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(54) **Title:** HYDROCARBON ABSORBING MATERIALS AND A PROCESS FOR THE PREPARATION THEREOF

(57) **Abstract:** The present invention discloses a composite comprising of absorbents/ natural fillers, highly amorphous hydrophobic polymers and a cross linker for selective absorption of spillages of organic wastes such as hydrocarbons and oil spills while not absorbing or showing poor absorption of water and water based compositions. The invention further provides a process for preparation of said composite thereof.



“HYDROCARBON ABSORBING MATERIALS AND A PROCESS FOR THE PREPARATION THEREOF”

The following specification particularly describes the nature of the inventions and manner in which it is to be performed.

5 Technical field of invention

The present invention relates to a composite comprising of absorbents/ natural fillers, highly amorphous hydrophobic polymers and a cross linker for selective absorption of spillages of organic wastes such as hydrocarbons and oil spills while not absorbing or showing poor absorption of water and water based compositions.

- 10 The invention further relates to a process for preparation of said composite thereof.

Background of invention

The rapid development and industrialization has led to an increase in the use and transportation of liquid hydrocarbons, petroleum products and various other oils.

- 15 Oil discharges inclusive of the accidental spills and running off of oil wastes from the oil drills, automotive, has led to the increased contamination in large areas of land causing serious environmental problems. Oil spills which may be due to leakages in the tankers, collision of ships, sinking of ships, offshore platforms, drilling rigs and wells, as well as spills of refined petroleum products (such as
- 20 gasoline, diesel) and their by-products, heavier fuels used by large ships such as bunker fuel, or the spill of any oily refuse or waste oil in oceans, inland waters, rivers, lakes, beaches, have proved to be catastrophic to marine life, birds, animals and has calamitous effect on the environment. Oil pollution particularly of
- 25 seas, navigable waters, inland waters, rivers, lakes remains a serious concern since crude oil spilt in the marine environment is subjected to invariable weathering conditions such as dispersion, dissolution, evaporation, agglomeration, adsorption, photochemical oxidation which leads to the formation of numerous hazardous

oxygenated compounds thus posing danger to the flora and fauna of the marine life and has adverse effect on human life also.

The behavior of the oil spill and its displacement over time are two important considerations when planning and directing actions aimed at fighting and
5 controlling oil spills in oceans, rivers, lakes and other water bodies. Because of the varying atmospheric and marine conditions at any given time, it is necessary to develop measures for controlling and cleaning of oil spills from the surfaces of water that can withstand various atmospheric challenges and which causes
10 minimum damage to the marine life, is cost effective, are safe and has minimal toxic effects on the operators.

The methods commonly used to remove oil involve oil booms, dispersants, solidifiers, skimmers etc. However, the measures adopted have certain disadvantages such as most of the dispersants possess some level of toxicity and are inflammable, the oil booms and the skimmers used increase the costs of
15 operation.

Absorbents show porosity and ability to absorb oil in the presence of water. The addition of absorbents to oil spill areas facilitates a change from liquid to semi-solid phase which facilitates the easy removal of the oil. These include mineral products such as zeolites, silica, graphite, sorbent clay exfoliated micas, chalk
20 powder etc; synthetic organic products such as polypropylene and polyurethane foams, polyether, fibers of nylon, polyethylene. Organic vegetable products (or natural sorbents) such as straw, corn corb, wood fiber, cotton fiber, cellulosic kapok fiber, kenaf etc. The major disadvantage of synthetic materials is that they degrade very slowly in comparison with mineral or vegetable products and are not
25 as naturally occurring as mineral products, moreover they are costly.

Secondary wood product such as saw dust is widely used for oil absorption. Though abundantly distributed, sawdust has a major disadvantage that it very quickly absorbs water and hence the oil sorption capacity is reduced considerably (Wardley-Smith, 1983). The sorption properties of sawdust are now significantly

improved by making the surface hydrophobic. Various materials and compounds are used such as starch, natural rubber, fatty acids, vegetable oils; polymers for surface modification of saw dust from polar to hydrophobic.

There are various prior arts which describe the composites of wood and hydrophobic material/compounds. Also, methods such as dewaxing, alkali treatment, cyanoethylation, benzylation etc for surface modification are also described.

An article titled "Preparation and Some Mechanical Properties of Composite Materials Made from Sawdust, Cassava Starch and Natural Rubber Latex" by Apusraporn Prompunjai and Waranyou Sridach, published in World Academy of Science, Engineering and Technology 72 2010 discloses the composite materials comprising sawdust, cassava starch and natural rubber (NR) latex. The said article in particular relates to hot compression moulding process to prepare the composites based on cassava starch, NR latex and sawdust and to assess the effect of varying the proportion of these three components on the physicochemical and mechanical properties of composites. The said article is however silent on the oil absorption capacity.

An abstract of the article titled "Interfacial adhesion and molecular diffusion in melt lamination of wood sawdust/ebonite NR and EPDM" by W. Yamsaengsung and N. Sombatsompop published in Polymer Composites, Volume 30, Issue 3, pages 248-256, March 2009 discloses wood/ebonite Natural Rubber-EPDM laminates. Chemical coupling agents: namely; N-(β aminoethyl)- γ -aminopropyl-triethoxysilane (AAS), 3-methacryloxypropyl trimethoxysilane (ACS), and Bis-(3-triethoxypropyl) tetrasulfan (Si69) are introduced into the wood/NR composites.

An article titled "The Curing Characteristics and Mechanical Properties of Wood Sawdust/Carbon Black Filled Ethylene Propylene Diene Rubber Composites" by Prachid Saramolee and Saranyoo Bunloy, published in Walailak J Sci & Tech 2009; 6(2): 255-271 discloses ethylene propylene diene rubber (EPDM) composites prepared by incorporating wood sawdust and carbon black on a 2 roll mill. The

composites of ethylene propylene diene rubber (EPDM) and wood sawdust are used as rubber mudguard application.

US Patent No. 6326070 describes Teflon (polytetrafluoroethylene) coated sawdust in control of oil spills.

- 5 US Patent No. 4925343 relates to oil sweep biodegradable composition constituting a particulate admixture of wood fiber and acid-treated hydrophobic, organophilic water wettable cotton linters for absorbing oil from the surface of oil contaminated water, or land.

10 An article titled "Preparation of Foaming Material and Removal of Machine Oil from Wastewater" by Xiuqi Liu and Heqin Xing published in Fourth International Conference on Intelligent Computation Technology and Automation, 2011 discloses a foaming material for oil adsorption prepared by melting blend and mold pressing, with Ethylene Propylene Diene Monomer (EPDM) as the matrix and waste dusty slag as the filler, wherein the waste dusty slag is iron waste particles derived from gold
15 mines. The article further discloses the use of DCP (Dicumyl peroxide) as crosslinking agent with EPDM.

