Sea ReClaim™ Sorbent

Earth's Natural Buoyant Oil-Binding Materials for Immediate and Effective Reclamation of Oil Spills

TECHNICAL BULLETIN #1

TECHNOLOGY

Sea ReClaim™ Product

We call our product "Sea ReClaim™" to speak to its function, composition and mode of action. Sea ReClaim™ is a floatable oil binding material for immediate and effective reclamation of oil spills. It works with all types of crude which is dependent upon the process used. Sea ReClaim™ uses nature's nanotechnology to reclaim the oil and reclaim the sea. The power of natural nanotechnology comes not from the chemistry but from the high surface areas and the natural physical properties of the mined materials themselves. Sea ReClaim™ is composed of natural and modified natural scoriaceous material found naturally in the earth which is currently obtained by mining and metallurgy.

Sea ReClaim™ is a sorbent material and consists solely of the materials listed in § 300.915(g)(1) of the NCP. But it exhibits some of the properties of solidifiers with one distinct difference: it does not transform the oil chemically into a new substance but uses natural physical properties instead to agglomerate the oil into a semi solid mass that can be readily harvested. There is another unique difference. The physical process used for agglomeration and solidification can be reversed by high heat, and the oil can be reclaimed and the raw materials recycled or disposed. Hence Sea ReClaim™ has the benefits of sorbents with some of the properties of solidifiers without the toxic and disposal issues. Sea ReClaim™ is enviro-friendly.

Sea ReClaim™ is also formulated to achieve three things as the means to providing a total solution to crude oil spills: (a) reclaim the oil; (b) naturally eliminate malodors found in crude oil; and (c) permanently and irreversibly bind toxic heavy metals found in both the crude oil and transferred by crude into the sea.

The reaction time for the agglomeration of sweet crude to a semi rigid cake is approximately 10 minutes. Sea ReClaim™ works best in an agitated environment as realized in open seawater. The procedure used for dispersing the material and recovery will depend upon the type of crude oil. Perpetually hydrophobic in nature, Sea ReClaim™ not only floats on the surface of the water but also adheres immediately to any floating petroleum based product and builds a solid mass without the

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detrimental attributes associated with crude oil. Its incorporation into the contaminant stream results in a floatable, recoverable, recyclable sub product of its original polluting form. All ingredients incorporated into our premier formula are derived from earth's inorganic resources and are Generally Regarded As Safe (GRAS) materials 100% safe to humans, the environment and marine fauna and flora.

Our Technology

"Use of Nature's Nanotechnology"

Sea ReClaim™ is composed of an admixture of natural and modified-natural scoriaceous material derived from the earth. Sea ReClaim™ is derived from earth's natural scoriaceous material which is both highly porosive and buoyant. Although not used in Sea ReClaim™, the most universally known scoriaceous material is lava which is a form of scoria from a geological perspective. Scoria is produced by heat and/or pressure over time. Another well known example of scoria from metallurgy is dross.

Scoriae are natural materials derived from earth's rock, sand, dirt and dust. Scoriaceous material can be macroporous to mesoporous in porosiveness (porosity). Macroporous materials are large granular porosive material that can vary in particle diameter and/or mesh size. Sea ReClaim™ uses macroporous scoria of 0.5--2 mm diameter. Microporous material generally has pore sizes > 50 nm. Mesoporous materials have pore sizes from 2 to 50 nm. Both microporous and mesoporous structures are considered **nature's natural nanotechnology**. Sea ReClaim™ uses both microporous and mesoporous natural nanomaterials derived from the earth. Some natural scoriaceous material is modified by Sea ReClaim™ scientists for specific properties necessary for immediate and effective oil spill reclamation. The natural nanomaterials in Sea ReClaim™, since they are derived from the earth, are environmentally friendly when returned to the earth.

One would ask, Why use nature's nanotechnology? The reason is simple. Found naturally in the earth itself, these nanomaterials afford the means to

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deal with the oil spill with some very distinct advantages. Natural nanomaterial benefits derive from their small physical size (nano = 0.000000001 meters= 1 nm), which translates directly into an extremely large surface area. As will be explained later, 5 gm of natural nanomaterial as used in Sea Reclaim™ has the surface area of 10 football fields. This allows a small amount of material to have a significant action on oil, an advantage never seen with conventional sorbents or solidifiers. By way of comparison, activated carbon, another scoriaceous material with pores (not useful with oil spills) has a surface area of only 1 football field per 5 gm.

Another unique advantage to some of nature's nanomaterials is their unique ability to spontaneously aggregate together upon contact with oil. Nature's nanomaterials as used in Sea ReClaim™ come unassembled like a jigsaw puzzle. After contact with oil, the nanomaterials spontaneously self assemble into a solid 3-D network, *inter allia*, a solid mass. This very unique property allows the sorbent Sea ReaClaim™ to have physical properties only formerly attributable to chemical solidifiers. Chemical solidifiers are not natural and chemically convert the oil into a new material. Solidifiers are toxic to the environment. Why use a toxic man-made chemical when one can use a natural physical process; the very process that allows scoriaceous material to be formed naturally in the earth in the first place? Natural is always eco-friendly.

