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(71) Applicant (for all designated States except US): **LES PROCEDES SERVI-SAND CANADA INC.** [CA/CA];
125 De la Barre, Boucherville, Québec J4B 2X6 (CA).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **JOLLEZ, Paul** [CA/CA]; 2255 rue du Vermont, Sherbrooke, Québec J1J 1G9 (CA).(74) Agent: **ROBIC**; Centre CDP Capital, 1001 Square Victoria Bloc E 8e étage, Montréal, Québec H2Z 2B7 (CA).

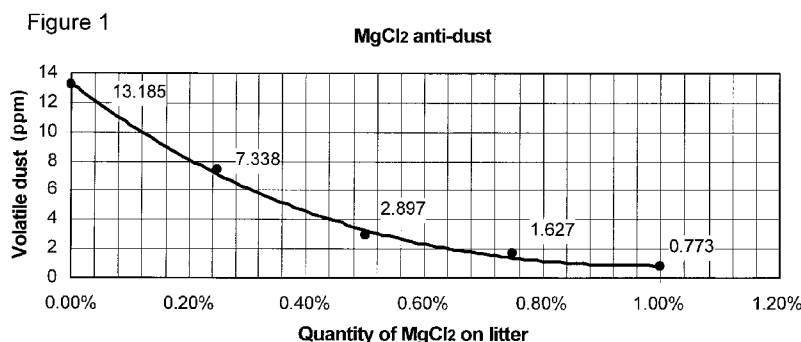
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(54) Title: DUST AND ODOR CONTROL MATERIALS AND PROCESSES

(57) Abstract: A dust and odor control material comprises a substrate, an odor-neutralising and dust-control agent associated with the substrate and an odor-retardant agent associated with the substrate. The animal litter material may comprise a bentonite-based substrate, N-(n-butyl) thiophosphoric triamide (nBTPT) and MgCl₂. A process for making the material comprises introducing the agents via spray-drying, extrusion, impregnation, compression, or pellet or granule growth methods such as tumbling.

DUST AND ODOR CONTROL MATERIALS AND PROCESSES

FIELD OF THE INVENTION

The present invention generally relates to the field of odor and dust control, and in particular to dust and odor control of materials such as particulate domestic animal litter.

BACKGROUND

Dust and odor are problematic phenomena that occur particularly in connection with particulate materials such as animal litter. When urine is released into litter, it contains a variety of compounds including ammonium, uric acid and urea. Ammonia, which is a relatively volatile odorous compound, can be released from the urine and over time urea is broken down into carbon dioxide and ammonia, resulting in disruptive odors emanating from the litter immediately and over time.

In addition, materials such as animal litter often have a tendency to allow particles to “dust” and become suspended in the air, which reduces air quality and in some cases can be a health hazard depending on the material and quantity of dust in the air. For materials that are disrupted, scooped, poured and displaced on a regular basis, dusting can be a particularly acute problem. It is a challenge to provide materials such as animal litter that has effective dust control.

Some substances are known for attempting to control odors, in a variety of different fields. In some cases, perfumes are used but they tend to mask rather than control odors. Urease inhibitors have been used in some industries for controlling urine odors by inhibiting the hydrolysis of urea into carbon dioxide and ammonia. Other known substances have proved ineffective, inefficient, costly, or difficult to apply to certain materials.

Indeed, there is a present need in for techniques and products that respond to the disadvantages of what is known to enable effective dust and odor control of materials.

SUMMARY OF THE INVENTION

The present invention provides a dust and odor control material comprising a substrate; an odor-neutralising and dust-control agent associated with the substrate; and an odor-retardant agent associated with the substrate.

In an optional aspect, the substrate comprises a clay-based substance. In one preferred aspect, the substrate substantially comprises bentonite clay. In one aspect, the bentonite comprises sodium bentonite. The clay may comprise clumping clay and/or non clumping clay. The substrate may also comprise starch. In another aspect, the substrate comprises at least one of a clay-based compound, limestone-based compound, silica-based compound, cellulose-based compound, cellulose derivatives-based compound, agricultural waste-based compound or soil-based compound. In another aspect, the substrate comprises an extruded compound which may be in the form of pellets.