US Patent No. 6723791 relates to an oil-sorbent composition of styrene-butadiene-styrene (SBS) and ethylene propylene diene monomer (EPDM).

20 An article titled "Treatment of oil spill by sorption technique using fatty acid grafted sawdust" by Shashwat S. Banerjee et al., published in S.S. Banerjee et al. / Chemosphere 64 (2006) 1026-1031, discloses surface modification of sawdust by fatty acids such as oleic acid, stearic acid and decanoic acid and vegetable oils selected from castor oil or mustard oil for oil sorption along with removal of dissolved organic carbon (DOC) present in weathered oil contaminated sea water
25 (WOCS).

Ab Tech sponges which are made of polymeric material are used for cleaning up oils from storm water. However, sponges tend to dissolve in hydrocarbon and are costly.

Oil sorbents composed of natural fibers such as cotton, straw, linen, and jute have been on the market as well. These natural fibers show good oil absorbency, low cost, and easy disposal. However, they possess hydroxyl groups on their surfaces that make them hydrophilic. There are reports of treating the cotton fibers to decrease the hydrophilicity. In an article titled 'Advantages of cotton in cleaning of oil spills' it is disclosed that if the cotton is modified with the help of chemical additives, the soaking property increases, however, the ability to soak up oil decreases with each use.

Cesear [Ceaser, A.V. (1988, October). Oil Spill Absorbent Material. U.S. Patent No. 47805187] documented his work modifying cellulose-based fibers with a metal-ammonium complex, mainly to rid the fiber surface of hydroxyl groups and impart hydrophobic/oleophilic properties. Work has also been done in the area of superhydrophobic cotton and other textiles for commercial use [Xue, C.H., Jia, S.T., Zhang, J., & Tian, L.Q. (2009). Superhydrophobic surfaces on cotton textiles by complex coating of silica nanoparticles and hydrophobization. *Thin Solid Films*, 517, 4593-4598. Ma, M. & Hill, R. M. (2006). Superhydrophobic surfaces. *Current Opinion in Colloid & Interface Science*, 11, 193 - 2028, 9].

Modification by way of self-assembled monolayers produced cotton with water contact angles ranging from 150°-170°, indicating high water repellence [Xue, C.H., Jia, S.T., Zhang, J., & Tian, L.Q. (2009). Superhydrophobic surfaces on cotton textiles by complex coating of silica nanoparticles and hydrophobization. *Thin Solid Films*, 517, 4593-4598].

An article titled 'Hydrophobic cotton fabric coated by a thin nanoparticulate plasma film' by 1.Jing Zhang et.al in *Journal of Applied Polymer Science*, Volume 88, Issue 6, pages 1473-1481 report the audio frequency (AC) plasma of some kind of fluorocarbon chemical that was applied to deposit a nanoparticulate hydrophobic film onto a cotton fabric surface. The article further mentions that post-treatment at a high temperature was conducive to increase the hydrophobicity and the recovery of the water repellency of the plasma-coated fabric after it was washed.

As seen from above, use of the products/materials known for oil sorption have certain limitations for example foam based HC(hydrocarbon) sorbent tend to absorb water along with HC; particulate sorbents like sawdust, not only favor water more than HC owing to their structural composition but are also difficult to collect from open waters, the use of saw dust only shows lower HC-to-water sorption ratio, further collection from open water requires special vehicles thus not preferred on open waters. Moreover, the sorption capacity of certain composites of wood -polymer of prior arts are low; in some cases the oil sorption capacity decreases with increase in foaming agents; the sorbents known in the art tested are not sufficiently oil reactive at acceptable costs; require a costly disposal after being soaked with oil because of transportation to specially selected places for incineration which creates a secondary environmental pollution problem. Further, surface modification of cotton material as known in the art are costly, Moreover, the processes for preparation of composites of wood-polymer employ costly chemicals and are not commercially feasible.

In view of the low cost and eco-friendly nature of natural absorbents including saw dust, cotton fibers combined with the ease with which such fibers could be modified makes them a viable choice for use in oil spill cleanup. However, the present techniques and measures adopted for controlling and removing the oil slick from the surface of water which selectively absorbs hydrocarbon wastes while not absorbing or showing poor absorption of water and water based compositions leaves much to be desired.

Objective of the invention

The main object of the present invention is to provide a composite that selectively absorbs hydrocarbon wastes and oil spillages while not absorbing or showing poor absorption of water and water based compositions.

Another object of the present invention is to provide a composite that absorb the hydrocarbons and oils spilled on the surfaces of land and water.

Another object of the present invention is to provide a composite that favors hydrocarbon sorption only, is readily collectable, floats after absorbing hydrocarbons (HCs), exhibits enhanced mechanical properties i.e. does not leach out HCs, does not crumble upon sorption, is nature friendly and is cheap.

- 5 Yet another object of the present invention is to provide a process for the synthesis of a composite.

Summary of the invention

Accordingly, the present invention provides a composite for absorbing spillages of organic wastes selected from hydrocarbons and oil spills on land or water with no
10 or poor absorption of water and water based compositions, comprising one or more absorbents/natural fillers a highly hydrophobic amorphous polymer and a cross linker, wherein the ratio of polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9.

In one embodiment of the present invention the absorbents/natural fillers are
15 selected from saw dust or cotton fibers.

In an embodiment of the present invention the highly hydrophobic amorphous polymer is selected from ethylene propylene diene monomer (EPDM), cross linked Engage 8400 (XEn) or ethylene-octene comonomer.

In another embodiment of the present invention the cross linker used is, benzoyl
20 peroxide.

In another embodiment of the present invention the amount of cross linker used is not more than 9 wt % of polymer.

In another embodiment of the present invention the composite is structured in forms and shapes selected from pellets, granules, particles, discs, extrudates,
25 pouches, membranes and foamy structures with variable porosity or fused to mats-porous or nonporous sheet.

In another embodiment of the present invention the hydrocarbons and the oil spills on the land surfaces and water comprises natural low-molecular-weight hydrocarbons, polyaromatic hydrocarbons, heterocyclic hydrocarbons, petroleum products, grease and oil from automobiles, waxes, running off of oil wastes from the oil drills, discharges of drilling muds and cuttings, crude oil from tankers, offshore platforms, spilled hydrocarbons from the places where they are stored, dispensed, hydrocarbons from storm water, hydrocarbons spilled on automobile floorings/ under-the -hood applications, garage floorings.

In another embodiment of the present invention the composite provides high hydrocarbon sorption ratio in comparison to water sorption.

In another embodiment of the present invention the hydrocarbons and the oil spills are absorbed from surfaces of land and water.

