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(54) **Decontamination/detoxification composition**

(57) A decontamination/detoxification composition, which comprises: (A) 10% to 40% by weight of a oxidizing agent including potassium or sodium isocyanurate dichloride and/or trichloride; (B) 8% to 35% by weight of a alkalizing agent; (C) 30% to 70% by weight of at least one inorganic filler; (D) 0,5% to 5% by weight of at least one suspending agent and (E) 0% to 7% by weight of at

least one surfactant, the total of the percentages by weight of the components (A) to (E) being 100%. The composition has a solubility in water at 20 °C of at least 90 grams/100 ml. The composition is free from metal oxides.

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DescriptionField of the invention

5 **[0001]** The present invention relates to the technical field of the reclamation of contaminated surfaces, and particularly relates to a decontamination/detoxification composition for reclaiming surfaces polluted by toxic and/or pathogenic chemical and/or biological substances, as well as its use for reclaiming such contaminated surfaces.

[0002] The composition of the invention is also useful for decontaminating surfaces polluted by toxic and/or pathogenic nuclear and/or radiological particles.

Background of the invention

[0003] It is known that, for reclaiming surfaces polluted by toxic and/or pathogenic chemical, biological, nuclear and/or radiological substances, a treatment with suitable decontamination/detoxification products is needed.

15 **[0004]** Such decontamination/detoxification products oxidate, hydrolyze and solubilize the toxic and/or pathogenic substances, in such a manner to allow the removal thereof from the polluted surfaces by a subsequent spraying of the surface with hot water in pressure. Examples of these known decontamination/detoxification products are disclosed in the Italian patent IT1235421 and in the Italian patent application V12008A000049, in the name of the same Applicant.

[0005] These products are in powder or granular form, and are to be added to a liquid phase, generally water, to form an aqueous decontamination/detoxification solution.

[0006] Although the above-mentioned known decontamination/detoxification products are very stable once packaged and effective against the toxic and/or pathogenic substances, they show in practice the drawback of the separation between the solid and liquid phases, if the aqueous solution is maintained in a tank for a relatively long time without stirring.

[0007] This drawback may lead to a clogging of the conduits and/or the nozzle of the same tank or the apparatuses by which they are sprayed or otherwise used, until a complete breaking thereof.

[0008] Moreover, this drawback can obviously lead, with time, to the lowering of the effectiveness of the reclaiming.

[0009] Further, since the decontamination/detoxification products are usually used in emergency situations, where the time factor plays a key role, it is apparent that these drawbacks may lead to irremediable personal injuries and/or damages.

Summary of the invention

[0010] The object of the present invention is to overcome at least partly the above drawbacks, by providing a decontamination/detoxification composition which is highly efficient and relatively cost-effective.

35 **[0011]** A particular object of the present invention is to provide a decontamination/detoxification composition which is effective against toxic and/or pathogenic chemical and/or biological substances.

[0012] A further object of the present invention is to provide a decontamination composition which is effective against nuclear and/or radiological particles, such as powders, fallouts and the like.

[0013] A further object of the present invention is to provide a decontamination/detoxification composition which is stable with time once packaged.

[0014] A further object of the present invention is to provide a decontamination/detoxification composition which is substantially not subject to the separation between the solid and liquid phases once added to a liquid phase and then maintained in a tank.

45 **[0015]** A further object of the present invention is to provide a decontamination/detoxification composition which minimizes the clogging and/or the breaking of the conduits and/or the nozzles of the apparatuses by which it is delivered on the surfaces to be reclaimed once added to a liquid phase.

[0016] Another object of the present invention is to provide a decontamination/detoxification composition having a reclaiming efficiency substantially unchanged with time.

[0017] Yet another object of the present invention is to provide a decontamination/detoxification composition which minimizes personal injuries and/or damages.

[0018] These and other objects, as better explained hereafter, are fulfilled by a decontamination/detoxification composition as disclosed in the independent claim 1.

[0019] The inventive composition may comprise:

55 (A) 10% to 40% by weight of an oxidizing agent including potassium or sodium isocyanurate dichloride and/or trichloride;

(B) 8% to 35% by weight of an alkalinizing agent;

(C) 30% to 70% by weight of at least one inorganic filler;

(D) 0,5% to 5% by weight of at least one suspending agent;

(E) 0% (i.e. not present in the composition) to 7% by weight of at least one surfactant;

the total of the percentages by weight of the components (A) to (E) being 100%;

wherein the composition has a solubility in water at 20 °C of at least 90 grams/100 ml;

and wherein the composition is free from metal oxides specifically added.

