

PATENT SPECIFICATION

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(54) METHOD OF COLLECTING OIL FROM THE SURFACE OF WATER

(71) We, IKEDA BUSSAN COMPANY, LIMITED, of 1-3, Higashikawashima-cho, Hodogaya-ku, Yokohama-shi, Kanawaga-ken, Japan, a joint-stock company organised under the laws of Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of collecting oil from the surface of water.

Various kinds of materials have hitherto been employed as oleospecific absorbents for rapidly removing effluents such as crude oil, heavy oil and other oily substances which may flow out of an oil tanker or a tanker lorry, etc., in the course of transportation by sea or overland, so as to avoid consequent pollution problems.

The above-mentioned oleospecific absorbing materials which have been used include straw, synthetic resin foams such as fibrous polymeric materials or polyurethane, and expanded perlite. Straw and perlite can be obtained cheaply but are defective in oil-absorbing ability, while polymerized fibres or the synthetic resin foams are too expensive to be used as oil-absorbing materials for removing economically a large amount of oil floating on the water, and also have the defect that if they are burnt after having been used they generate harmful gases, thus causing secondary pollution problems and other difficulties.

According to the present invention there is provided a method of collecting oil from the surface of water, wherein the oil is collected

using an oil absorbing material which comprises coir dust, as hereinafter defined, taken from husks of coconuts.

In the accompanying drawings:

Fig. 1 is a partially cutaway perspective view of an oleospecific absorbing material for use in the present invention, which is a porous substance covered with oil permeable material;

Fig. 2 is a partially cutaway perspective view of an oleospecific absorbing material for use in the present invention, showing a porous substance covered with an oil permeable material;

Fig. 3 is a perspective view of an oleospecific absorbing material for use in the present invention, which is a layered fibrous material covered on the outer periphery thereof with oil permeable material;

Fig. 4 is a vertical sectional view taken along the line IV—IV of Fig. 3;

Fig. 5 is a vertical sectional view of a modified embodiment of the oleospecific absorbing material shown in Fig. 3;

Fig. 6 is a vertical sectional view of another modified embodiment of the oleospecific absorbing material shown in Fig. 3;

Fig. 7 is a perspective view of an oil absorbing apparatus;

Fig. 8 is a vertical sectional view taken along the line VIII—VIII of Fig. 7;

Fig. 9 is a longitudinal sectional view of the apparatus shown in Fig. 7 in a form of a modified embodiment;

Fig. 10 is a longitudinal sectional view of the apparatus shown in Fig. 7 in the form of another embodiment;

Fig. 11 is a longitudinal sectional view of

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another oil absorbing apparatus; and
 Fig. 12 is a longitudinal sectional view of
 modification of the apparatus shown in Fig.
 11.

5 The "coir dust" used in the present inven-
 tion is produced in large quantities in the
 course of treating the husks of coconuts, for
 example in retting the husks of coconuts in
 water manually or by machine in order to
 10 separate fibre therefrom. The term "coir dust"
 is used herein to denote the material which
 can be derived as waste material from the
 husks of coconuts in the course of separating
 coir. It is to be understood, however, that
 15 the term "coir dust" refers to the material
 as such and is not restricted to any particular
 method of obtaining the material. The coir

dust is a mixture of particles of various irregu-
 lar shapes, and may include small lumps
 having dimensions ranging from about 8 to 10
 20 mm, particles having dimensions of about 5
 mm and fine pulverulent material having
 dimensions of less than 1 mm. The coir
 dust has an apparent specific gravity ranging
 from about 0.05 to 0.1 g/ml which is sub-
 25 jected to a sieve analysis test for screening
 the dust into fine pulverulent material having
 a grain size of less than about 1 mm and
 granulated material having a grain size ranging
 from about 1 to 3 mm.

The results of observing the property of
 each fraction of the screened dust are indicated
 in the following table.

