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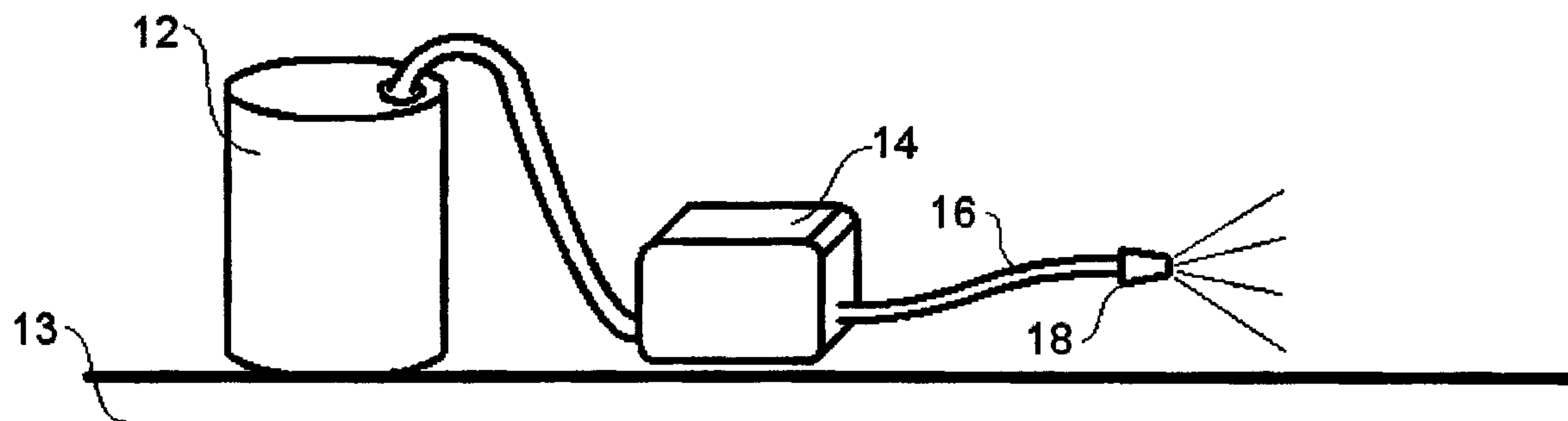
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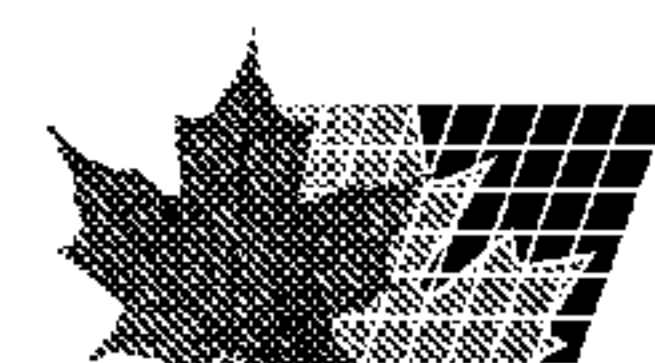
(54) Titre : METHODE D'ELIMINATION DE CONTAMINANTS AU MOYEN D'ORGANISMES D'ORIGINE NATURELLE

(54) Title: METHOD OF REMEDIATION OF CONTAMINANTS USING NATURALLY OCCURING ORGANISMS



(57) **Abrégé/Abstract:**

A method of remediation of contaminants is described, which uses naturally occurring organisms. A first step involves determining that a substrate containing naturally occurring organisms is contaminated. A second step involves applying an aqueous solvent solution to the substrate. The solvent solution must have known properties of disrupting the substrate and contaminant interface. The solvent solution is applied in concentrations within a range of approximately 3% to 7%, so as to render the contaminants more accessible to naturally occurring organisms in the substrate, without killing the naturally occurring organisms. A third step involves monitoring the activities of the naturally occurring organisms and applying further applications of the solvent solution at intervals, as required, until the contaminants in the substrate are reduced to acceptable levels.