In another optional aspect, the odor-neutralising and dust-control agent comprises a salt. The salt may be a hydrate. It may be an alkaline earth salt, preferably an alkaline-earth chloride. In one aspect, the odor-neutralising and dust-control agent comprises at least one of CaCl_2 or MgCl_2 . In one preferred aspect, the odor-neutralising and dust-control agent is MgCl_2 , preferably in hydrous form. In another aspect, the MgCl_2 is provided on the substrate as an aqueous solution. The aqueous solution may contain between about 20 wt% and about 35 wt% MgCl_2 . The aqueous solution may be provided in an amount between 0 % and about 2 % relative to the animal litter material. The aqueous solution may be provided in an amount between about 0.1% and about 2% or an amount between 0.3% and about 1% relative to the animal litter material. The hydrate which may be a hydrate of MgCl_2 may be selected to maintain water of crystallisation above 50°C, preferably at or above 60°C. In another aspect, the odor-neutralising and dust-control agent is provided in a concentration sufficient to reduce dusting by at least about 50%.

In another optional aspect, the odor-retardant agent is a urease inhibitor. The urease inhibitor may be selected from N(n-butyl) thiophosphoric triamide (nBTPT), cyclohexyl thiophosphoric triamide (CHTPT), N-(N-butyl) phosphoric triamide (NBPT), cyclohexyl phosphoric triamide (CHPT), N-aliphatic and N,N-aliphatic phosphoric triamide, phosphorotriamides, 4-aminophenyl sulphonyl amino phenyl phosphorodiamidates, and N-(diaminophosphinyl)arylcarboxamines. The urease inhibitor may be a polysulfide or thiosulphate or the like.

In one aspect, the odor-retardant agent comprises or consists essentially of N-(n-butyl) thiophosphoric triamide (nBTPT). The odor-retardant agent may be provided as a solution of nBTPT. The solution of nBTPT may comprise a solvent, which is a glycol such as propyl glycol. The solution of nBTPT may also contain a lactam, such as a pyrrolidone like methylpyrrolidone. The solution of nBTPT may contain between about 15% to about 30 % w/w of the nBTPT. The solution of nBTPT may be applied to the substrate at between about 0.03% to about 0.06 % w/w. The nBTPT may be used between about 0.01 % and about 1 % relative to the animal litter material.

In a further optional aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are associated with the substrate substantially in the form of a coating. Depending on the application method, there may be a solvent for each or both of the two agents. In one aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are associated by extrusion into the substrate. In another aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are associated by compression into the substrate. In another aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are associated by pellet or granule growth into the substrate. In another aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are associated as a coating or surface treatment onto the substrate. In another aspect, the odor-retardant agent is associated as a coating or surface treatment onto the substrate. In another aspect, the odor-retardant agent is embedded or distributed within the substrate. In yet another aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are sprayed onto the substrate. The odor-neutralising and dust-control agent and the odor-retardant agent may be sprayed sequentially or simultaneously onto the substrate, e.g. the odor-neutralising and dust-control agent may be sprayed first and the odor-retardant agent may be sprayed second.

The invention also provides a dust and odor control animal litter material comprising a substrate, N-(n-butyl) thiophosphoric triamide (nBTPT) and MgCl_2 .

The present invention also provides a process of making a dust and odor control material, comprising providing a substrate; introducing an odor-neutralising and dust-control agent to the substrate; and introducing odor-retardant agent to the substrate.

In one optional aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are applied onto the substrate as a coating. The two agents may be added sequentially or simultaneously. In one aspect, the odor-neutralising and dust-control agent is sprayed onto the substrate first and the odor-retardant agent is sprayed on second. In other aspects, the odor-neutralising and dust-control agent and the odor-retardant agent may be introduced during spray-drying, during extrusion into an appropriate substrate, during impregnation, during compression, or during pellet or granule growth methods such as tumbling. The agents may be provided on the exterior of the substrate as a coating, or within the substrate such that the substrate coats the agents, or mixed together with the substrate to form a mixed material that can have even distribution of the agents within the substrate volume or not.

The present invention also provides a use of a combination for dust and odor control of a substrate material, the combination comprising an odor-neutralising and dust-control agent and an odor-retardant agent both provided on the substrate material.

The present invention also provides a kit for dust and odor control of a substrate material, the kit including an odor-neutralising and dust-control agent and an odor-retardant agent provided on the substrate material.

DETAILED DESCRIPTION OF EMBODIMENTS AND ASPECTS

In an optional embodiment, the dust and odor control particulate material is a domestic animal litter preferably for use in a litter box. The particulate material is preferably used for controlling the odor when a bodily fluid, such as urine, is released into it. The particulate material may also be a material onto which the agents are provided for neutralising its existing odors and retarding further odor development and release.

