, particularly about 70-75.

(b) Viscosity: a minimum of about 100 and a maximum of about 100,000 cP (at 25^{0}C), particularly about 500 to about 10,000, more particularly about 1,600 to about 2,500.

The % Brix is analyzed by a refractometer. The viscosity is measured by cooling the sample at 25 °C and 20 rpm in a Brookfield viscometer DV I.

Due to the characteristics of the additive according to the present invention, especially with respect to controlled concentrations of sugar, as well as physical

characteristics (viscosity), it is possible to obtain an improved ingredient able to act as anti-dusting for a broad range of inorganic fertilizers or mining products.

It was found that the application as anti-dusting is not possible with the use of sugars alone (for instance glucose), due to its high viscosity. Contrary to what one would expect, the raffinate (c) is able to control the sugar-containing solution viscosity allowing the anti-dusting application for fertilizers and mining industry, i.e. due the formation of a film with improved anti-dusting properties. Moreover, there is a use of a waste derived from citric acid industry, providing a low-cost and environment friendly anti-dusting product, which also helps the fertilizer function by distributing micronutrients in small and suitable amounts.

The sugar-containing additive according to the present invention may also comprise other ingredients well known in the art, such as surfactants, biocides, pH adjusters, thickeners, etc.

The inorganic fertilizers treated in accordance with the present invention include, without any limitation, for instance the compounds disclosed in the handbook *The Fertilizer Encyclopedia* (2009) or *Merck Index: 13th edition* (2006), also incorporated herein by reference. Exemplary compounds include phosphates, such as ammonium phosphate, including monoammonium phosphate (MAP) and diammonium phosphate (DAP), and single and triple superphosphates, nitrates, such as ammonium nitrate and potassium nitrate, sulfates, such as ammonium sulfate, and potassium magnesium sulfate, chlorides such as potassium chloride, limestone, dolomite and mixtures thereof.

Mining products include, without any limitation, for instance coal, petroleum coke, minerals or metals.

The present invention also concerns to the use of the additive as described above as anti-dusting agent for mining industry, particularly to avoid powder from impact or wind erosion, or a method for reducing dust emission. This method is particularly useful to avoid dust from impact or wind erosion or during stacking, crushing, milling, breaking, or reclaiming operations.

In addition, the present invention also concerns to the use of the additive as described above as anti-dusting agent for fertilizers or a method for reducing dust emission from fertilizers during manufacturing, transportation or application that comprises applying a dust reducing amount of an additive as described above. This method is particularly useful for producing a particulate fertilizer having reduced dust emission content compared to particulate fertilizers with additives such as petroleum-based coating agents, oils, by-products such as molasses or vinasses with uncontrolled sugar contend.

Particulate fertilizers are manufactured according to processes well known to those skilled in the art, such as crystallization techniques or recovered naturally in a granular form can be treated to reduce fugitive dust emission in accordance with the method of the present invention.

The following examples are provided for illustration and are not intended as a limitation to the scope of the present invention, other than what is described in the attached claims.

EXAMPLES

OBTAINING OF RAFFINATE

A raffinate sample was obtained from the citric acid recovery process disclosed in the patent US 4,994,609, assigned to Cargill Inc. (1991).

Such an ingredient was evaluated in order to identify organic and mineral contents.

One of the tests was carried out to verify the mineral ingredients contained in the raffinate (a). Therefore, ashes without organic elements (i.e. water, citric acid, raw protein and sugar not converted) were evaluated and the following composition was identified:

Table 1 - Raffinate characteristics: inorganic elements (<1.0%)

Ingredient	Amount
Nitrogen	0.58%
Phosphorus	0.12%
Potassium	35.0 ppm
Calcium	148.0 ppm
Magnesium	25.0 ppm
Sulphur	0.25 ppm
iron	1.0 ppm
manganese	3.0 ppm
copper	3.0 ppm
zinc	10.0 ppm
boron	110.0 ppm
sodium	900.0 ppm
cobalt	-
molybdenum	-
aluminum	-
chlorine	-
nickel	-
organic carbon	-
organic matter	19,50 %
pH	2.2
density	1.25 g/mL
C / N ratio	19/1
electric condition	340.0 µS/cm

Organic elements detected in the sample include:

Table 2- Raffinate characteristics: organic elements

Ingredient	Amount
Citric acid	5%
Fructose	1%
Dextrose	2%

Maltose	4%
Arabitol	0.6%
Erythritol	2.2%

The analyzed sample also contains solids (15%) and trace ingredients (<100ppm). C/N ratio = 19 and pH = 3.

PREPARATION OF THE ANTI-DUSTING ADDITIVE

A sample of the anti-dusting additive was prepared by:

(a) evaporation of a raffinate stream according to a process disclosed in the patent US 4,994,609 up to 50% solids;

(b) mixing 6 kg of the raffinate obtained in the step (a) with 4 kg of a glucose syrup, commercialized as Glucogill 40/82, until complete homogenization.

The viscosity and sugar content of the resulting mixture was then analyzed:

(a) % Brix (sugar parameter) from about 60 to about 80, particularly about 70.