Three Unique Functions

Oil Reclamation * Malodor Elimination * Toxic Heavy Metal Removal

Sea ReClaim™ uses buoyant materials that are either naturally highly porosive, or modified nanoparticulate material that has been rendered hydrophobic and buoyant. All materials are derived from scoria except for one man-made ceramic material.

There are six oil binding components in Sea ReClaim™.

One of the main components is naturally mined scoria that is inherently buoyant due to its high porosiveness. This material is highly oleophilic (oil-binding) and hydrophobic (water-repellant) at the same time. It ranges from macroporous to mesoporous in natural nanostructure.

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The next three (3) components in Sea ReClaim™ are also modified natural scoria mined from rock that is made to be hydrophobic rendering it perpetually buoyant. When added to water, Sea ReClaim™ is self coalescing and buoyant unlike some other sorbents that either sink or spread over the surface in a layer too thin to be effective or controllable. These three natural materials contain unassembled non-porous nanoparticulate subassemblies with a hydrocarbon-like surface that are naturally physically attracted to oil as "like seeks like". This material increases crude oil viscosity upon contact and aids in immediate aggregation of the crude oil into an aggregated solidified mass. Hence, Sea ReClaim™ has the benefits of a sorbent with the properties of a solidifier. There is no chemical transformation of the oil into a new (non-oil) substance with Sea ReClaim™ as seen with solidifiers. It's purely a physical attraction as one loves to bind to the other and tighten up.

The fifth component in Sea ReClaim™ is another modified natural scoria which has an extremely strong affinity for the hydrogen atom found on hydrocarbons in that it cross links them. This aids directly in stabilizing the solid mass again through a natural physical process reversible by heat for reclamation of the oil.

The last component in Sea ReClaim™ is a man-made microporous hollow sphere which is comprised of a nano-cage structure that is selective for binding toxic heavy metals that are found in crude oil and which get absorbed into the sea. Toxic heavy metal binding within the nano-cage is permanent and irreversible hence removing the toxic heavy metals from the environment

"The Benefits of Sorbents, the Properties of Solidifiers"

Although Sea ReClaim™ is comprised of sorbents, its functionality is a lot like that of solidifiers. Solidifiers are EPA approved chemicals comprising hydrocarbon-like polymers and surfactants which chemically transform oil into a new non-oil substance which must in itself be disposed of or have another use found for used sorbent – oil mixture.

Sea ReClaim™ sorbents behave like solidifiers in that they form a soil-mass. They do so physically by natural means, not chemically. The resultant Oil Kake is different from solidifiers in that the oil is agglomerated

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and solidified but it is not transformed into a new substance. The oil is actually recoverable from the Sea ReClaim™ sorbent after harvesting through heating.

Sea ReClaim™ achieves solidification through the integration of 4 natural mechanisms of action: (1) absorption and (2) adsorption (usually limited to sorbents); (3) solidification by physical attraction between non-polar, hydrocarbon-like nanoconstructs and the hydrocarbons in crude oil enhanced by van-der-Waals forces; (4)as well as by natural hydrogen bonding of hydrocarbons by amorphous unassembled microparticulate nanostructures through a natural process of spontaneous self assembly upon contact directly with crude oil. This interaction results in a stabilized three dimensional cross-linked lattice e.g., the solid mass or Oil Kake.

This naturally occurring process is known as mixed clathrate formation. It is seen in nature most notably with methane snow found on the ocean floor. The hydrogen bonds involved in this natural reaction are the bonds that hold DNA strands together. Hydrogen bonds differ from covalent bonding in that hydrogen bonding is strong yet reversible with heat or enzymes. Hence, oil can be reclaimed from Sea ReClaim™ which gives the product the **benefits of a sorbent, but with the properties of a solidifier** with an added advantage of **oil reclamation**.

Sea ReClaim™ has two additional features differentiating it from all other sorbents and solidifiers on the market. One of the modified natural nano materials in Sea ReClaim™ derived from scoria is extremely effective at malodor elimination. Sea ReClaim uses the patent pending proprietary technology of Red Lion Scientifics, LLC. Oil from oil spills is notorious for binding with organic matter readily found in the ocean, which putrefies over time yielding malodors.

The final unique feature of Sea ReClaim™ is the permanent removal of toxic heavy metals found naturally in crude oil. These include lead, mercury, arsenic and chromium among others. These toxic heavy metals, which are also the basis of fossil fuel smokestack emissions, are found in crude oil. Toxic heavy metals in crude oil readily contaminate the seawater and they out-survive the oil spill in the ocean for millennia to come because they are elemental in composition in that they cannot be broken down any further.

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Toxic heavy metals readily contaminate plant, fish, and wildlife in the environment and are poisonous for humans as well. The half life for mercury in human tissue as example is 37.5 years, so the only way to not be poisoned by the toxin is to avoid exposure in the first place. Mercury is currently found in all species of fish as a toxic contaminant. Sea ReClaim™ uses a man-made ceramic nanoconstruct in the form of a nano-cage with high internal loading capacity to selectively bind toxic heavy metals and will do so both in oil and in water with extremely high efficiency. Sea ReClaim™ utilizes the proprietary technology of Red Lion Scientifics, LLC.

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