The particulate material may include a substrate composed of one or more materials. In some preferred aspects, the substrate may be a typical animal or pet litter, such as a cat litter, which are typically mixtures of absorbent materials, odor controlling agents, clumping agents, and other functional or cosmetic enhancing additives. Such substrates cover a wide range of materials and can include recycled newsprint, recycled paper, paper sludge, corn cob granules, rice hulls, peanut hulls, alfalfa, sawdust, cedar sawdust, calcareous matter, ground cereals such as wheat, corn, guar gum, and various clays such as calcium and sodium montmorillonites (including sodium and calcium

bentonite), attapulgites, kaolins, and opal clay mixtures. Clay-based litters which provide a clumping property allowing removal of liquid waste from the litter container without excessively contaminating the remaining litter have become popular. Clumps are created when the composition of the swells during the absorption of pet urine, creating a localized rigid clump. Typical additives for litter which provide this swelling and urine absorption property include montmorillonite clays.

In one aspect, the substrate is made of clay-based material which may be clumping or non-clumping. The substrate may also be composed of other appropriate materials for use as animal litter and similar applications wherein a potentially odorous liquid is released into the particulate material and may remain there for some time. In one preferred aspect, particularly for the embodiment of animal litter, the substrate comprises a clay-based substance, preferably bentonite clay, and still preferably sodium bentonite.

The particulate material includes an odor-neutralising and dust-control agent and an odor-retardant agent. The combination of the two agents enables advantageous functionality for dust and odor control in response to an odorous fluid, such as urine, that is released into the particulate material. The agents may be provided via a solution or in dry form, for instance by spray-drying.

Consider the case of urine in further detail. Urine contains ammonium, uric acid and urea. When urine is released into the particulate material, the first agent neutralises ammonia that is already present in the fluid and controls dusting and its negative and exacerbating effect on odor and air quality. Thus, the first agent has a rapid effect on the immediate odor-causing compound of ammonia. Though the initial amount of ammonia is neutralised, the urea present in the fluid has the potential to break down and form additional ammonia which cannot be neutralised by the first agent. The second agent retards the formation of additional ammonia that results from the hydrolysis of urea, preferably by blocking or retarding urease.

In one optional aspect, the agents are selected according to their action on particular compounds. For instance, the odor-neutralising and dust-control agent may be selected to neutralise a volatile odorous compound, while the odor-retardant agent may be selected to retard the formation of that same volatile compound by, for example, blocking an enzyme or reaction that would transform a less-odorous compound into the volatile

odorous compound. The agents thus provide a complementary and advantageous functionality.

In another optional aspect, the odor-neutralising and dust-control agent is an alkaline-earth or alkaline metal chloride. In one preferred aspect, the odor-neutralising and dust-control agent comprises at least one of CaCl_2 or MgCl_2 , still preferably MgCl_2 . The MgCl_2 may be provided in diluted solution form such as a 30 wt% solution. Regarding the action of MgCl_2 , in addition to its strong dust control properties, it conserves its water of crystallisation even above 50°C. It also remains active over time and even in high temperature environments. Solutions of MgCl_2 and ammonia form a stabilised ionic system which inhibits the liberation of ammonia into the atmosphere and displays a certain absorptive capacity evidenced by the absence of characteristic ammonia odors. In addition, Mg^{2+} ions have some degree of inhibiting action on urease, which also retards the formation of ammonia during the transformation of urea.

In the preferred embodiment of the present invention, MgCl_2 is used. MgCl_2 has a number of advantages over other compounds such as CaCl_2 . For instance, MgCl_2 provides reduced corrosivity; it provides increased conservation of its water of crystallisation at high temperatures such as around 60°C which helps maintain anti-dust effects; it facilitates providing a concentrated solution (e.g. 30%) that is stable at low temperatures (e.g. -30°C); and it is more efficient than CaCl_2 at low concentrations.

In another optional aspect, particularly for the embodiment of animal litter, the odor-retardant agent is a urease inhibitor. The urease inhibitor may be selected from N-(n-butyl thiophosphoric triamide (nBTPT), cyclohexyl thiophosphoric triamide (CHTPT), N-(N-butyl) phosphoric triamide (NBPT), cyclohexyl phosphoric triamide (CHPT), N-aliphatic and N,N-aliphatic phosphoric triamide, phosphorotriamides, 4-Aminophenyl sulphonyl amino phenyl phosphorodiamidates, and N-(diaminophosphinyl) arylcarboxamines. The urease inhibitor may also be a polysulfide, or thiosulphate. When the odor-retardant agent has an odor of its own, it may be preferred to associate it with the substrate so as to minimize or eliminate such odor, for example by impregnating the material with it or by providing in a non-exposed layer or in a certain form. Molecule such as the triamides and other products, while effective as retardants of the transformation of urea by urease, do not have an effect on the ammonia already present in the medium.