In another embodiment of the present invention the process for preparation of composite, wherein the said process comprises;

- i. Carrying out melt process of highly hydrophobic amorphous polymer and absorbent/ natural filler followed by crosslinking to obtain the composite which may optionally be coated with the polymer layer; or
- ii. Carrying out solution process of largely hydrophobic amorphous polymer and absorbent/ natural filler followed by crosslinking.

In another embodiment of the present invention the composite is structured in forms and shapes selected from pellets, granules, particles, discs, extrudates, pouches, membranes and foamy structures with variable porosity or fused to mats-porous or nonporous sheet.

In yet another embodiment of the present invention melt process (i) for the preparation of composite- pellet comprises the steps of

- a. melt compounding of highly hydrophobic amorphous polymer and absorbent/ natural filler using a compounder at a temperature

chosen in accordance with the processing temperature of the polymer to obtain the compounds of composite followed by granulating the compound followed by crosslinking with a crosslinker at a temperature chosen in accordance with the activation temperature of crosslinker to obtain pellets of composite,

b. optionally coating of pellets of composite as obtained in step (a) with the polymer layer by dipping the dried pellets in water to obtain controlled pellet swelling followed by drying for a period ranging between 12-48 hours ;

c. dipping the dried pellets as obtained in step (b) in polymer solution in toluene containing cross linker for about a period ranging between 2-10 minutes and draining out excess polymer solution followed by evaporating the solvent at temperature ranging between 20-40°C to obtain first coat;

d. applying a second coat on top of completely dried first coat as obtained in step (c) and subjecting to drying; and

e. heating the double coated swollen pellets at temperature ranging between 135-145°C for a period ranging between 30-120 minutes to ensure crosslinking of polymer coat.

In yet another embodiment of the present invention the solution process(ii) for preparation of composite comprising the steps of ;

i. dispersing filler in polymer solution in toluene containing crosslinker for a period ranging between 10-60 minutes;

ii. casting the dispersed mixture as obtained in step (i) on to a glass plate to obtain 1-1.5 mm thick membrane like film followed by drying at temperature ranging between 20-40°C for a period ranging between 12-48 hours to obtain membrane;

- iii. cross linking polymer by heating the membrane as obtained in step (ii) at temperature ranging between 135-140°C for a period ranging 30-120 minutes under vacuum and cooling;
- iv. dipping in polymer solution in toluene containing crosslinker for a period ranging between 2-3 mins followed by draining excess polymer solution subsequently solvent evaporation at temperature ranging between 20-40°C drying; and
- v. removing the membranes as obtained in step (iv) from the glass plate and further heating to 135-145°C under vacuum for a period ranging between 30-120 minutes to obtain composite.

In still another embodiment of the present invention the ratio of highly hydrophobic amorphous polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9.

In still another embodiment of the present invention the amount of cross linker used is not more than 9 wt % of polymer.

In still another embodiment of the present invention hydrophobic amorphous polymer is selected from the group consisting of ethylene propylene diene monomer (EPDM), cross linked Engage 8400 (XEn) or ethylene-octene comonomer.

In still another embodiment of the present invention absorbent/ natural filler is selected from the group consisting of saw dust or cotton fibers.

In still another embodiment of the present invention cross linker used is benzoyl peroxide.

In still another embodiment of the present invention the process for preparation of absorbent/ natural filler pouch coated with crosslinked polymer, wherein the said process comprising the steps of;

- i. soaking sealed pouch filled with absorbent/ natural filler in polymer solution in toluene containing crosslinker until complete saturation of

absorbent/ natural filler and pouch paper by polymer solution and drying; and

- ii. dipping the dried pouch as obtained in step (i) in polymer solution, drying and heating the pouch in vacuum oven at 135-145°C for a period ranging between 30-120 minutes to obtain absorbent/ natural filler pouch coated with crosslinked polymer.

In still another embodiment of the present invention the ratio of highly hydrophobic amorphous polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9.

- 10 In still another embodiment of the present invention the amount of cross linker used is not more than 9 wt % of polymer.

In still another embodiment of the present invention hydrophobic amorphous polymer is selected from the group consisting of ethylene propylene diene monomer (EPDM), cross linked Engage 8400 (XEn) or ethylene-octene comonomer.

- 15 In still another embodiment of the present invention absorbent/ natural filler is selected from the group consisting of saw dust or cotton fibers.

In still another embodiment of the present invention cross linker used is selected from benzoyl peroxide.

- 20 In still another embodiment of the present invention a method for selective sorption of hydrocarbons and oil spills/slick from land surfaces and water wherein said method consists of laying out or dragging mats/sheets of a composite comprising absorbents/natural fillers, highly hydrophobic amorphous polymer and a cross linker, wherein the ratio of polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9 through the oil spill/slick and allowing a period of 20-30 minutes to absorb said hydrocarbon and oil spills/slick selectively.

In still another embodiment of the present invention use of the composite comprising of absorbents/natural fillers, highly hydrophobic amorphous polymer

and a cross linker for selective absorption of spillages of organic wastes such as hydrocarbons and oil spills with no or poor absorption of water and water based compositions

Detailed description of invention

- 5 The invention will now be described in detail so that various aspects thereof may be more fully understood and appreciated.

The present invention relates to a composite that selectively absorbs hydrocarbon wastes and oil spillages while not absorbing or showing poor absorption of water and water based compositions. The composite of the present invention has good
10 buoyancy and floats after absorption of the hydrocarbons and/or oil for long period and is readily collectable. Further, the composite of the present invention absorbs all types of hydrocarbons and oil from the surfaces of land and water.

The term 'absorption' or 'sorption' referred herein alternatively, means and relates to a process of soaking the contaminants until they run out of the surface
15 area.

The term 'highly hydrophobic amorphous polymer' referred herein means a polymer that does not or minimally absorb water and has greater than 50% amorphous (non-crystalline) content

The term 'Engage®' referred herein means and relates to polymer Engage 8400
20 (XEn), an ethylene-octene comonomer.

The present invention relate to a composite that selectively absorbs spillages of organic wastes such as hydrocarbons and oil spills on land or water with no or poor absorption of water and water based compositions, comprising, absorbents/natural fillers, highly hydrophobic amorphous polymer and a cross
25 linker, wherein the ratio of polymer to the absorbent/natural fillers is in the range of 1:1 to 1:9.

The composite of the present invention favors the absorption of hydrocarbons (HC) and oil spilled on the surfaces of land and water, is readily collectible, floats after

absorbing HCs, does not leach out HCs, does not crumble upon sorption, is nature friendly and cheap.

The absorbent/natural fillers of the current invention are selected from saw dust, cotton fibers, wood fibers etc.

- 5 The highly hydrophobic amorphous polymers are selected from ethylene propylene diene monomer (EPDM) (or equivalent); cross linked Engage 8400 (XEn), an ethylene-octene comonomer. The cross linker is selected from benzoyl peroxide (BPO).