[0020] All components (A) to (E) of the composition of the present invention will be in granular or powder form.

[0021] Unless otherwise specified, the salts of the present invention can be in the in the hydrate or anhydrous form.

[0022] Unless otherwise specified, the percentages indicated in the present document are to be considered as percentages (%) by weight.

[0023] As used herein, the term "% by weight" and its derivatives is intended to indicate, unless otherwise indicated, the percentage by weight of a given component based on the total dry weight of the composition in which it is included.

[0024] As used herein, the term "solubility" and its derivatives is intended to indicate, unless otherwise indicated, the grams of substance dissolved in 100 ml of distilled water at 20 °C.

[0025] The composition of the invention is highly soluble in water, in such a manner that, once added to a liquid phase to form a decontamination/detoxification aqueous solution, it minimizes the clogging of the conduits and/or the nozzle of the apparatuses by which it is used.

[0026] Advantageously, each of the above-mentioned alkalinizing agent (B), at least one inorganic filler (C), at least one suspending agent (D) and at least one surfactant (E) may have a solubility in water at 20°C of at least 10 grams/100 ml, and preferably of 15 grams/100 ml.

[0027] Thanks to these features, the composition of the present invention has a reclaiming efficiency substantially unchanged with time.

[0028] Moreover, the composition of the present invention minimizes the danger of personal injuries and/or damages, as well as the breaking of the apparatuses by which it is delivered on the polluted surfaces.

[0029] The Applicant unexpectedly found that the composition according to the present invention, although it is free from metal oxides, has a high reclaiming efficiency against toxic and/or pathogenic chemical and/or biological substances, as clearly demonstrated by the examples below.

[0030] This finding is surprising, since the prior art documents clearly indicates that the metal oxides was almost indispensable for an effective reclaiming action. In fact, the prior art teaches that they act as activating agent and/or catalyst for the oxidizing agent.

[0031] In addition to chemical and biological decontamination, the composition has shown interesting properties in the field of nuclear and radiological decontamination. The composition has been designed for reducing and removing contamination radioactive particles from structures, surfaces, objects, personnel gears and the like. It can be successfully used for both gross or rough decontamination and detailed decontamination.

[0032] Further, the instant composition shows a good stability with time, as clearly demonstrated by the examples below. As known, the stability of a composition measure the tendency thereof to be subject to undesired internal reactions, which inevitably lead to the degradation of the product before use.

[0033] As used herein, the term "oxidizing agent" and its derivatives is intended to indicate, unless otherwise indicated, one or more chemical compounds which are suitable to oxidize one or more toxic and/or pathogenic chemical, biological, nuclear and/or radiological substances by which they are contacted.

[0034] The oxidizing agent may comprise, or may consist of, potassium or sodium isocyanurate dichloride and/or trichloride.

[0035] In a preferred embodiment of the present invention, the oxidizing agent (A) may consist of potassium or sodium isocyanurate dichloride.

[0036] The amount of the oxidizing agent (A) may be of 10% to 40% by weight with respect to the dry weight of the composition, and may vary according to the use of the isocyanurate dichloride and/or trichloride.

[0037] It is to be taken into account that the solubility in water of the isocyanurate trichloride is less than the solubility of the isocyanurate dichloride.

[0038] Suitably, if the composition comprises both isocyanurate dichloride and trichloride, the isocyanurate trichloride may be in an amount which is less than the amount of the isocyanurate dichloride.

[0039] For example, in this case, the isocyanurate dichloride may be of 10% to 30%, preferably of 10% to 25% and more preferably of 10% to 20%, while the isocyanurate trichloride may be of 5% to 20%, preferably of 5% to 15%.

[0040] Generally, it can be established that if the oxidizing agent (A) includes, respectively consists of, only isocyanurate dichloride, without isocyanurate trichloride, the amount thereof in the composition may be of 20% to 40%, preferably of 25% to 40% and more preferably of 30% to 40%.

[0041] On the other hand, if the oxidizing agent (A) includes, respectively consists of, only isocyanurate trichloride, without isocyanurate dichloride, the amount thereof in the composition may be of 10% to 30%, preferably of 15% to 30% and more preferably of 15% to 25%.