In a further optional aspect, the odor-neutralising and dust-control agent and the odor-retardant agent are associated with the substrate substantially in the form of a coating. Depending on the application method, there may be a solvent for each or both of the two agents. Depending in the chemical nature and properties of the selected agents, there may be one common solvent for a single spray application of the coating. Alternatively, there may be a different solvent for each agent when applied separately. The two agents may also be added sequentially or simultaneously. In one aspect, the odor-neutralising and dust-control agent is sprayed onto the substrate first and the odor-retardant agent is sprayed on second.

The present invention also provides a process of making a dust and odor control particulate material, comprising providing a substrate; introducing an odor-neutralising and dust-control agent to the substrate; and introducing odor-retardant agent to the substrate.

In other aspects, the odor-neutralising and dust-control agent and the odor-retardant agent may be introduced by extrusion into an appropriate substrate, by compression, or by pellet or granule growth methods such as tumbling. The odor-neutralising and dust-control agent is preferably provided as a coating or otherwise available to rapidly neutralise odors already present in the fluid when released into the particulate material. The odor-retardant agent is provided so as to be available over a longer period of time for retarding the generation of highly odorous substances such as ammonia. Accordingly, the odor-retardant agent may be associated with the substrate to enable a long-lasting effect and thus may be partially embedded or distributed within the particles of the material. The odor-retardant agent may access the fluid due to the fluid's infiltrating around or into the particulate material.

In another aspect, there is provided a use of a combination of compounds for dust and odor control of a substrate material. The combination includes the odor-neutralising and dust-control agent and the odor-retardant agent as described above. The agents are provided on the substrate material, preferably particulate materials such as materials that are clay-based, limestone-based, silica-based, cellulose-based, cellulose derivatives-based, agricultural waste-based, soil-based, in natural or synthetic form, or any number of substrates. The agents may be pre-applied on the particulate substrate material to make a product such as animal litter, hygiene products, or the like; or may be

applied on an odorous municipal or industrial material such as solid or semi-solid waste, filtrates, residues, tailings, or the like; or may be other like materials that may benefit from dust and odor control. The combination mentioned above may be provided in the form of a chemical kit comprising the two agents in dry form or in separate solvents.

It should also be understood that, in some aspects and embodiments, the odor-neutralising and dust-control agent and the odor-retardant agent may be one and the same substance. In addition, there may be one or more of each agent provided in a single material and they may be provided together or in separate layers or coatings. It should also be understood that the material may include a first portion of substrates that are provided with one agent and a second portion of the substrates that are provided with the other agent, the first and second portions being mixable together by a manufacturer prior to packaging or by a user just prior to use.

EXAMPLES

Example 1

Cat litter material was prepared according to the following procedures:

A bentonite type absorbent substrate was prepared having a known granulometry. A first aqueous solution (solution I) containing 20-35 % w/w of MgCl_2 was prepared to then be applied on a portion of the prepared litter absorbent at 1-1.3 % w/w. In parallel, a second aqueous solution (solution II) containing about 15-30 % w/w of N(n-butyl) thiophosphoric triamide nBTPT was prepared, in the presence of surfactant or not, to be applied on another portion of the prepared litter substrate at 0.03-0.06 % w/w. Finally, the two solutions I and II were applied one after the other on another portion of the prepared litter substrate in the same concentrations noted hereinabove.

The dosimetric responses regarding the detection of ammonia released for the three portions of solution-treated litter after adding 50 ml of ammonia at 4 % w/w, showed the following results:

Solution treatment	Released ammonia
Solution I	474 ppm after 24 hours
Solution II	500 ppm after 1 hour
Solution I & 2	480 ppm after 24 hours

Example 2

The same litter preparation as in Example 1 was separated into 3 portions of 400 grams that were exposed to an aqueous solution containing 7.5 grams of urea, 0.5 grams of urease in 50 grams of water. The results of released ammonia over time are as follows:

Solution treatment	Released ammonia
Solution I	21 ppm after 48 hours
Solution II	11 ppm after 48 hours
Solution I & 2	8 ppm after 48 hours

Example 3

Regarding detection of volatile dust, the following results were obtained:

Solution treatment	Dust
Solution I	1 ppm
Solution II	10 ppm
Solution I & 2	1 ppm

Example 4

In this example, the products were introduced at the last stage of an extrusion of a mixture of bentonite and starch. The conditions were as follows:

- Twin screw extruder was used.
- Starch and MgCl_2 were introduced into the upstream part along with the bentonite in suspension in water.
- The mixture was heated and then the product was cooled at the middle of the extruder and the odor control solution was introduced at a downstream end of the extruder.

- The end-products that were obtained were cut up, dried and tested in the presence of urea and urease.
- The results show that only 1 to 2.5 ppm of ammonia is detected after 48 hours.