The hydrocarbons and the oil spills on the land surfaces and water include natural
10 low-molecular-weight hydrocarbons, polyaromatic hydrocarbons, heterocyclic hydrocarbons, petroleum products, grease and oil from automobiles, waxes, running off of oil wastes from the oil drills, discharges of drilling muds and cuttings, crude oil from tankers, offshore platforms, spilled hydrocarbons from the places where they are stored, dispensed etc (ex: petrol pumps, refineries etc),
15 hydrocarbons from storm water, hydrocarbons spilled on automobile floorings/ under-the -hood applications, garage floorings and such like.

The crosslinking of highly hydrophobic amorphous polymer is carried out with peroxide, specifically benzoyl peroxide. The composite of the present invention is structured in various forms and shapes such as pellets, granules, particles, discs,
20 extrudates, pouches, membranes and foamy structures with variable porosity or fused to mats-porous or nonporous sheet.

Saw dust which is widely used for oil absorption has a major disadvantage that it very quickly absorbs water and hence the oil sorption capacity is considerably reduced. The sorption property of sawdust is significantly improved by making the
25 surface hydrophobic. Ter-polymerization of ethylene, propylene and a non-conjugated diene yields EPDM rubber, which has a saturated polymer backbone and a residual unsaturation in the side groups. EPDM is observed to show superior resistance against oxygen, ozone, heat and irradiation over other known polydiene rubbers, such as natural rubber (NR), Butadiene rubber (BR) and styrene-butadiene

rubber (SBR). Since the main-chain in EPDM is saturated alkane structure and the oil is saturated compound, EPDM can adsorb oil. Further, EPDM can dissolve in the oil for a long time due to having no crosslink structure in EPDM. It is therefore necessary to cross link EPDM to achieve optimum performance in terms of elasticity, tensile and tear strength and solvent resistance.

Thus, in a preferred embodiment, the present invention relate to a composite (XE-SD) comprising of saw dust, ethylene propylene diene monomer (EPDM) (or equivalent); and Benzoyl peroxide as a cross-linking agent, for selective absorption of spillages of organic wastes such as hydrocarbons and oil spills with no or poor absorption of water and water based compositions.. The ratio of EPDM to saw dust is in the range of 2:1 to 1:9.

The said composite of the present invention favors hydrocarbon sorption only, is readily collectable, has good buoyancy and floats after absorbing hydrocarbons (HCs) for a long period, does not leach out HCs, do not crumble upon sorption, is nature friendly and cheap.

The composite of the present invention exhibits high ratio of hydrocarbon (HC) sorption to water sorption in the range of 80-130 > 50°C (greater than 50°C)

In another preferred embodiment, the present invention relates to a composite (XEn-CF) comprising of cotton fiber cuttings (CF), Engage 8400 (XEn), an ethylene-octene comonomer, and Benzoyl peroxide as crosslinker for selective absorption of spillages of organic wastes such as hydrocarbons and oil spills with no or poor absorption of water and water based compositions.. The ratio of cross linked Engage 8400 (XEn) to cotton fiber cuttings (CF) is in the range of 1:1 to 1:9.

The composites of the present invention absorb the hydrocarbons and oil spilled on the surfaces of land and water. Further, the composites of the invention, cleans up organic chemical spill, useful in extraction of organics from drain water and such like.

The hydrocarbons and the oil spills on the land surfaces and water include natural low-molecular-weight hydrocarbons, polyaromatic hydrocarbons, heterocyclic hydrocarbons, petroleum products, grease and oil from automobiles, waxes, running off of oil wastes from the oil drills, discharges of drilling muds and cuttings, crude oil from tankers, offshore platforms spilled hydrocarbons from the places where they are stored, dispensed etc (ex: petrol pumps, refineries etc), hydrocarbons from storm water, hydrocarbons spilled on automobile floorings/ under-the -hood applications, garage floorings and such like.

In an embodiment, the composite is structured in various forms and shapes such as pellets, granules, particles, discs, extrudates, pouches, membranes and foamy structures with variable porosity or fused to mats-porous or nonporous sheet.

In another embodiment, the present invention provides a process for preparation of said composite comprising of absorbent/ natural filler, largely hydrophobic amorphous polymer and a cross linker, the said process comprising;

1. Melt processing of largely hydrophobic amorphous polymer and absorbent/ natural filler followed by crosslinking to obtain pellets, pouches which may optionally be coated with the polymer layer; or
2. Solution processing of largely hydrophobic amorphous polymer and absorbent/ natural filler followed by crosslinking.

The process for preparation of composite of present invention, comprises;

- Melt processing of EPDM with SD followed by crosslinking
- Solution processing of EPDM with SD followed by crosslinking.
- Coating pellets/ particles of SD with EPDM followed by crosslinking.
- Sawdust pouch coated with crosslinked EPDM.
- Melt processing of Engage (En) with Cotton Fiber (CF) followed by crosslinking.

In the melt process, composite comprising of absorbent/natural filler- amorphous hydrophobic polymer- crosslinker (BPO) is prepared by the following steps;

- a. melt compounding the absorbent/natural filler- amorphous hydrophobic polymer- crosslinker (BPO) using DSM micro-compounder at temperature of about 100°C for 5 minutes,
- b. granulating the compound followed by cross-linking at 115-145°C for 15 minutes to an hour in vacuum oven to obtain pellets of composite.

(I) Melt process for preparation of XE-SD and XEn-CF materials - pellets.

In the process, EPDM-Sawdust-Benzoyl peroxide, Engage®-Cotton Fiber-Benzoyl peroxide - were melt compounded using DSM micro-compounder at temperature of 100°C for 5 minutes. The compound were granulated followed by cross-linking at 140°C for one hour in vacuum oven to obtain granules of saw dust coated with EPDM(XE-SD) and at 120°C for 30 min in vacuum oven to obtain the composite of cotton fiber cuttings (CF) coated with Engage 8400 (XEn), an ethylene-octene comonomer (XEn-CF).

In another embodiment, the present invention discloses a process for the preparation of coated XE-SD pellets. The process consists of the following steps;

- a. adding measured quantity of water to SD pellets of melt process to obtain controlled pellet swelling followed by drying;
- b. dipping the dried pellets in EPDM solution in toluene containing BPO cross linker for about 5 minutes and draining out excess EPDM;
- c. evaporating the solvent under room condition;
- d. applying a second coat on top of completely dried first coat and subjecting to drying;
- e. heating the double coated swollen pellets to 135-145°C for about one hour to ensure crosslinking of EPDM coat.