[0042] As used herein, the term "alkalinizing agent" and its derivatives is intended to indicate, unless otherwise indicated, one or more compounds suitable to enhance the pH of the composition.

[0043] Advantageously, the alkalinizing agent (B) may comprise at least one compound chosen among the group consisting of: sodium or potassium phosphates, sodium or potassium silicates, sodium or potassium carbonates and sodium hydroxide, or a mixture of one or more thereof.

[0044] In a preferred but non-exclusive embodiment of the present invention, the alkalinizing agent (B) may comprise sodium or potassium tripolyphosphate, which also act as sequestering agent.

[0045] The amount of the alkalinizing agent (B) in the composition may be of 8% to 35% by weight, preferably of 10% to 35% and more preferably of 15% to 35%.

[0046] The sodium or potassium hydroxide may be used to increase the pH and the solubility of the composition. The amount thereof in the composition may be of 0,1% to 5%, preferably of 0,5% to 4% by weight.

[0047] Preferably, in order to improve the stability and/or the efficiency, if the composition includes an amount of oxidizing agent (A) which is equal or more than 15% by weight, the amount of the alkalinizing agent (B) may be more than 15% by weight, preferably more than 20% by weight and more preferably more than 25% by weight.

[0048] As used herein, the term "inorganic filler" and its derivatives is intended to indicate, unless otherwise indicated, inorganic solid particulate substantially chemically inert.

[0049] Suitably, the inorganic filler (C) may be chosen among the group consisting of sodium or potassium anhydrous sulphate, sodium or potassium chloride, ammonium difluoride, sodium or potassium silicate, magnesium sulphate.

[0050] As used herein, the term "suspending agent" and its derivatives is intended to indicate, unless otherwise indicated, one or more compounds suitable to reducing the sedimentation rate of particles in suspension.

[0051] Advantageously, the suspending agent (D) may be cellulose-based, such as carboxymethylcellulose and/or cellulose acetate.

[0052] Other suitable suspending agents may be proteic substances or vinylpolymers.

[0053] As used herein, the term "surfactant" and its derivatives is intended to indicate, unless otherwise indicated, one or more compounds suitable to lowering the surface tension of a liquid.

[0054] If present, the amount of the surfactant (E) in the composition may be of 0,1% to 7%, preferably of 2% to 7% by weight.

[0055] Suitable surfactants may be: alkylpolyglycoside, sodium lauryl sulfate, sodium alkyl sulfonate, sodium alkyl aryl sulfonate, sodium laureth sulfate, or a mixture of two or more thereof.

[0056] The instant composition may also contain one or more additive, such as excipients, coadjuvants, binders, gliders, disintegrants and the like.

[0057] Conveniently, the average particle size of the components (A) to (E) may be less than 0,5 mm, in order to increase solubility.

[0058] This granular or powder composition may be used as such or, preferably, as a solid phase of an aqueous solution, to be prepared on site just before use. On the other hand, the granular powder may be mixed with the liquid phase by means of a jet lance, such as the apparatus disclosed in the European Patent Application EP-A1-1930083, in the name of the same Applicant.

[0059] Advantageous embodiments of the invention are defined in accordance with the dependent claims.

[0060] The invention will be more in detail described with reference to the following examples that, however, are not intended to restrict the scope of the invention.

Examples

[0061] Several decontamination/detoxification product sample (S1 - S9) have been prepared having a composition according to the following table 1. For comparison purpose, one sample (S10) has been prepared having a composition according to the teachings of the Italian Patent Application VI2008A000049.

TABLE 1

Component	Compound	Solubility	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Ox. Ag. (A)	Na isocyan.dichloro	22,5	35	25	32		5	10	25	15		32
	Na isocyan. trichl.	1,2		5		20		25		10	18	
Alk. Ag. (B)	Sodium hydroxide	109	2			2		2				
	Sodium carbonate	21,5	5	10	19	5	5	5	15	7	15	19
	Sodium bicarbonate	17					5	5				
	Na metasilicate	V. S.	7	5	4		5	5	4	5	7	4

(continued)