Knowing that a higher degree of dusting also favours odor dispersion, one can appreciate the importance of these low dust detection levels with the combination of the two agents on solutions I and II, as well as the combination's efficiency pertaining the detection levels of ammonia.

By associating the MgCl_2 with the odor-retardants one observes complementary action and synergy that allow obtaining a product that is dust-reducing and that neutralises ammonia that may already be present in the medium and also retards the action of urease thus avoiding the formation of additional ammonia and, consequently, the occurrence of odors. The above examples show these effects.

The MgCl_2 may be used in an amount of about 0.1 % to about 2 % of a 20-35 wt% MgCl_2 solution, preferably in an amount of about 0.3 % to about 1 %.

A solution of N-(n-butyl) thiophosphoric triamide may be used for the odor-retardant agent. The solution may be about 20 % to about 30 % of the N-(n-butyl) thiophosphoric triamide agent with a certain amount of solvent and/or solubilising compounds for providing it as a liquid. There may also be other additives such as surfactants, dispersing agents, stabilisers, and the like. The N-(n-butyl) thiophosphoric triamide may be preferably used in an amount between about 0.01 % and about 1 %.

Example 5

A sample of sodium bentonite (white) was treated in a small 60 L mixer with 0.25% of mineral oil and then with an aqueous solution containing 0.85% of MgCl_2 at 30 %w/w (hereafter referred to as sample 1).

Sample 1 was then treated with a solution containing 20% nBTPT in a methylpyrrolidone based solvent at 0.06%, 0.15% and 0.3% (hereafter referred to as samples 2, 3 and 4 respectively).

The samples 1-4 were then compared to the initial untreated white sodium bentonite and the sodium bentonite with an odor neutralising treatment based on polyborates 0.17% in aqueous solution (hereafter referred to as sample 5). The following table summarizes the comparison for dust and odor.

Sample	White	1	2	3	4	5
Dust ppm	6	2.4	2.8	3.2	3.1	2
Dosimetry 48h Urea/Urease (ppm ammonia)	33	36	24	26	16	45

Example 6

In a factory setting, products (3 tonnes) were produced with the same base clay substrate:

- Control products. These products were produced with mineral oil as anti-dust agent and 1% of polyborate based odor neutraliser.
- Improved products. These products were treated with 0.24% mineral oil, 0.82% $MgCl_2$ solution at 30% and then 0.05% of nBTPT solution at 20% in methylpyrrolidone.

Results :

Sample	Control products	Improved products
FSC %	418	573
Absorption capacity %	77	79
Dust ppm	8.8	4.6
Dosimerty ppm ammonia	31.5	14.1

One will note that the addition of the odor control enabled a 50% reduction in ammonia release after 48 hrs. These results are particularly advantageous since at large scale the homogenisation of the product is more efficient. These results also show the superiority of this embodiment of the present invention in terms of anti-dust properties in relation to the borate based product.

Example 7

A comparison was also made between $MgCl_2$ and $CaCl_2$ as odor-neutralising and dust-control agent on a same substrate of sodium bentonite. The results are shown in the following table and in Figures 1 and 2.

Alternative compounds MgCl_2 and CaCl_2

With CaCl_2		With MgCl_2	
	ppm		ppm
0.5% water	-	0.5% water	13.6
0.00%	12.4	0.00%	13.2
0.26%	11.0	0.25%	7.4
0.51%	6.5	0.50%	2.9
0.77%	1.2	0.75%	1.6
1.00%	0.8	1.00%	0.8

Note that the aqueous solutions that were used were at 30% w/w of salt (anhydrous basis).

It should be understood that the embodiments, aspects and examples provided hereinabove are meant to be exemplary and should not be used to limit what has actually been invented.

CLAIMS

1. A dust and odor control animal litter material comprising:
 - a substrate;
 - an odor-neutralising and dust-control agent associated with the substrate; and
 - an odor-retardant agent associated with the substrate.
2. The animal litter material of claim 1, wherein the substrate comprises clay.
3. The animal litter material of claim 2, wherein the clay comprises bentonite.
4. The animal litter material of claim 3, wherein the bentonite comprises sodium bentonite.
5. The animal litter material of any one of claims 2 to 4, wherein the clay comprises clumping clay.
6. The animal litter material of any one of claims 2 to 4, wherein the clay is non clumping clay.
7. The animal litter material of any one of claims 2 to 6, wherein the substrate also comprises starch.
8. The animal litter material of any one of claims 1, wherein the substrate comprises at least one of a clay-based compound, limestone-based compound, silica-based compound, cellulose-based compound, cellulose derivatives-based compound, agricultural waste-based compound or soil-based compound.
9. The animal litter material of any one of claims 1 to 8, wherein the substrate comprises an extruded compound.
10. The animal litter material of claim 9, wherein the extruded compound is in the form of pellets.
11. The animal litter material of any one of claims 1 to 9, wherein the substrate comprises pellets.

