Claims

1. A surface-treated calcium carbonate for binding and bioremediating hydrocarbon-containing compositions having a degradation rate for the hydrocarbon-containing composition of at least 25 %, based on the total weight of the hydrocarbon-containing composition, wherein at least 10 % of the aliphatic carboxylic acid accessible surface area of the calcium carbonate is covered by a coating comprising at least one aliphatic carboxylic acid having between 5 and 24 carbon atoms and/or reaction products thereof.

2. The surface-treated calcium carbonate according to claim 1, wherein the surface-treated calcium carbonate comprises ground calcium carbonate and/or precipitated calcium carbonate and/or surface-modified calcium carbonate, preferably ground calcium carbonate.

3. The surface-treated calcium carbonate according to claim 2, wherein the source of ground calcium carbonate (GCC) is selected from marble, chalk, calcite, dolomite, limestone and mixtures thereof and/or the precipitated calcium carbonate (PCC) is selected from one or more of the aragonitic, vateritic and calcitic mineralogical crystal forms.

4. The surface-treated calcium carbonate according to any one of claims 1 to 3, wherein the surface-treated calcium carbonate has a weight median particle diameter $d_{50}$ value of between 0.1 μm and 250 μm, preferably between 1 μm and 200 μm, more preferably between 1 μm and 150 μm, even more preferably between 1 μm and 100 μm and most preferably between 3 μm and 100 μm.

5. The surface-treated calcium carbonate according to any one of claims 1 to 4, wherein the coating of the surface-treated calcium carbonate comprises at least one aliphatic carboxylic acid selected from the group consisting of pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, lauric acid, tridecanoic acid, myristic acid, pentadecanoic acid, palmitic acid, heptadecanoic acid, stearic acid, nonadecanoic acid, arachidic acid, heneicosylic acid, behenic acid, tricosylic acid, lignoceric acid and mixtures thereof, preferably the aliphatic carboxylic acid is selected from the group consisting of octanoic acid, decanoic acid, lauric acid, myristic acid, palmitic acid, stearic acid, arachidic acid and mixtures thereof and most preferably the aliphatic carboxylic acid is selected from the group consisting of myristic acid, palmitic acid, stearic acid and mixtures thereof.

6. The surface-treated calcium carbonate according to any one of claims 1 to 5, wherein at least 20 % of the aliphatic carboxylic acid accessible surface area of the calcium carbonate is covered by a coating comprising at least one aliphatic carboxylic acid and/or reaction products thereof and preferably at least 30 % of the accessible surface area and most preferably at least 50 % of the accessible surface area.

7. The surface-treated calcium carbonate according to any one of claims 1 to 6, wherein the surface-treated calcium carbonate further comprises at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition.

8. The surface-treated calcium carbonate according to claim 7, wherein the surface-treated calcium carbonate is immobilized with at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition.

9. The surface-treated calcium carbonate according to any one of claims 7 or 8, wherein the at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition is selected from at least one strain of bacteria and/or fungi.

10. The surface-treated calcium carbonate according to any one of claims 9, wherein the at least one strain of bacteria and/or fungi is at least one strain of petroleum-degrading bacteria and/or petroleum-degrading fungi.

11. The surface-treated calcium carbonate according to any one of claims 9 or 10, wherein the at least one strain of bacteria is selected from the group comprising *Psychrobacter, Pseudomonas, Pseudobacterium, Acinetobacter, Vibrio, Planococcus, Actinobacterium, Arthrobacter, Marinobacter, Methylosinus, Methylomonas, Methylobacterium, Mycobacterium, Nocardia, Bacillus, Brevibacterium, Micrococcus, Corynebacterium, Sarcina, Streptomyces, Flavobacterium, Xanthomonas* and mixtures thereof, more preferably are selected from the group comprising *Psychrobacter glacincola*, *Acinetobacter calcoaceticus*, *Acinetobacter faecalis* and mixtures thereof.

12. The surface-treated calcium carbonate according to any one of claims 1 to 11, wherein the surface-treated calcium carbonate is in powder form and/or in the form of granules or in the form of slurry.

13. The surface-treated calcium carbonate according to any one of claims 1 to 12, wherein the surface-treated calcium carbonate is incorporated in a nonwoven fabric, preferably the surface-treated calcium carbonate is incorporated in a biodegradable nonwoven fabric.