Sample	Bulk Specific Gravity (g/ml)	True Specific Gravity (g/ml)	Net Volume (ml/g)	All Fine Pore Capacity (ml/g)	Distribution of Fine Pores			Space Capacity (ml/g)
					Calib 0.003- 0.02 μ	Calib 0.02- 0.1 μ	Calib 1.0- 100 μ	
Grain Size below 1 mm.	0.0964	0.72	1.389	5.0	0.46	0.16	4.38	3.774
Grain Size 1 - 3 mm.	0.0322	1.45	0.690	6.0	0.28	0.34	5.38	9.387

35 The coir dust thus obtained by separating
 coir from the husk of coconuts can be used
 without further treatment, or can be used
 after the grain size thereof being made
 uniform by screening or by a preparatory
 40 grinding step followed by screening. The coir

dust may include coir to be mixed therewith,
 so that the husk of coconut can directly be
 ground or cut to a proper shape and dimen-
 sion. Preferably the grain size of the coir dust
 is in the range of from 0.5-3 mm.

The coir dust for use in the invention can

be obtained cheaply in large quantities as a by-product when coir is removed from the husks of coconuts in the production of copra.

The coir dust may be made water repellent by impregnating it with a suitable hydrophobic material in an appropriate quantity. Such an impregnation process has been found to improve the absorption of oil from water. The amount of impregnated hydrophobic material is preferably in the range of from 0.5 to 200% by weight based on the weight of coir dust, more preferably in the range of from 2% to 50% by weight.

Suitable hydrophobic materials include mineral oils such as naphtha, kerosene, light oil, paraffin, heavy oil, crude oil and asphalt, surface active agents having oleophilic properties as well as hydrophobic properties, animal and vegetable oils, fats and waxes, fatty acids, metallic soaps and silicones. The hydrophobic material can be impregnated in an appropriate amount thereof into the coir dust by spraying, or the coir dust may be dipped into the hydrophobic material and then excess hydrophobic material can be removed by placing the impregnated material on a mesh or the like for a certain period of time, or by compressing it. Further ways of carrying out impregnation is to vapourise the hydrophobic material on to the coir dust. The coir dust may previously be dried, if it contains water, at a temperature of from 50 to 200°C, and subsequently impregnated with hydrophobic material.

In an experimental test on coir dust, one sample of which had been subjected to a water repelling treatment and another sample of which had not been so treated, the amount of mineral oil absorbed by each sample was between 5 and 20 times its own weight, but the amount of water absorbed by the latter was found to be about 2 to 3 times its own weight, whereas while amounts of water absorbed by the former was about one half of the amount absorbed by the latter.

Stalks of Indian corns or kaoliangs as well as husks of peanuts or the like may be mixed with the coir dust, as may porous mineral substances.

Oil absorbing material comprising the coir dust can be scattered in an appropriate quantity over mineral oil, etc., such as heavy oil and the like floating on the sea or other stretch of water, so as to absorb the oil rapidly. As used below the term "oil absorbing material" is to be understood as referring to an oil absorbing material which comprises coir dust. Particles of the oil absorbing material laden with oil agglomerate and thus are neither scattered about nor sunk into the water. The oil absorbed agglomerates can be easily collected, for example by a scoop, and transported for dumping to a location where they will not cause pollution, or they can be readily disposed of by burning, since the coir

dust is a vegetable material and will not cause any secondary pollution problem by generating harmful gases.

If desired the oil absorbing material with the oil therein may be subjected to treatment with a centrifugal separator or a compressor to separate the oil for salvage. The oil absorbing material is capable of absorbing oil contained in waste water or the like in an emulsion state.

The oil absorbable material may be enveloped within an oil permeable sheathing material such as, for instance, a bag made of woven fabric, nonwoven fabric, knitted cloth, metal, fibre, or plastics net, or synthetic resin film, each of which is formed with textures, stitches, pores or clearances, but which is impermeable to the oil absorbing material enveloped in the bag.