12. The animal litter material of any one of claims 1 to 11, wherein the odor-neutralising and dust-control agent comprises a salt.
13. The animal litter material of claim 12, wherein the odor-neutralising and dust-control agent comprises an alkaline earth salt.
14. The animal litter material of claim 3, wherein the salt comprises a chloride salt.
15. The animal litter material of claim 14, wherein the odor-neutralising and dust-control agent comprises at least one of CaCl_2 or MgCl_2 .
16. The animal litter material of claim 15, wherein the odor-neutralising and dust-control agent comprises MgCl_2 .
17. The animal litter material of claim 16, wherein the MgCl_2 is provided on the substrate as an aqueous solution.
18. The animal litter material of claim 17, wherein the aqueous solution contains between about 20 wt% and about 35 wt% MgCl_2 .
19. The animal litter material of claim 18, wherein the aqueous solution is provided in an amount between 0 % and about 2 % relative to the animal litter material.
20. The animal litter material of claim 18, wherein the aqueous solution is provided in an amount between about 0.1% and about 2% or between 0.3% and about 1% relative to the animal litter material.
21. The animal litter material of any one of claims 14 to 20, wherein the salt comprises a hydrate.
22. The animal litter material of claim 21, wherein the hydrate is selected to maintain water of crystallisation above 50°C , or at or above 60°C .
23. The animal litter material of any one of claims 1 to 22, wherein the odor-neutralising and dust-control agent is provided in a concentration sufficient to reduce dusting by at least about 50%.

24. The animal litter material of any one of claims 1 to 23, wherein the odor-retardant agent comprises a urease inhibitor.
25. The animal litter material of any one of claims 1 to 24, wherein the odor-retardant agent comprises at least one of N-(n-butyl) thiophosphoric triamide (nBTPT), cyclohexyl thiophosphoric triamide (CHTPT), N-(N-butyl) phosphoric triamide (NBPT), cyclohexyl phosphoric triamide (CHPT), N-aliphatic and N,N-aliphatic phosphoric triamide, phosphorotriamides, 4-Aminophenyl sulphonyl amino phenyl phosphorodiamidates, and N-(diaminophosphinyl) arylcarboxamines.
26. The animal litter material of any one of claims 1 to 24, wherein the odor-retardant agent comprises at least one polysulfide or thiosulphate.
27. The animal litter material of any one of claims 1 to 24, wherein the odor-retardant agent comprises N-(n-butyl) thiophosphoric triamide (nBTPT).
28. The animal litter material of claim 27, wherein the odor-retardant agent is provided as a solution of nBTPT.
29. The animal litter material of claim 28, wherein the solution of nBTPT comprises a solvent.
30. The animal litter material of claim 29, wherein the solvent comprises a glycol.
31. The animal litter material of claim 30, wherein the solvent comprises propyl glycol.
32. The animal litter material of any one of claims claim 29 to 31, wherein the solution of nBTPT comprises a lactam.
33. The animal litter material of claim 32, wherein the solution of nBTPT comprises a pyrrolidone.
34. The animal litter material of claim 33, wherein the solution of nBTPT comprises methylpyrrolidone.
35. The animal litter material of any one of claims 28 to 34, wherein the solution of nBTPT contains between about 15% to about 30 % w/w of the nBTPT.

36. The animal litter material of any one of claims 28 to 35, wherein the solution of nBTPT is applied to the substrate at between about 0.03% to about 0.06 % w/w.
37. The animal litter material of any one of claims 27 to 36, wherein the nBTPT is used between about 0.01 % and about 1 % relative to the animal litter material.
38. The animal litter material of any one of claims 1 to 37, wherein the odor-neutralising and dust-control agent and the odor-retardant agent are associated by extrusion into the substrate.
39. The animal litter material of any one of claims 1 to 337, wherein the odor-neutralising and dust-control agent and the odor-retardant agent are associated by compression into the substrate.
40. The animal litter material of any one of claims 1 to 37, wherein the odor-neutralising and dust-control agent and the odor-retardant agent are associated by pellet or granule growth into the substrate.
41. The animal litter material of any one of claims 1 to 37, wherein the odor-neutralising and dust-control agent and the odor-retardant agent are associated as a coating or surface treatment onto the substrate.
42. The animal litter material of any one of claims 1 to 37, wherein the odor-retardant agent is associated as a coating or surface treatment onto the substrate.
43. The animal litter material of any one of claims 1 to 37, wherein the odor-retardant agent is embedded or distributed within the substrate.
44. The animal litter material of any one of claims 1 to 37, wherein the odor-neutralising and dust-control agent and the odor-retardant agent are sprayed onto the substrate.
45. The animal litter material of claim 44, wherein the odor-neutralising and dust-control agent and the odor-retardant agent are sprayed sequentially or simultaneously onto the substrate.
46. The animal litter material of claim 45, wherein the odor-neutralising and dust-control agent is sprayed first and the odor-retardant agent is sprayed second.