14. A method for binding and bioremediating hydrocarbon-containing compositions, comprising the following steps:

a) providing a hydrocarbon-containing composition;

b) providing at least one surface-treated calcium carbonate according to any one of claims 1 to 13; and

c) contacting the hydrocarbon-containing composition of step a) with the surface-treated calcium carbonate of step b) for obtaining a composite material of surface-treated calcium carbonate and hydrocarbon-containing composition.

15. The method according to claim 14, wherein the hydrocarbon-containing composition is crude oil and/or a refined petroleum product selected from the group comprising gasoline, diesel fuel, aviation fuel, hydraulic oil, kerosene and mixtures thereof.

16. The method according to any one of claims 14 or 15, wherein step c) is carried out by at least partially covering the surface of the hydrocarbon-containing composition of step a) with the surface-treated calcium carbonate of step b) and/or mixing the hydrocarbon-containing composition of step a) with the surface-treated calcium carbonate of step b).

17. The method according to any one of claims 14 to 16, wherein step c) is carried out in that the weight ratio of hydrocarbon-containing composition and surface-treated calcium carbonate is from 10:1 to 1:100, more preferably from 1:1 to 1:50, even more preferably from 1:1 to 1:25 and most preferably from 1:1 to 1:15.

18. The method according to any one of claims 14 to 17, wherein the method further comprises step d) of contacting the composite material obtained in step c) with a composition comprising at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition.

19. The method according to claim 18, wherein the at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition is selected from at least one strain of bacteria and/or fungi.

20. The method according to claim 19, wherein the at least one strain of bacteria is selected from the group comprising *Psychrobacter, Pseudomonas, Pseudobacterium, Acinetobacter, Vibrio, Planococcus, Actinobacterium, Arthrobacter, Marinobacter, Methylosinus, Methylomonas, Methylobacterium, Mycobacterium, Nocardia, Bacillus, Brevibacterium, Micrococcus, Corynebacterium, Sarcina, Streptomyces, Flavobacterium, Xanthomonas* and mixtures thereof, more preferably is selected from the group comprising *Psychrobacter glacincola*, *Acinetobacter calcoaceticus*, *Acinetobacter faecalis* and mixtures thereof.

21. The method according to any one of claims 18 to 20, wherein step c) and step d) are carried out simultaneously or separately.

22. The method according to any one of claims 14 to 21 wherein step c) and/or step d) are repeated one or more times.

23. Use of surface-treated calcium carbonate according to any one of the claims 1 to 13 for binding and bioremediating hydrocarbon-containing compositions.

24. The use according to claim 23, wherein the surface-treated calcium carbonate is used in soil, sea water, ground water, flat water, shore lines, containers and/or reservoirs.

25. A composite material comprising the surface-treated calcium carbonate according to any one of the claims 1 to 13 and a hydrocarbon-containing composition.

# Claims

1. A composition comprising surface-treated calcium carbonate having a weight median particle diameter $d_{50}$ value of between 0.1 μm and 250 μm for binding and bioremediating hydrocarbon-containing compositions having a degradation rate for the hydrocarbon-containing composition of at least 25 %, based on the total weight of the hydrocarbon-containing composition, wherein at least 10 % of the aliphatic carboxylic acid accessible surface area of the calcium carbonate is covered by a coating comprising at least one aliphatic carboxylic acid having between 5 and 24 carbon atoms, and wherein the surface-treated calcium carbonate further comprises at least one microorganisms capable of degrading at least one component of the hydrocarbon-containing composition.

2. The composition comprising surface-treated calcium carbonate according to claim 1, wherein the surface-treated calcium carbonate comprises ground calcium carbonate and/or precipitated calcium carbonate and/or surface-modified calcium carbonate.

3. The composition comprising surface-treated calcium carbonate according to claim 2, wherein the source of ground calcium carbonate (GCC) is selected from marble, chalk, calcite, dolomite, limestone and mixtures thereof and/or the precipitated calcium carbonate (PCC) is selected from one or more of the aragonitic, vateritic and calcitic mineralogical crystal forms.

4. The composition comprising surface-treated calcium carbonateaccording to any one of claims 1 to 3, wherein the coating of the surface-treated calcium carbonate comprises at least one aliphatic carboxylic acid selected from the group consisting of pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, lauric acid, tridecanoic acid, myristic acid, pentadecanoic acid, palmitic acid, heptadecanoic acid, stearic acid,

nonadecanoic acid, arachidic acid, heneicosylic acid, behenic acid, tricosylic acid, lignoceric acid and mixtures thereof.