Component	Compound	Solubility	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
5 Filler (C)	Na tripolyphosphate	14,5	5	6	7	7	5	5	5		4	7
	Sodium sulfate	19,5	38	43	33	27	30	21	30	28		
10 Susp. Ag. (D)	NaCl	36				34		16		24.5	27	
	MgSO ₄	33,7					39		14		23	
	Bentonite	N.S.										15
	Talc	N.S.										17
15 Surfact. (E)	Carboxymethylcell.	V.S.	2	3	2, 5	2, 5	3	3	3	3,5	3	2,5
	Cellulose acetate	V. S.	1						1			
	Na lauryl sulphate	V. S.	5	3	2, 5	2, 5	3	3	1	3	3	2,5
Catalyst	Alkyl Polyglycol	V.S.							2			
	Titanium dioxide	N. S.										1

[0062] All components are in % by weight based on the total dry weight of the composition. For all components, the solubility in grams/100 ml of water at 20 °C has been given. The components which are very soluble have been labelled as "V.S.". The components which are insoluble in water have been labelled as "N.S." (not soluble).

[0063] All samples have been prepared by mixing the various components under vacuum at a temperature of 50 °C to 100 °C, to obtain a granular product.

[0064] For each sample S1-S10, the solubility in water, the reclaiming efficiency and the stability once packaged have been measured. The results of these tests are shown in the following table 2.

[0065] The solubility in water has been determined by dissolving the various samples S1 - S10 in 100 ml of distilled water at 20 °C. The results shown are in grams of composition dissolved.

[0066] The reclaiming efficiency has been tested by contacting 150 grams of the compositions corresponding to the various samples with an initial contamination (of CARC paint) of 10 g/m² of Iprite, a vesicant agent. After a contacting time of 30 min the residual contamination of Iprite has been evaluated. In table 2, the results are given in percentage of reclaimed surface with respect to the initial concentration of Iprite.

[0067] The stability of the composition once packaged has been measured by maintaining 100 Kg of the compositions corresponding to the various samples packaged in a polyethylene container at a temperature of 40 °C for 7 days. After this period, the temperature of the solid bulk has been measured.

[0068] If the final temperature of the bulk maintained substantially equal to 40 °C (i.e. the ambient temperature on which the sample was maintained), the sample was "stable" ("S" in table 2). If the final temperature of the bulk was equal to 45 °C or more, the sample was "unstable" ("NS" in table 2). If the final temperature of the bulk was of about 40 °C to 45 °C, the sample was "almost stable" ("AS" in table 2).

TABLE 2

Sample	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Solubility	100	99	100	96	100	95	100	98	96	70
Recl. eff., %	96	84	95	25	30	55	98	85	97	99
Stability	AS	AS	S	NS	S	NS	S	AS	S	S

[0069] From the data shown in the preceding table 2, it is apparent that all the samples S1 to S9 are soluble in water, while the sample S10 is almost insoluble in water.

[0070] Without being bound by any theory, it is possible to state that a composition having a solubility in water less than 90 grams/100ml does not fall within the scope of the present invention.

[0071] Concerning the reclaiming efficiency, it is apparent that the samples S4 and S5 have an unacceptable low efficiency, while the sample S6 has a low but acceptable efficiency.

[0072] Without being bound by any theory, it is possible to state that a composition having a reclaiming efficiency (% of the initial amount of 10 grams of Iprite reclaimed from and surface of one square metre) less than 50% does not fall within the scope of the present invention.

[0073] Concerning the stability, all samples S1 to S3, S5 and S7 to S10 was found stable or almost stable, while the samples S4 and S6 was found unstable.

[0074] Without being bound by any theory, it is possible to state that an unstable composition, i.e. a composition that shows a temperature increase equal or more than 5 °C once packaged in a polyethylene container in an amount of 100 Kg and maintained in an environment at temperature of 40 °C for 7 days, does not fall within the scope of the present invention.

[0075] Accordingly, the compositions corresponding to the samples S4, S5, S6 and S10 do not fall within the scope of the present invention.

[0076] In view of the foregoing, it is apparent that the composition according to the present invention fulfils the intended objects.

[0077] In particular, the instant composition, while being stable with time and effective against toxic and/or pathogenic chemical, biological, nuclear and/or radiological substances, is substantially not subject to separation phenomena once added to a liquid phase, in such a manner to minimize the clogging and/or the breaking of the conduits and/or the nozzles of the apparatuses by which it is delivered, as well as minimizing personal injuries and/or damages.

[0078] The composition of this invention is susceptible of a number of changes and variants. All the components thereof may be replaced by other technically equivalent compounds without departure from the scope of the invention as defined in the appended claims.