47. The animal litter material of any one of claims 1 to 46, wherein the odor-neutralising and dust-control agent and the odor-retardant agent are two distinct compounds.
48. A dust and odor control animal litter material comprising a substrate, N-(n-butyl) thiophosphoric triamide (nBTPT) and MgCl_2 .
49. A process of making a dust and odor control material, comprising:
- providing a substrate;
 - introducing an odor-neutralising and dust-control agent to the substrate; and
 - introducing odor-retardant agent to the substrate.
50. The process of claim 49, wherein the steps of introducing the odor-neutralising and dust-control agent and the odor-retardant agent to the substrate comprise extrusion, compression, pellet or granule growth, coating or surface treatment onto the substrate or spraying or a combination thereof.
51. The process of claim 49 or 50, comprising first spraying the odor-neutralising and dust-control agent onto the substrate and then spraying the odor-retardant agent onto the substrate.
52. The process of any one of claims 49 to 51, producing the dust and odor control animal litter material as defined in any one of claims 1 to 48.

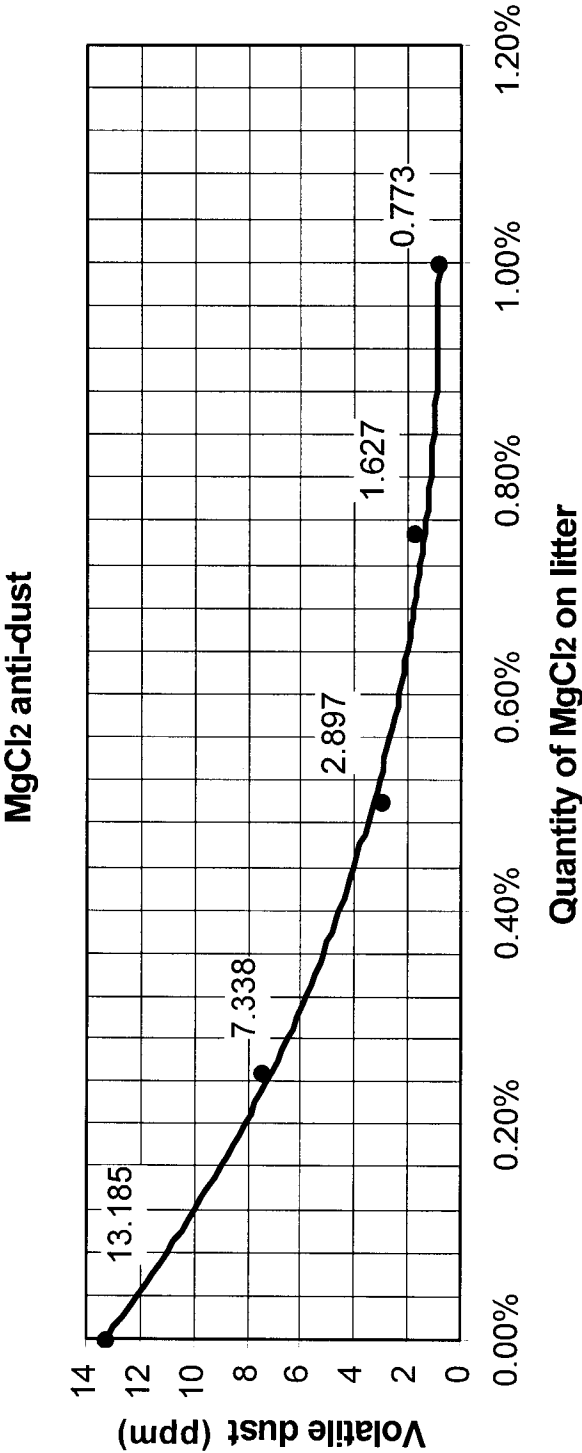


Figure 1

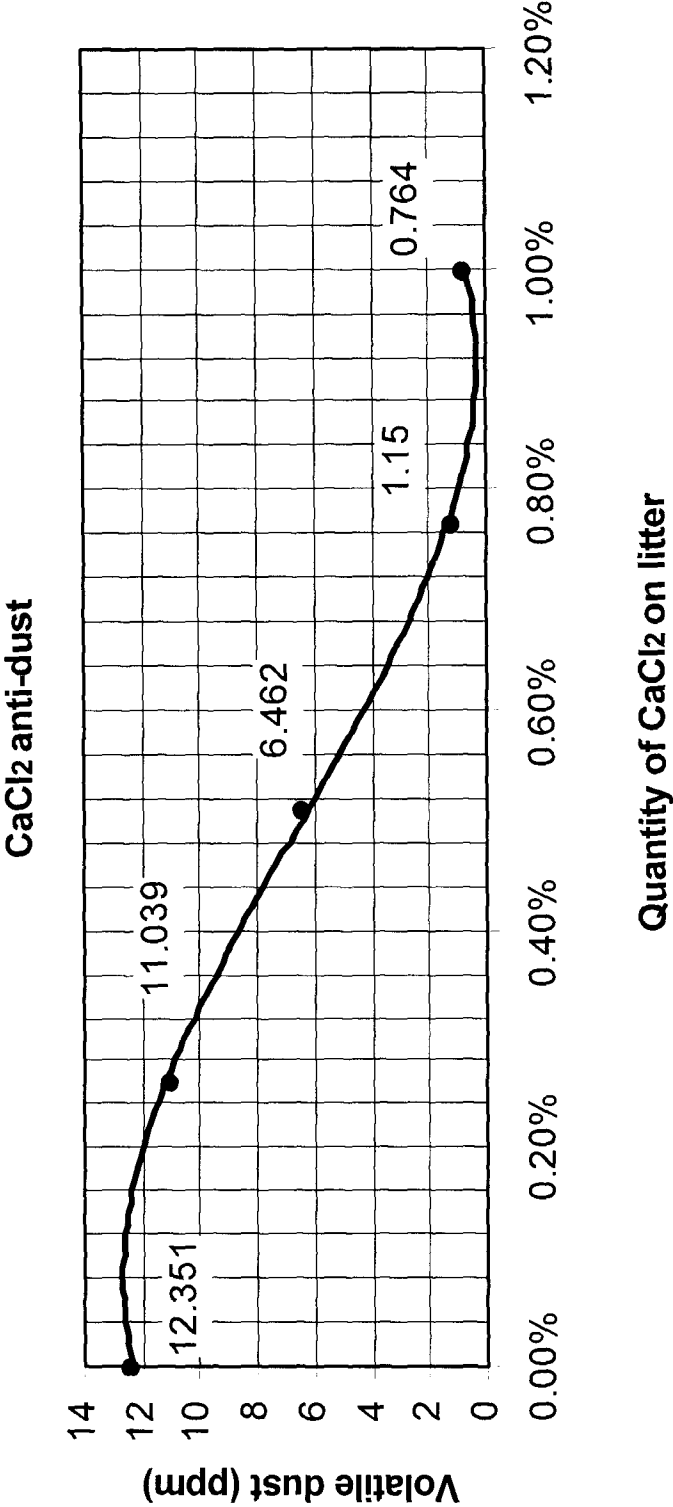


Figure 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2011/000502

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **A61L 9/014** (2006.01) , **A01K 1/015** (2006.01)