(IIa) Process of preparation of XE-SD materials - coated pellet method

To the saw dust pellets made using pellet mold, measured quantity of water is added to obtain controlled pellet swelling. The wet swollen sawdust pellets are dried for 24 hours to ensure complete evaporation of water. The dried pellets are further dipped in EPDM solution in toluene containing BPO cross linker for about 5 minutes. Excess EPDM solution is drained from pellets and is placed on glass petridish for solvent evaporation under room condition. This is followed by applying a second coat on top of completely dried first coat and subjected to drying for about 24 hours. The double coated swollen pellets are heated to 140°C for one hour to ensure crosslinking of EPDM coat.

In another embodiment, the present invention disclose a process for preparation of sawdust pouch coated with crosslinked EPDM. The process comprises the steps of;

1. soaking sealed pouch filled with saw dust in EPDM solution in toluene containing BPO until complete saturation of sawdust and pouch paper by EPDM solution and drying;
2. dipping the dried pouch in EPDM solution; drying and heating the pouch in vacuum oven at 135-145°C for one hour to obtain the desired product.

The measured quantity of saw dust is filled in small tissue paper pouch. Sealed pouch is then soaked in EPDM solution in toluene containing BPO cross linker for one hour ensuring complete saturation of sawdust and pouch paper by EPDM solution. Upon soaking, the pouch is dried for 24 hours under room conditions followed by second dip in EPDM solution for 30 minutes and drying for further 24 hours under room conditions. Crosslinking of coated EPDM is carried out by heating the pouch in vacuum oven at 140°C for one hour.

In yet another embodiment, the present invention relates to the preparation of XE-SD composite by solution process as follows;

- a. dispersing saw dust in EPDM solution in toluene containing BPO for about 30mins;

- b. casting the dispersed mixture on to a glass plate to obtain 1-1.5mm thick membrane like film followed by drying at room condition;
- c. Cross linking EPDM by heating the membranes to 135-140°C for one hour under vacuum and cooling;
- 5 d. Dipping in EPDM solution in toluene containing BPO for about 2-3 mins, draining excess EPDM followed by solvent evaporation under room conditions and drying;
- e. Removing the membranes from the glass plate and further heating to 135-145°C under vacuum for one hour to obtain the product.

10 (IIb) Process of preparation of XE-SD material- Solution process

Measured quantity of saw dust is dispersed in EPDM solution in toluene containing BPO cross linker for 30 minutes. Dispersed mixture is casted on glass plate. 1-1.5 mm thick membrane-like film obtained is kept for drying for about 24 hours at room conditions. EPDM is cross linked by heating these membranes to 140°C for
15 one hour under vacuum. Membranes are further cooled to room temperature. In order to ensure uniform coat of EPDM over the surface of cross linked membranes, they are further dipped in EPDM solution in toluene containing BPO cross linker for 2 minutes. Excess EPDM solution is drained and placed on glass plate for solvent evaporation under room conditions. After 6 hours of drying, membranes are
20 removed from glass plate using doctor blade. EPDM coat over cross linked membrane is further cross linked by applying heat for one hour under vacuum at 140°C.

In an embodiment, the amount of cross linker added is optimized to obtain
25 maximum ratio of hydrocarbon sorption to water sorption. The amount of crosslinker used is not more than 9 wt % of Polymer.

The amount of benzoyl peroxide added to crosslink the EPDM polymer ranges in an amount of not more than 3.5 wt % of EPDM while same ranges in an amount not more than 9 w% of Engage®

5 The as prepared composite consisting of saw dust (SD) coated with cross linked ethylene propylene diene monomer (XE) and cotton fiber cuttings (CF) coated with Engage 8400 (XEn), an ethylene-octene comonomer (XEn-CF).exhibits enhanced absorption of hydrocarbons and oil as compared to Abtech Smart Sponge and a comparative table is given in examples below.

10 In an embodiment, the present invention provides a method for selective sorption of hydrocarbons and oil spills from land surfaces and water which method consists of laying out or dragging sheets of the invented material through the oilspill/slick and allowing a period of 20-30 minutes to absorb hydrocarbon selectively.

15 In another embodiment, the composite comprising of absorbents/natural fillers, highly hydrophobic amorphous polymer and a cross linker of the current invention is used for selective absorption of spillages of organic wastes such as hydrocarbons and oil spills with no or poor absorption of water and water based compositions.

20 The organic hydrocarbons and oil absorption composite consisting of absorbents/natural fillers coated with cross-linked highly amorphous hydrophobic polymers of the current invention is biodegradable, non-toxic, has high hydrocarbon sorption ratio in comparison to water sorption, and can remove hydrocarbon from land or water surfaces effectively. Moreover, the composite has good buoyancy and floats after absorbing hydrocarbons (HCs) for a long period, does not leach out HCs, do not crumble upon sorption, is nature friendly and cheap.

25 In an embodiment, two different types of hydrocarbons (HC), Cyclohexane and Diesel fuel, were used for sorption studies of disclosed HC sorbing materials. The data is provided in the examples below.

The following non-limiting examples, and comparative data illustrate the more salient features, and manner of practicing the invention.

Examples

Example 1: Experiments on saw dust - Bath System

HC Sorption Capacity: Weighed quantity (5 gm) of dry sawdust was taken in nylon sieve* which was then placed into cage holder. Cage holder was lowered into HC (hydrocarbon bath containing 300 ml hydrocarbon in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The HC wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. HC sorption capacity was calculated using formula stated.

$$\begin{aligned} \text{HC Sorption Capacity of Dry Sorbent} &= \frac{(\text{HC saturated Sorbent, g}) - (\text{Dry Sorbent, g})}{(\text{Dry Sorbent, g})} \\ &= \text{g water/ g dry sorbent} \end{aligned}$$

Water Sorption Capacity: Weighed quantity (5 gm) of dry sawdust was taken in nylon sieve* which was then placed into cage holder. Cage holder was lowered into water bath containing 300 ml Artificial Sea Water (ASW)[#] in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The water wetted sorbent was then removed from cage and weight of water saturated sorbent was noted. Water sorption capacity was calculated using formula stated.

$$\begin{aligned} \text{Water Sorption Capacity of Dry Sorbent} &= \frac{(\text{Water saturated Sorbent, g}) - (\text{Dry Sorbent, g})}{(\text{Dry Sorbent, g})} \\ &= \text{g water/ g dry sorbent} \end{aligned}$$

*Due to passage of sawdust through cage holder, nylon sieve was used as a sorbent holder.

[#]Artificial Sea Water (ASW) contains 3.5 wt% of NaCl salt in distilled water.

Results obtained are shown in Table 1

Table 1: Measured sorption ratios		
Parameter	Cyclohexane	Diesel
HC sorption from HC bath	2.82	2.32
Water sorption from water bath	5.32	5.32
Ratio of HC sorption from HC bath and water sorption from water bath	0.5	0.4

Example 2: Experiments on Cotton Fiber Cuttings - Bath System

- 5 *HC Sorption Capacity:* Cage holder containing weighed quantity (5 gm) of Cotton Fiber Cuttings was lowered into HC bath containing 300 ml hydrocarbon in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The HC wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. HC sorption capacity was calculated using formula
10 stated.