(b) Viscosity: about 1,900 cP (250^{0}C).

The information contained in the foregoing, as well as in the examples, allows a person skilled in the art to perform alternative embodiments not expressly described, but which perform the functions taught herein with the results revealed herein. Such equivalent embodiments are encompassed by the scope of the invention and are therefore covered by the claims presented further on.

CLAIMS

1. ANTI-DUSTING ADDITIVE comprising a mixture of (a) glycerol, (b) sugar-containing solution and (c) optionally raffinate derived from citric acid recovery industry.

2. ANTI-DUSTING ADDITIVE, according to claim 1, comprising from about 10 to about 90% glycerol.

3. ANTI-DUSTING ADDITIVE, according to one of claims 1 or 2, comprising about 40% glycerol.

4. ANTI-DUSTING ADDITIVE, according to claim 1, wherein sugar-containing solution (b) comprises monosaccharide, disaccharide, oligosaccharide, polysaccharide; or mixture thereof.

5. ANTI-DUSTING ADDITIVE, according to one of claims 1 or 4, wherein sugar-containing solution (b) comprises glucose, fructose, galactose, xylose, ribose, sucrose, maltose, lactose, raffinose, stachyose, starch, amylose, amylopectin, cellulose, chitin, hydrolysates, derivatives or mixtures thereof.

6. ANTI-DUSTING ADDITIVE, according to one of claims 1, 4 or 5 comprising from about 10 to about 90% sugar-containing solution (b).

7. ANTI-DUSTING ADDITIVE, according to claim 6, comprising about 60% sugar-containing solution.

8. ANTI-DUSTING ADDITIVE, according to one of claims 1 or 4 to 7, wherein the sugar-containing solution (b) contains about 40% equivalent dextrose in relation to about 80% total solids.

9. ANTI-DUSTING ADDITIVE, according to one of claims 1 or 4 to 8, wherein the sugar-containing solution (b) is derived from corn.

10. ANTI-DUSTING ADDITIVE, according to claim 1, wherein raffinate (c) is a by-product derived from the

citric acid recovery process.

11. ANTI-DUSTING ADDITIVE, according to one of claims 1 or 10, wherein raffinate (c) is an aqueous solution comprising at least at least citric acid, inorganic matter, proteic matter and sugar matter.

12. ANTI-DUSTING ADDITIVE, according to claim 11, wherein sugar matter comprises carbohydrate selected from fructose, dextrose, maltose and/or polyol selected from arabitol, erythritol, or mixtures thereof.

13. ANTI-DUSTING ADDITIVE, according to claim 11, wherein inorganic matter includes nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, copper, zinc, boron, sodium, or mixtures thereof.

14. ANTI-DUSTING ADDITIVE, according to one of claims 1 to 13 presenting the following characteristics:

(a) % Brix from about 60 to about 80;

(b) viscosity of minimum of about 100 cP (about 25^{0}C).

15. PROCESS FOR MANUFACTURING THE ANTI-DUSTING ADDITIVE according to one of claims 1 to 14 comprising the steps of:

(i) mixing glycerol (a) with sugar-containing solution (b) until complete homogenization;

(ii) optionally evaporation of raffinate component (a) up to about 50-65% solids and mixing the resulting evaporate into (i);

(iii) controlling the viscosity by addition of sugar-containing solution (b) if necessary, considering a minimum of about 100 and a maximum of about 100,000 cP (at 25^{0}C), particularly about 500 to about 10,000, more particularly about 1,600 to about 2,500.

16. USE OF THE ADDITIVE according to one of claims 1 to 14 for reducing dust emission during the

manufacture, transportation and application of fertilizers.

17. USE OF THE ADDITIVE according to one of claims 1 to 14 for reducing dust emission from mining industry.

18. METHOD FOR REDUCING DUST EMISSION FROM FERTILIZERS comprising applying a dust reducing amount of an anti-dusting additive according to one of claims 1 to 14.

19. METHOD FOR REDUCING DUST EMISSION FROM MINING INDUSTRY comprising applying a dust reducing amount of an anti-dusting additive according to one of claims 1 to 14.

20. FERTILIZER comprising anti-dusting additive according to one of claims 1 to 14.

INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2012/000323

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01J2/30 C05C1/02 C05C7/02 C05C9/00 C05G3/00
E21F5/00
ADD.
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)
B01J C05C C05G E21F

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 383 952 A (SINGEWALD ARNO [DE] ET AL) 24 January 1995 (1995-01-24) cited in the application claims 1-3; example 1 -----	1-16,18, 20
X	EP 2 228 420 A1 (JAPAN CORN STARCH CO LTD [JP]) 15 September 2010 (2010-09-15) cited in the application claims 1-7; examples 1-8 -----	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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

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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 December 2012	13/12/2012

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, Fax: (+31-70) 340-3016	Gilliquet, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/BR2012/000323

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5383952 A	24-01-1995	NONE	
EP 2228420 A1	15-09-2010	NONE	