ABSTRACT OF THE DISCLOSURE

A method of remediation of contaminants is described, which uses naturally occurring organisms. A first step involves determining that a substrate containing naturally occurring organisms is contaminated. A second step involves applying an aqueous solvent solution to the substrate. The solvent solution must have known properties of disrupting the substrate and contaminant interface. The solvent solution is applied in concentrations within a range of approximately 3% to 7%, so as to render the contaminants more accessible to naturally occurring organisms in the substrate, without killing the naturally occurring organisms. A third step involves monitoring the activities of the naturally occurring organisms and applying further applications of the solvent solution at intervals, as required, until the contaminants in the substrate are reduced to acceptable levels.

TITLE OF THE INVENTION:

Method of remediation of contaminants using naturally occurring organisms

FIELD OF THE INVENTION

5 The present invention relates to a method of remediation of contaminants using naturally occurring organisms that reside in substrates, such as soil or water.

BACKGROUND OF THE INVENTION

10 Healthy soil is teeming with microscopic organisms. When a hydrocarbon spill occurs, there are organisms in the soil that are capable of breaking down and assimilating the hydrocarbon. A problem that arises is that, left to natural processes, this breakdown could potentially take years. Regulatory authorities are not prepared to wait years for contaminated soil to be remediated, nor are property owners. The most common form of site "remediation", therefore, consists of removing the contaminated soil and having it hauled to a disposal site.

15 This form of "remediation" merely serves to transfer the contamination problem to a different site.

 There are solvents with properties which facilitate assimilation of hydrocarbons from soils. An example of such a solvent is described in Canadian patent 2,059,488 (Fandrick

20 1999). The solvent is manufactured by Shac Environmental Products Inc. and sold under the Trade Mark "SHAC". SHAC was originally developed as an oven cleaner, due to its ability to remove hydrocarbon based grease from ovens. In order to be effective for hydrocarbon extraction from soil, solvents, such as SHAC, must be placed in concentrated form into the soil. For example, the Fandrick patent claims that SHAC should be placed in an aqueous

25 solution in concentrations within a range of 21% to 36%. In such concentrations, the solvent will tend to overwhelm organisms in the soil.

SUMMARY OF THE INVENTION

 According to the present invention there is provided a method of remediation of

30 contaminants using naturally occurring organisms. A first step involves determining that a substrate containing naturally occurring organisms is contaminated and the extent of the contamination. A second step involves applying an aqueous solvent solution to the substrate.

The solvent solution must have known properties of disrupting and purging the contaminant leaving easy access of natural microbes to the contaminated area. The solvent solution is applied in concentrations within a range of approximately 3% to 7%, so as to render the contaminants more accessible to naturally occurring organisms in the substrate, without
5 killing the naturally occurring organisms. A third step involves monitoring the activities of the naturally occurring organisms and applying further applications of the solvent solution at intervals, as required, until contaminants in the substrate are reduced to acceptable levels.

BRIEF DESCRIPTION OF THE DRAWINGS

10 These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

FIGURE 1 is a schematic flow diagram outlining the steps in the method of
15 remediation of contaminants in accordance with the teachings of the present invention.

FIGURE 2 is another schematic flow diagram outlining the steps in the method of remediation of contaminants using different means than those shown in FIGURE 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

20 The preferred method of remediation of contaminants using naturally occurring organisms will now be described with reference to FIGURES 1 and 2.

A first step involves determining that soil is contaminated. Common contaminants which may be remediated using this method include, but are not limited to: BTEX, solvents,
25 oil well drilling mud, herbicides, alcohols, ketones, acids, esters, amines, pesticides, crude oils, mineral oils, petroleum, synthetic oils, crude oil fractions, diesel, kerosene, fuel oil, gasoline, motor oil, lubricants, transmission fluid, hydraulic fluid, oil sands and a variety oils and hydrocarbons.

30 Referring to FIGURES 1 and 2, a second step involves applying an aqueous solvent solution 12 to the soil 13. The solvent solution must have known properties of disrupting the soil and contaminant interface. The solvent solution is applied in concentrations within a

range of approximately 3% to 7%, so as to render the contaminant more accessible to naturally occurring organisms in the soil, without killing the naturally occurring organisms.