- Water Sorption Capacity:* Cage holder containing weighed quantity (5 gm) of Cotton Fiber Cuttings was lowered into water bath containing 300 ml ASW in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The water wetted sorbent was then removed from cage and weight of HC
15 saturated sorbent was noted. Water sorption capacity was calculated using formula stated.

Results obtained are shown in Table 2

Table 2: Measured sorption ratios		
Parameter	Cyclohexane	Diesel
HC sorption from HC bath	8.175	10.85
Water sorption from water bath	3.89	3.89

Ratio of HC sorption from HC bath and water sorption from water bath	2	3
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Example 3: Experiments on Abtech Smart Sponge®

HC Sorption Capacity: Cage holder containing weighed quantity (5 gm) of Abtech Smart Sponge® was lowered into HC bath containing 300 ml hydrocarbon in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The HC wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. HC sorption capacity was calculated using formula stated.

Water Sorption Capacity: Cage holder containing weighed quantity (5 gm) of Abtech Smart Sponge® was lowered into water bath containing 300 ml ASW in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The water wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. Water sorption capacity was calculated using formula stated.

Results obtained are shown in Table 3

Table 3: Measured sorption ratios		
Parameter	Cyclohexane	Diesel
HC sorption from HC bath	1.24	1.04
Water sorption from water bath	0.06	0.06
Ratio of HC sorption from HC bath and water sorption from water bath	21	18

Example 4: Process of preparation of XE-SD materials - pellets from melt method

Ethylene propylene diene monomer (EPDM) (1000g)-Sawdust (1000g) and benzoyl peroxide (15g) as a cross-linking agent was melt compounded using DSM micro-

compounder. Compounding was carried out at temperature of 100°C and maintained for about 5 minutes. Compound was pelletized followed by cross-linking at 140°C in vacuum oven for one hour. The cross linked pellet were used for sorption studies.

5 **Example 5: Process of preparation of XE-SD materials - coated pellet method**

0.29g of saw dust pellets made using pellet mold were exposed to 1 ml of water causing controlled pellet swelling by water sorption. The wet swollen sawdust pellets were dried for 24 hours at temperature 100°C assuring complete evaporation of water. The dried swollen pellets were dipped in EPDM solution in
10 toluene containing BPO crosslinker (EPDM = 15 g; toluene = 300 ml; BPO = 0.225 g) for 5 minutes. Excess EPDM solution was drained from pellets and these were placed on glass petridish for solvent evaporation under room conditions. Correspondingly, on top of completely dried first coat, second coat was applied. After 24 hours of drying, double coated swollen pellet was heated to 140°C for one
15 hour to ensure crosslinking of EPDM coat. This crosslinked EPDM coated sawdust pellet was used for sorption studies.

Example 6: Process of preparation of XE-SD materials - Solution method

Saw dust was dispersed in EPDM solution in toluene containing BPO crosslinker for 30 minutes. (EPDM = 5.95 g; saw dust = 13.96 g; toluene = 130 ml; BPO = 0.09 g).
20 Dispersed mixture was then casted on glass plate. 1.5 mm thick membrane-like film was obtained upon 24 hours of drying at room conditions (25°C). EPDM was crosslinked by heating these membranes to 140°C for one hour under vacuum. Membranes were cooled down to room temperature (25°C).

In order to ensure uniform coat of EPDM over the surface of crosslinked
25 membranes, they were further dipped in EPDM solution in toluene containing BPO crosslinker for 2 minutes. Excess EPDM solution was drained and these were placed on glass plate for solvent evaporation under room conditions. After 6 hours of drying, membranes were removed from glass plate using doctor blade. EPDM coat over crosslinked membrane was further applied for cross linking and heated for

one hour under vacuum at 140°C. The coated crosslinked membranes were used for sorption studies.

Example 7: Process of preparation of sawdust pouch coated with cross linked EPDM

- 5 2.8g of saw dust was filled in small tissue paper pouches made from Kimwipes® sealed using paper glue. The sealed pouches were dipped in EPDM solution in toluene containing BPO crosslinker (EPDM = 15 g; toluene = 300 ml; BPO = 0.225 g) for one hour ensuring complete saturation of sawdust and paper pouch by EPDM solution. Upon soaking, after draining excess EPDM solution, the pouches were
10 dried for 24 hours under room conditions (25°C) followed by second dip in EPDM solution containing BPO for 30 minutes and drying for further 24 hours under room conditions (25°C). After ensuring complete solvent evaporation crosslinking of coated EPDM was carried out by heating the pouch in vacuum oven at 140°C for one hour. These cross linked EPDM coated sawdust pouches were used for sorption
15 studies.

Example 8: Experiments on XE-SD materials - Bath System

HC Sorption Capacity: Cage holder containing weighed quantity (5 gm) of XE-SD (granules, pellets membrane and pouch) was lowered into HC bath containing 300 ml hydrocarbon in 500 ml glass beaker. Magnetic stirring was applied throughout
20 the soaking time of 30 minutes. The HC wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. HC sorption capacity was calculated using formula stated.

Water Sorption Capacity: Cage holder containing weighed quantity (5 gm) of XE-SD (granules, pellets membrane and pouch) was lowered into water bath containing
25 300 ml ASW in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The water wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. Water sorption capacity was calculated using formula stated.

Results obtained for Cyclohexane Sorption are shown in Table 4

Parameter	Example 4 materials Measured values	Example 5 materials Measured values	Example 6 materials Measured values	Example 7 materials Measured values
HC sorption from HC bath	2.118	2.115	5.595	2.770
Water sorption from water bath	0.018	0.020	0.044	0.240
Ratio of HC sorption from HC bath and water sorption from water bath	118	106	128	12

Results obtained for Diesel Sorption are shown in Table 5

Parameter	Example 4 materials Measured values	Example 5 materials Measured values	Example 6 materials Measured values	Example 7 materials Measured values
HC sorption from HC bath	1.593	1.575	4.516	2.780
Water sorption from water bath	0.018	0.020	0.044	0.240
Ratio of HC sorption from HC bath and water sorption from water bath	89	79	103	12

5

Example 9: Effect of crosslinker concentration for Melt processed sorbent

Two compositions of EPDM-Sawdust containing different crosslinker concentration (with respect to EPDM) were melt compounded using DSM micro-compounder at temperature of 100°C for 5 minutes. Compound was granulated followed by cross-linking at 140°C in vacuum oven for one hour. The crosslinked melt processed granules were used for sorption studies.