Figs. 1 and 2 respectively show a collector in a form of a mat in Fig. 1 and in a form of a pillow in Fig. 2, each of which is filled with coir dust 1 having a diameter of more than 1 mm enveloped in a sheathing material 2 made of lawn. Since the collectors are able to float moderately on the water surface, they are thrown on the oil layers, the number of collectors used being determined by the quantity of effluent oil or suspended oil and by the area over which the oil to be collected has spread. Also, the collectors may be joined to one another in large numbers to form an oil fence to prevent spreading of oil in mid-ocean or on other stretches of water as well as to collect by absorption the floating oil which is enclosed by the fence.

If the collectors are formed into an oil fence with gaps between adjacent collectors, these gaps may be blocked with shield plates. The collectors with the oil absorbed therein are gathered to be disposed of either together with the sheathing material or after having been taken out therefrom.

Another type of collector may be made in a form of a structure comprising oil absorbing material retained in fibrous layers. The outer surface of the fibrous layered structure may be encompassed by the above-mentioned oil permeable sheathing bag.

Fibres forming the fibrous layered structure may include natural fibres such as animal, vegetable and mineral fibres, and man-made fibres such as inorganic fibres, regenerated fibres or synthetic fibres. Among the above-mentioned fibres, fibres having a high rigidity and elasticity are preferred. Such fibres include coconut fibres, hemp-palm fibres, and fibres which are made of nylon or polyvinylidene chloride and which have a relatively large diameter.

In a modification of the fibrous layered structure described above at least the cross-bridging parts of fibres are adhered by a bonding agent. Also, the oil absorbing material may be adhered to the fibres at the surface

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thereof by a bonding agent.

A collector having fibrous layers has an excellent oil absorbing ability.

5 Figs. 3 and 4, Fig. 5 and Fig. 6, each show a collector 14 in the form of an elongate mat for absorbing oil, which is produced as follows. Coconut fibres are mixed with about 10 160—170 g of rubber latex containing solid component in an amount of about 50% to 100 g of the fibres. The mixture is spread uniformly over a calico cloth 12 to form an even fibrous layer 13 having a bulk density of from 300 to 350 g/m³, and is subjected to a pre-heating process at a temperature of 15 70 to 80°C to reduce the fibrous layer to a thickness of from 20 to 30 mm. Coir dust 11 is introduced in an amount of from 300 to 350 g/m³ into the spaces 13b between the fibres 13a of the fibrous layered material from the upper surface thereof, and a covering layer of calico cloth is then pasted on the fibrous material. The fibrous-layered material is then heated to a temperature of from 100 to 150°C. The collector thus produced may be used as an elongate mat as it is or it may be cut to appropriate dimensions to form a bolster-like shape. Alternatively, the collectors can be made into the form of a large mat having a thickness of about 100 mm, for instance by joining together an appropriate number of collectors by a bonding agent.

20 Figs. 5 and 6 respectively show two embodiments of collector in which the fibrous layered material 13 comprising coir dust therewithin is squeezed at the peripheral portion 15 thereof to further improve the retention therein of the coir dust.

To absorb heavy oil it has been found advantageous to use an apparatus comprising 40 a container having an opening provided with oil absorbing material enveloped in a sheathing bag. The container is thrown on the water where heavy oil is floating thereon so that the oil absorbing material accommodated within the container is in contact with the floating layer of heavy oil. The oil absorbing material is capable of absorbing the heavy oil at the rate of about 600—1000l per 1 m² of the oil absorbing material for 1 to 60 sec. depending on the packing density of the oil absorbing material. When this material is saturated with oil, the heavy oil starts to drip from the material into a space at the bottom of the container and the oil absorbing material can continue to absorb floating heavy oil until the above mentioned space is subsequently full of oil.