Claims

1. A decontamination/detoxification composition, comprising:

- (A) 10% to 40% by weight of a oxidizing agent including potassium or sodium isocyanurate dichloride and/or trichloride;
- (B) 8% to 35% by weight of a alkalinizing agent;
- (C) 30% to 70% by weight of at least one inorganic filler;
- (D) 0,5% to 5% by weight of at least one suspending agent;
- (E) 0% to 7% by weight of at least one surfactant;

the total of the percentages by weight of the components (A) to (E) being 100%;
wherein the composition has a solubility in water at 20 °C of at least 90 grams/100 ml;
and wherein the composition is free from metal oxides.

2. Composition as claimed in claim 1, wherein each of said alkalinizing agent (B), at least one inorganic filler (C), said at least one suspending agent (D) and possibly said at least one surfactant (E) has a solubility in water at 20 °C of at least 10 grams/100 ml, and preferably of 15 grams/100 ml.

3. Composition as claimed in claim 1 or 2, wherein said oxidizing agent (A) consists of potassium or sodium isocyanurate dichloride and trichloride, the isocyanurate dichloride being of 10% to 30% by weight, preferably of 10% to 25% by weight and more preferably of 10% to 20% by weight, the isocyanurate trichloride being of 5% to 20% by weight, preferably of 5% to 15% by weight.

4. Composition as claimed in claim 1 or 2, wherein said oxidizing agent (A) consists of potassium or sodium isocyanurate trichloride in an amount of 10% to 30% by weight, preferably of 15% to 30% by weight and more preferably of 15% to 25% by weight.

5. Composition as claimed in claim 1 or 2, wherein said oxidizing agent (A) consists of potassium or sodium isocyanurate dichloride in an amount of 20% to 40% by weight, preferably of 25% to 40% by weight and more preferably of 30% to 40% by weight.

6. Composition as claimed in one or more of the preceding claims, wherein said alkalinizing agent (B) comprises at least one compound chosen among the group consisting of: sodium or potassium phosphates, sodium or potassium silicates, sodium or potassium carbonates, sodium or potassium hydroxide or a mixture of two or more thereof.

7. Composition as claimed in one or more of the preceding claims, wherein said alkalinizing agent (B) comprises sodium or potassium triphosphate.

8. Composition as claimed in one or more of the preceding claims, wherein said oxidizing agent (A) is equal to or more than 15% by weight, said alkalizing agent (B) being more than 15% by weight, preferably more than 20% by weight and more preferably more than 25% by weight.

9. Composition as claimed in one or more of the preceding claims, wherein said at least one inorganic filler (C) is chosen among the group consisting of sodium or potassium anhydrous sulphate, sodium or potassium chloride, ammonium difluoride, sodium or potassium silicate, magnesium sulphate, or a mixture of two or more thereof.

10. Composition as claimed in one or more of the preceding claims, wherein said suspending agent (D) is chosen among the group consisting of:

carboxymethylcellulose, cellulose acetate, proteic substances, vinylpolymers or a mixture of two or more thereof.

11. Composition as claimed in the preceding claim, wherein said surfactant (E) is 0,1% to 7%, preferably 2% to 7% based on the total weight of the composition.

12. Composition as claimed in one or more of the preceding claims, wherein said surfactant (E) is chosen among the group consisting of: alkylpolyglycoside, sodium lauryl sulfate, sodium alkyl sulfonate, sodium alkyl aryl Sulfonate, sodium laureth sulfate, or a mixture of two or more thereof.

13. A decontamination/detoxification aqueous solution comprising a solid phase consisting of the composition as claimed in one or more of the preceding claims.

14. The use of the composition according to one or more of claims 1 to 12 or the aqueous solution according to claim 13 for the detoxification/decontamination of surfaces polluted by toxic and/or pathogenic chemical and/or biological substances.

15. The use of the composition according to one or more of claims 1 to 12 or the aqueous solution according to claim 13 for the decontamination of surfaces polluted by nuclear and/or radiological particles.



EUROPEAN SEARCH REPORT

Application Number
EP 10 00 4907

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 27 43 910 A1 (STAUFFER CHEMICAL CO) 27 April 1978 (1978-04-27)	1-14	INV. G21F9/00
A	* page 1, line 1 - page 13, last line * -----	15	C23G1/14 C11D3/08
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 August 2011	Examiner Lohberger, Severin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 00 4907

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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25-08-2011

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