10

Results obtained are shown in Table 6

Table 6: Measured sorption ratios	Amount of Cross linker	
	3 wt% of EPDM	1.5 wt% of EPDM
HC sorption from HC bath	1.89	2.118
Water sorption from water bath	0.06	0.018
Ratio of HC sorption from HC bath and water sorption from water bath	31.5	118

Example 10: Process of preparation of XEn-CF materials - pellets from melt method

- 5 Engage(1000g)-Cotton Fiber(1000g) and benzoyl peroxide(90g) as a cross-linking agent was melt compounded using DSM micro-compounder. Compounding was carried out at temperature of 100°C and maintained for about 5 minutes. Compound was granulated followed by cross-linking at 120°C in vacuum oven for 30 min. The cross linked melt processed granules were used for sorption studies.

10 Example 11: Experiments on XEn-CF material

- HC Sorption Capacity:* Cage holder containing weighed quantity 5g of XEn-CF granules was lowered into HC bath containing 300 ml hydrocarbon in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The HC wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. HC sorption capacity was calculated using formula stated.

- Water Sorption Capacity:* Cage holder containing weighed quantity 5g of XEn-CF granules was lowered into water bath containing 300 ml ASW in 500 ml glass beaker. Magnetic stirring was applied throughout the soaking time of 30 minutes. The water wetted sorbent was then removed from cage and weight of HC saturated sorbent was noted. Water sorption capacity was calculated using formula stated.

Results obtained are shown in Table 7

Parameter	Example 12 materials Measured values	
	Cyclohexane	Diesel
HC sorption from HC bath	3.170	2.792
Water sorption from water bath	0.032	0.032
Ratio of HC sorption from HC bath and water sorption from water bath	100	88

Example 12: Experiments on saw dust - Interface Setup

Sorption Capacity: Weighed quantity 5g of dry sawdust was taken in nylon sieve* which was dropped into liquid bath containing 150 ml hydrocarbon and 150 ml ASW in 500 ml glass beaker for 30 minutes. Due to immiscibility of two liquids and lower density of hydrocarbon, hydrocarbon layer floats on water giving two distinct layers and an interface surface. Sawdust being heavier than hydrocarbon and lighter than water tends to sink in hydrocarbon layer and settling at interface. Sorption capacity was calculated using formula stated.

$$\begin{aligned}
 \text{Sorption Capacity of Dry Sorbent} &= \frac{(\text{saturated Sorbent, g}) - (\text{Dry Sorbent, g})}{(\text{Dry Sorbent, g})} \\
 &= \text{g liquids/ g dry sorbent}
 \end{aligned}$$

*In order to facilitate collection, nylon sieve was used as a sorbent holder.

Results obtained are shown in Table 8

Results obtained are shown in Table 8		
Parameter	Cyclohexane	Diesel
Sorption from HC - ASW Interface	2.717	2.303

Example 13: Experiments on Cotton Fiber Cuttings - Interface System

Sorption Capacity: Weighed quantity (5 gm) of Cotton Fiber Cuttings was dropped into liquid bath containing 150 ml hydrocarbon and 150 ml ASW in 500 ml glass beaker for 30 minutes. Due to immiscibility of two liquids and lower density of hydrocarbon, hydrocarbon layer floats on water giving two distinct layers and an interface surface. Cotton Fiber Cuttings tends to sink in hydrocarbon layer only, settling at interface. Sorption capacity was calculated using formula stated earlier.

Results obtained are shown in Table 9

Results obtained are shown in Table 9		
Parameter	Cyclohexane	Diesel
Sorption from HC - ASW Interface	8.660	11.090

10 Example 14: Experiments on Abtech Smart Sponge® - Interface System

Sorption Capacity: Weighed quantity (5 gm) of Abtech Smart Sponge® was dropped into liquid bath containing 150 ml hydrocarbon and 150 ml ASW in 500 ml glass beaker for 30 minutes. Due to immiscibility of two liquids and lower density of hydrocarbon, hydrocarbon layer floats on water giving two distinct layers and an interface surface. Abtech Smart Sponge tends to sink in hydrocarbon layer only, settling at interface. Sorption capacity was calculated using formula stated earlier.

Results obtained are shown in Table 10

Results obtained are shown in Table 10		
Parameter	Cyclohexane	Diesel
Sorption from HC - ASW Interface	1.786	1.401

20 Example 15: Experiments on XE-SD materials - Interface System

Sorption Capacity: Weighed quantity (5 gm) of XE-SD (granules, membrane, pellets) was dropped into HC-ASW bath containing 150 ml hydrocarbon and 150 ml ASW in 500 ml glass beaker. Fixed soaking time of 30 minutes was used. The wetted sorbent was then removed from hydrocarbon-ASW interface and weight of

saturated sorbent was noted. Sorption capacity was calculated using formula stated.

Results obtained for Cyclohexane Sorption at Interface are shown in Table 11

Parameter	Example 4 materials Measured values	Example 5 materials Measured values	Example 6 materials Measured values
Sorption from HC - ASW Interface	2.120	2.179	5.334

5 Results obtained for Diesel Sorption at Interface are shown in Table 12

Parameter	Example 4 materials Measured values	Example 5 materials Measured values	Example 6 materials Measured values
Sorption from HC - ASW Interface	1.596	1.658	4.501

Example 16: Experiments on XEn-CF material - Interface System

- 10 Sorption Capacity: Weighed quantity (5 gm) of XEn-CF granules was dropped into HC-ASW bath containing 150 ml hydrocarbon and 150 ml ASW in 500 ml glass beaker. Fixed soaking time of 30 minutes was used. The wetted sorbent was then removed from hydrocarbon-ASW interface and weight of saturated sorbent was noted. Sorption capacity was calculated using formula stated.

Results obtained are shown in Table 13

Parameter	Example 10 materials Measured values	
	Cyclohexane	Diesel
Sorption from HC - ASW Interface	3.071	2.919

Advantages of the present invention

The materials in the current invention have the following advantages:

5

1. The materials do not absorb water and aqueous solvents, as opposed to natural absorbents.
2. They absorb hydrocarbons with high sorption capacity and retention
3. They are faster and cheaper than other synthetic hydrocarbon absorbing
10 materials.
4. They do not exude or leak hydrocarbons, unlike porous mats and foams
5. They absorb hydrocarbon at low hydrocarbon concentration unlike solidifier.
6. They have sufficient mechanical strength in swollen conditions to be pulled
15 out intact out of oil spill areas.