5 A third step involves monitoring the activities of the naturally occurring organisms and applying further applications of the solvent solution at intervals, as required, until the contaminants in the soil are reduced to acceptable levels.

There will now be described a number of examples. For all of the examples, the solvent solution used was SHAC. As described in Canadian Patent 2,059,488, SHAC
10 consists of a hydrogen peroxide with an alkali metal hydroxide.

Example # 1 – Surface contamination

The entire contents of a diesel fuel tanker truck spilled into a drainage ditch. The fuel flowed along the drainage ditch into a pond, which was located approximately 150
15 meters from the site of the original spill. The contamination levels at the site were determined to be 3140 parts per million of C10-C40. Referring to **FIGURE 1**, a 5% solution 12 of SHAC mixed with water was sprayed along the drainage ditch, using a pump 14, hose 16 and nozzle 18. A second application of SHAC was applied a few days after the first application. A third application of SHAC was applied a week after the
20 second application. At the end of twelve weeks, contamination levels at the site were determined to be 102 parts per million.

Example #2 – Subsurface contamination

A site had subsurface contamination by Diesel fuel in clays located 30 inches to 38
25 inches below surface. The contamination at the site was determined to be 19,005 parts per million of C10-C50. Referring to **FIGURE 2**, injection holes 20 were made and an aqueous 3% solution 12 of SHAC and water was injected. A second application was injected 30 days later. By the end of seventeen weeks, contamination at the site was determined to be 2500 parts per million. A third application was applied and monitoring
30 of the site continues.

Example #3 – Drilling mud

There was an accumulation of invert drilling mud at a drilling site. A trench two feet deep was dug and the invert drilling mud was placed in the trench. The contamination level was determined to be 209,662 parts per million of C10-C50. A 5% aqueous solution of SHAC and water was applied by both surface application and subsurface injection. After seven weeks the contamination level was determined to be 16,000 parts per million. A second application was applied and monitoring of the site continues.

The method, as described above, is used first to extract contaminants and then to remediate those contaminants which remain. It can also be used for remediation in situ without extraction. It is used to remediate contaminants from soils. However, it can also be used to remediate contaminants from non-flowing bodies of water or other substrates in which naturally occurring organisms reside.

In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

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It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

What is Claimed is:

1. A method, comprising the steps of:
 - 5 determining that a substrate having naturally occurring organisms is contaminated;
applying an aqueous solvent solution to the substrate, the solvent solution having known properties of disrupting the substrate and contaminant interface, the solvent solution being applied in concentrations within a range of approximately 3% to 7% so as to render the contaminants more accessible to naturally occurring organisms in the substrate, without
10 killing the naturally occurring organisms;
monitoring the activities of the naturally occurring organisms and applying further applications of the solvent solution at intervals, as required, until the contaminants in the substrate are reduced to acceptable levels.
- 15 2. The method as defined in Claim 1, wherein the substrate is soil.
3. The method as defined in Claim 1, wherein the substrate is a non-flowing body of water.
4. The method as defined in Claim 1, wherein the contaminant is a hydrocarbon.
- 20 5. The method as defined in Claim 1, wherein the solvent solution consists of a hydrogen peroxide with an alkali metal hydroxide.
6. A method, comprising the steps of:
 - 25 determining that soil having naturally occurring organisms is contaminated by a hydrocarbon;
applying an aqueous solvent solution consisting of a hydrogen peroxide with an alkali metal hydroxide to the soil, the solvent solution having known properties of disrupting the soil and hydrocarbon interface, the solvent solution being applied in concentrations within a
30 range of approximately 3% to 7% so as to render the hydrocarbons more accessible to naturally occurring organisms in the soil, without killing the naturally occurring organisms;
monitoring the activities of the naturally occurring organisms and applying further

applications of the solvent solution at intervals, as required, until the hydrocarbons in the soil are reduced to acceptable levels.