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): A61L 9/014, A01K 1/015

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

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

Canadaian Patent Database, Epoque (Epodoc, NPL)

keywords: litter, dust, cat, pet, magnesium chloride, Mg

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 09 590 (LANG et al.) 15 October 1992 (15-10-1992)	1, 8, 12-24, 41, 42, 44
Y	the whole document	2-7, 9-11, 25-40, 43, 45-52
Y	CA 2,576,045 (DUTKIEWICZ, J. K.) 16 February 2006 (16-02-2006) abstract; page 15, line 9 to page 21, line 22	2-7, 9-11, 25-40, 43, 45-52

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

☒ See patent family annex.

* Special categories of cited documents :	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search

5 July 2011 (05-07-2011)

Date of mailing of the international search report

15 August 2011 (15-08-2011)

Name and mailing address of the ISA/CA
Canadian Intellectual Property Office
Place du Portage I, C114 - 1st Floor, Box PCT
50 Victoria Street
Gatineau, Quebec K1A 0C9
Facsimile No.: 001-819-953-2476

Authorized officer

Geneviève Fortier, PhD (819) 994-3433

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2011/000502

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
DE4109590A1	15-10-1992	DE4109590A1 DE4109590C2	15-10-1992 02-05-1996
CA2576045A1	16-02-2006	CA2576045A1 EP1632253A1 MX2007001520A US2006029567A1 WO2006017441A1	16-02-2006 08-03-2006 23-04-2007 09-02-2006 16-02-2006