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The claim:

1. A composite for absorbing spillages of organic wastes selected from hydrocarbons and oil spills on land or water with no or poor absorption of water and water based compositions, comprising one or more
5 absorbents/natural fillers a highly hydrophobic amorphous polymer and a cross linker, wherein the ratio of polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9.
2. The composite according to claim 1, wherein the absorbents/natural fillers are selected from saw dust or cotton fibers.
- 10 3. The composite according to claim 1, wherein the highly hydrophobic amorphous polymer is selected from ethylene propylene diene monomer (EPDM), cross linked Engage 8400 (XEn) or ethylene-octene comonomer.
4. The composite according to claim 1, wherein the cross linker used is, benzoyl peroxide.
- 15 5. The composite according to claim 1, wherein the amount of cross linker used is not more than 9 wt % of polymer.
6. The composite according to claim 1, wherein the composite is structured in forms and shapes selected from pellets, granules, particles, discs, extrudates, pouches, membranes and foamy structures with variable
20 porosity or fused to mats-porous or nonporous sheet.
7. The composite according to claim 1, wherein the hydrocarbons and the oil spills on the land surfaces and water comprises natural low-molecular-weight hydrocarbons, polyaromatic hydrocarbons, heterocyclic hydrocarbons, petroleum products, grease and oil from automobiles, waxes,
25 running off of oil wastes from the oil drills, discharges of drilling muds and cuttings, crude oil from tankers, offshore platforms, spilled hydrocarbons from the places where they are stored, dispensed, hydrocarbons from storm

water, hydrocarbons spilled on automobile floorings/ under-the -hood applications, garage floorings.

8. The composite according to claim 1, wherein the composite provides high hydrocarbon sorption ratio in comparison to water sorption.

5 9. The composite according to claim 1, wherein the hydrocarbons and the oil spills are absorbed from surfaces of land and water.

10. The process for preparation of composite as claimed in claim 1, wherein the said process comprises;

10 I. carrying out melt process of highly hydrophobic amorphous polymer and absorbent/ natural filler followed by crosslinking to obtain the composite which may optionally be coated with the polymer layer; or

II. carrying out solution process of largely hydrophobic amorphous polymer and absorbent/ natural filler followed by crosslinking.

15 11. The process according to claim 10, wherein the composite is structured in forms and shapes selected from pellets, granules, particles, discs, extrudates, pouches, membranes and foamy structures with variable porosity or fused to mats-porous or nonporous sheet.

12. The process according to claim 10, wherein melt process(i) for the preparation of composite- pellet comprises the steps of

20 I. melt compounding of highly hydrophobic amorphous polymer and absorbent/ natural filler using a compounder at a temperature chosen in accordance with the processing temperature of the polymer to obtain the compounds of composite followed by granulating the compound followed by crosslinking with a crosslinker at a temperature chosen in accordance with the
25 activation temperature of crosslinker to obtain pellets of composite,

- II. optionally coating of pellets of composite as obtained in step (a) with the polymer layer by dipping the dried pellets in water to obtain controlled pellet swelling followed by drying for a period ranging between 12-48 hours ;
- 5 III. dipping the dried pellets as obtained in step (b) in polymer solution in toluene containing cross linker for about a period ranging between 2-10 minutes and draining out excess polymer solution followed by evaporating the solvent at temperature ranging between 20-40°C to obtain first coat;
- 10 IV. applying a second coat on top of completely dried first coat as obtained in step (c) and subjecting to drying; and
- V. heating the double coated swollen pellets at temperature ranging between 135-145°C for a period ranging between 30-120 minutes to ensure crosslinking of polymer coat.
- 15 13. The process according to claim 10, wherein the solution process(ii) for preparation of composite comprising the steps of ;
- I. dispersing filler in polymer solution in toluene containing crosslinker for a period ranging between 10-60 minutes;
- 20 II. casting the dispersed mixture as obtained in step (i) on to a glass plate to obtain 1-1.5 mm thick membrane like film followed by drying at temperature ranging between 20-40°C for a period ranging between 12-48 hours to obtain membrane;
- III. cross linking polymer by heating the membrane as obtained in step (ii) at temperature ranging between 135-140°C for a period ranging
- 25 30-120 minutes under vacuum and cooling;
- IV. dipping in polymer solution in toluene containing crosslinker for a period ranging between 2-3 mins followed by draining excess

polymer solution subsequently solvent evaporation at temperature ranging between 20-40°C drying; and

- V. removing the membranes as obtained in step (iv) from the glass plate and further heating to 135-145°C under vacuum for a period ranging between 30-120 minutes to obtain composite.

14. The process according to claim 12 and 13, wherein the ratio of highly hydrophobic amorphous polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9.

15. The process according to claim 12 and 13, wherein the amount of cross linker used is not more than 9 wt % of polymer.

16. The process according to claim 12 and 13, wherein hydrophobic amorphous polymer is selected from the group consisting of ethylene propylene diene monomer (EPDM), cross linked Engage 8400 (XEn) or ethylene-octene comonomer.

17. The process according to claim 12 and 13, wherein absorbent/ natural filler is selected from the group consisting of saw dust or cotton fibers.

18. The process according to claim 12 and 13, wherein cross linker used is benzoyl peroxide.

19. The process for preparation of absorbent/ natural filler pouch coated with crosslinked polymer, wherein the said process comprising the steps of;

I. soaking sealed pouch filled with absorbent/ natural filler in polymer solution in toluene containing crosslinker until complete saturation of absorbent/ natural filler and pouch paper by polymer solution and drying; and

II. dipping the dried pouch as obtained in step (i) in polymer solution, drying and heating the pouch in vacuum oven at 135-145°C for a

period ranging between 30-120 minutes to obtain absorbent/ natural filler pouch coated with crosslinked polymer.

20. The process according to claim 19, wherein the ratio of highly hydrophobic amorphous polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9.

21. The process according to claim 19, wherein the amount of cross linker used is not more than 9 wt % of polymer.

22. The process according to claim 19, wherein hydrophobic amorphous polymer is selected from the group consisting of ethylene propylene diene monomer (EPDM), cross linked Engage 8400 (XEn) or ethylene-octene comonomer.

23. The process according to claim 19, wherein absorbent/ natural filler is selected from the group consisting of saw dust or cotton fibers.

24. The process according to claim 19, wherein cross linker used is selected from benzoyl peroxide.

25. A method for selective sorption of hydrocarbons and oil spills/slick from land surfaces and water wherein said method consists of laying out or dragging mats/sheets of a composite comprising absorbents/natural fillers, highly hydrophobic amorphous polymer and a cross linker, wherein the ratio of polymer to the absorbent/natural fillers is in the range of 2:1 to 1:9 through the oil spill/slick and allowing a period of 20-30 minutes to absorb said hydrocarbon and oil spills/slick selectively.

26. Use of the composite comprising of absorbents/natural fillers, highly hydrophobic amorphous polymer and a cross linker for selective absorption of spillages of organic wastes such as hydrocarbons and oil spills with no or poor absorption of water and water based compositions.