5. The composition comprising surface-treated calcium carbonateaccording to any one of claims 1 to 4, wherein at least 20 % of the aliphatic carboxylic acid accessible surface area of the calcium carbonate is covered by a coating comprising at least one aliphatic carboxylic acid.

6. The composition comprising surface-treated calcium carbonate according to claim 5, wherein the surface-treated calcium carbonate is immobilized with at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition.

7. The composition comprising surface-treated calcium carbonate according to any one of claims 1 or 6, wherein the at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition is selected from at least one strain of bacteria and/or fungi.

8. The composition comprising surface-treated calcium carbonate according to claim 7, wherein the at least one strain of bacteria and/or fungi is at least one strain of petroleum-degrading bacteria and/or petroleum-degrading fungi.

9. The composition comprising surface-treated calcium carbonateaccording to any one of claims 7 or 8, wherein the at least one strain of bacteria is selected from the group comprising *Psychrobacter, Pseudomonas, Pseudobacterium, Acinetobacter, Vibrio, Planococcus, Actinobacterium, Arthrobacter, Marinobacter, Methylosinus, Methylomonas, Methylobacterium, Mycobacterium,*

*Nocardia, Bacillus, Brevibacterium, Micrococcus, Corynebacterium, Sarcina, Streptomyces, Flavobacterium, Xanthomonas* and mixtures thereof.

10. The composition comprising surface-treated calcium carbonate according to any one of claims 1 to 9, wherein the composition is in powder form and/or in the form of granules or in the form of slurry.

11. The composition comprising surface-treated calcium carbonateaccording to any one of claims 1 to 10, wherein the composition is impregnated in a nonwoven fabric.

12. A method for binding and bioremediating hydrocarbon-containing compositions, comprising the following steps:

d) providing a hydrocarbon-containing composition;
e) providing a composition comprising surface-treated calcium carbonate according to any one of claims 1 to 11; and
f) contacting the hydrocarbon-containing composition of step a) with the surface-treated calcium carbonate in the composition of step b) for obtaining a composite material of surface-treated calcium carbonate and hydrocarbon-containing composition.

13. The method according to claim 12, wherein the hydrocarbon-containing composition is crude oil and/or a refined petroleum product selected from the group comprising gasoline, diesel fuel, aviation fuel, hydraulic oil, kerosene and mixtures thereof.

14. The method according to any one of claims 12 or 13, wherein step c) is carried out by at least partially covering the surface of the hydrocarbon-

containing composition of step a) with the surface-treated calcium carbonate in the composition of step b) and/or mixing the hydrocarbon-containing composition of step a) with the surface-treated calcium carbonate in the composition of step b).

15. The method according to any one of claims 12 to 14, wherein step c) is carried out in that the weight ratio of hydrocarbon-containing composition and surface-treated calcium carbonate is from 10:1 to 1:100.

16. The method according to any one of claims 12 to 15, wherein the method further comprises step d) of contacting the composite material obtained in step c) with a composition comprising at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition.

17. The method according to claim 16, wherein the at least one microorganism capable of degrading at least one component of the hydrocarbon-containing composition is selected from at least one strain of bacteria and/or fungi.

18. The method according to claim 17, wherein the at least one strain of bacteria is selected from the group comprising *Psychrobacter, Pseudomonas, Pseudobacterium, Acinetobacter, Vibrio, Planococcus, Actinobacterium, Arthrobacter, Marinobacter, Methylosinus, Methylomonas, Methylobacterium, Mycobacterium, Nocardia, Bacillus, Brevibacterium, Micrococcus, Corynebacterium, Sarcina, Streptomyces, Flavobacterium, Xanthomonas* and mixtures thereof.

19. The method according to any one of claims 16 to 18, wherein step c) and step d) are carried out simultaneously or separately.

20. The method according to any one of claims 16 to 19 wherein step c) and/or step d) are repeated one or more times.

21. Use of composition comprising surface-treated calcium carbonate according to any one of the claims 1 to 11 for binding and bioremediating hydrocarbon-containing compositions.

22. The use according to claim 21, wherein the composition comprising surface-treated calcium carbonate is used in soil, sea water, ground water, flat water, shore lines, containers and/or reservoirs.

23. A composite material comprising the surface-treated calcium carbonate in the composition according to any one of the claims 1 to 11 and a hydrocarbon-containing composition.