55 Figs. 7 and 8 show such an apparatus 26 which comprises a container 22 closed at its bottom, except for a valved outlet, and made of sheet iron or synthetic resin. The upper part of the container 22 is fixedly covered with a perforated sheet 23a, on the top surface of which is spread a woven fabric 24a which is impermeable to particles of oil absorbing

material which forms a layer 21 of porous material having a thickness of from 180 to 200 mm. On the upper surface of the layer 21 another woven fabric 24b is laid over the layer 21 and then another perforated sheet 23b is placed over the woven fabric 24b and detachably fitted to the peripheral inner surface of the container 22 through stop members 25. The apparatus 26 is further provided with pieces or strips 27 of string, wire or other material which are effective for leading oil from the layer 21 into a space 22a in the container 22 when the layer 21 becomes saturated with absorbed oil.

70 The apparatus 26 is provided with a suitable buoyancy adjusting means in the form of a weight 28 suspended from the lower surface of the container. Thus, when the oil collecting apparatus in use, the layer 21 is constantly kept in contact with the layer of floating oil. The container 22 is provided at the outer periphery thereof with catch ring members 29 which serve as supports when handling the container in case of the container being thrown about in the layer of floating oil, being moored or joined with other like containers, or being landed when the collector is full of absorbed oil. The container has an outlet valve 22b for recovered oil.

80 Fig. 9 shows a modified embodiment of the apparatus which comprises a container 22 closed at the bottom. At the upper peripheral wall 22c round an opening 22d, the container has detachably mounted thereon through fixing members 25 a sheath 24 made of wire netting. The sheath 24 extends upwardly to cover the opening 22d and is filled with a layer 21 of oil absorbing material.

85 Fig. 10 shows an apparatus which comprises a plurality of containers 22 closed at the bottom and a corresponding plurality of supporting frame bodies 23 each extending upwardly from an upper opening 22c of a respective container 22. The outer periphery of each frame body 23 is detachably surrounded with an oil absorbing layer 21 composed of oil absorbing material enveloped by a cloth 24.

90 The containers are joined to one another by catch ring members 29 provided on the outer periphery of the containers and couplings 29a. Thus the apparatus is utilized to form an oil fence and is also effective as an oil collecting apparatus. The numeral 20 indicates a floating oil layer on the body of water and the numeral 20a indicates the recovered oil in the containers 22.

95 Each of the apparatuses 26 mentioned hereinbefore can be used for collecting oil floating on the surface of water.

Fig. 11 shows a collecting apparatus 26a which is similar to the apparatus shown in Figs. 7 to 9 and which is provided within a large-size tank 31. The numeral 31a indicates an outlet valve, the numeral 31b indicates an

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inlet pipe for a mixture of the floating oil and water, and the numeral 30 indicates an oil layer on a body of water 32.

Fig. 12 shows an absorbing and collecting apparatus 26b fixedly provided within a large-size tank 41. The apparatus effects a discharge continuously through an exhaust pipe 22b of oil collected by absorption with the help of the layers 21a of oil absorbing material and stored in the apparatus in the lower part 22a thereof. In this instance, the tank 41 is provided with an inlet port 41a and an exhaust port 41b for feeding in or discharging water to adjust the height of the water surface 42a within the tank and also may be provided with an indication member 43 for maintaining the uppermost surface 40a limit of the oil layer 40 stored in the tank.

WHAT WE CLAIM IS:—

1. A method of collecting oil from the surface of water, wherein the oil is collected using an oil absorbing material which comprises coir dust, as hereinbefore defined, taken from husks of coconuts.

2. A method according to claim 1, in which the coir dust is impregnated with a substance which is hydrophobic and oleophilic.

3. A method according to claim 2, in which

the said substance comprises a petroleum product.

4. A method according to claim 2 or 3, in which the said substance comprises a surface-active agent.

5. A method according to any preceding claim, in which the size of the particles of coir dust is from 0.5 to 3.0 mm.

6. A method according to any preceding claim, wherein the coir dust is surrounded by oil permeable fibrous material.

7. A method according to any preceding claim, in which the oil absorbing material is held in an oil permeable sheathing material.

8. A method according to any preceding claim, in which the oil absorbing material is supported in a container.

9. A method of collecting oil from the surface of water, substantially as herein described with reference to any one of the embodiments shown in the accompanying drawings.

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