OIL SPILL EATER II

Natural Biological Enzyme

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Tracing the Path from Research to Application: The Development of Oil Spill Eater II (OSE II)

The Problem of Oil Spills

Since the 1990s, offshore oil/gas production has greatly boosted its potential as a result of rising global demand and declining onshore reserves. Supertankers and pipelines deliver crude and product oil across oceans. Offshore oil extraction and transportation endangers marine ecosystems, whether through acute pollution, such as oil spills, or chronic contamination.

Oil spills occur as a result of natural releases, oil transportation, oil drilling, and accidental collision or sinking of oil tankers, pipeline and oil rig failures, and other causes. Small spills are easy to manage with existing technologies. According to recent studies, major spill incidents have been fewer in number, but minor spills continue to occur on a daily basis. Over 80% of accidents recorded since 1970 involved tiny leaks (<7 tons). According to data from the European Space Agency (ESA), ship operating practices result in an estimated loss of 250,000 tons of oil each year. An extra 120,000 tons of oil are spilled every year at ship terminals, near onshore refineries, and other similar facilities.

Table 1. Number of medium (7–700 tonnes) and large (>700 tonnes) spills per decade from 1970 to 2020 (source: [3]).

Period	7–700 tonnes	>700 tonnes
1970–1979	543	245
1980–1989	360	94
1990–1999	281	77
2000–2009	149	32
2010–2019	45	18
2020	3	0
Total	1381	466

Petroleum products must be degraded within a certain time frame using physical/chemical processes or microorganisms. Many environmental conditions, including temperature, salinity, and pH, and wave height, influence oil breakdown rates.

Bioremediation and Microbial Solutions

Many techniques are created and implemented over time to reduce the negative impact of oil spills. The most prevalent methods for spill management include the use of blooms and dispersants, mechanical devices known as skimmers, and oil burning, often known as in situ burning. However, each of these approaches has limits and cannot be called perfect for oil removal.

Bioremediation is the use of microorganisms to remove or transform contaminants into non-hazardous materials. Bioremediation can be divided into two techniques:

- Bio-stimulation: It includes injecting essential minerals into the affected region to enhance the petroleum metabolic rates of the naturally present microbial community.
- Bio-augmentation: It includes adding known oil-degrading microorganisms.

Combining these two methods has been found to enhance hydrocarbon breakdown.

Formation of the Core Product

Oil Spill Eater II (OSE II) is a fluid micronutrient that contains enzymes that degrade petroleum and other organic contaminants. OSE II has a strong potential for breaking down petroleum hydrocarbons. It is a nutrient/enzyme addition that comprises carbon, vitamins, phosphorus, and nitrogen, allowing bacteria from natural sources to colonize rapidly.

OSE II is neither a fertilizer nor a bacterial product; rather, it stimulates the growth of indigenous (local) bacteria, which eventually consume the contaminant, leaving only harmless carbon dioxide and water.

Oil Spill International Corporation

The Oil Spill International Corporation (originally Sky Blue Chemicals) commenced operation in 1989. OSEI Corporation manufactures and markets Oil Spill Eater II, a bioremediation product using enzymes that cleans up hydrocarbons and other organic base contaminants. The OSEI Corporation is marketing OSE II all over the world. All five branches of the United States military employ OSE II, as does the Canadian military. OSE II has been utilized in over 40 nations for cleanups, and it has 35 distributors. Our international market is quickly expanding as

OSEI Corporation continues to establish and demonstrate to new clients that Oil Spill Eater II is the most tested, effective, and efficient bioremediation solution in the world.

OSE II Action Process

Once OIL SPILL EATER II is introduced to a hydrocarbon spill, the enzymes and other product elements begin emulsifying and solubilizing the hydrocarbon substrate. Emulsification and solubilization of weathered heavy-end hydrocarbons can take anywhere from a few minutes to many hours. After solubilization, the hydrocarbon substrate is less poisonous (and the risk of fire is reduced), therefore naturally occurring bacteria will have a stronger affinity for the solubilized hydrocarbon substrate. During these reactions, OSE II provides a complete nutrient system to support the rapid growth or colonization of naturally occurring native microorganisms.

OSE II is likewise designed to cause molecular adhesion when applied to a hydrocarbon substrate. This makes it difficult to separate OSE II from hydrocarbons. The above process produces the substrate complex. Once the outer molecular barriers of the hydrocarbon substrate complex are weakened or disrupted, bacteria can gain easier access to the hydrocarbon substrate. The nutrients in OSE II's product matrices (available nitrogen, phosphorus, carbon, and vitamins) quickly populate naturally occurring bacteria. The improved naturally occurring hydrocarbon degrading bacteria convert the solubilized hydrocarbons to CO2 and water, which is the final step in the bioremediation of the hydrocarbon substrate. Any remaining OSE II product components are fully biodegradable and will degrade naturally.

Nature’s Response to Spills vs. OSE II’s Action

When a dangerous material is discharged in Mother Nature, the nature responds in following ways. There are bacteria everywhere, and when the spill comes into direct touch with bacteria, the bacteria is killed or dies. However, bacteria around the spill but not in direct contact react in a variety of ways. First, the bacteria split themselves far enough away to avoid the toxicity of the spill. Second, the bacterium secretes enzymes and biosurfactants to combat the spill. Third, the bio surfactants emulsify and dissolve the spill. This means that the bio surfactants will break up the spill and reduce it to a controllable consistency.

Enzymes provide binding sites on emulsified spills, where bacteria attach to begin digestion. This method requires a huge volume of bacteria, and bacteria take a long time to adjust to a spill. It takes time for bacteria to produce enzymes and surfactants. One of the limiting elements is the amount of bacteria present, which must create and release sufficient enzymes and surfactants to initiate the process. This is why scientists talk about giving nutrients to help bacteria grow quickly so that enough enzymes and biosurfactants can be released to help with spill mitigation.

However, nutrients alone are limited due to concentration (washed away or diluted) and the time required to cultivate a big colony of bacteria.

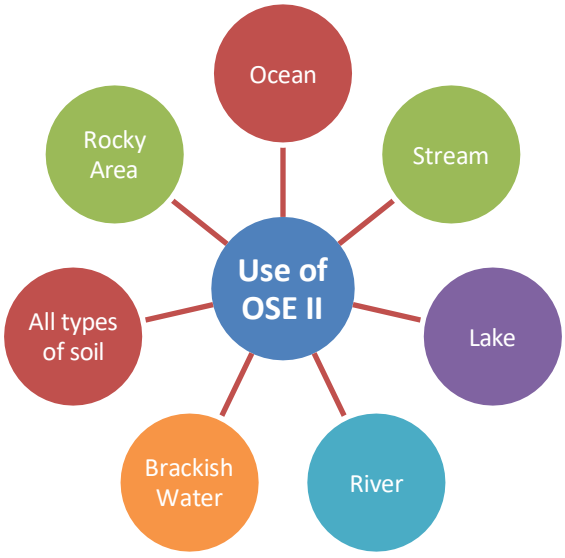
OIL SPILL EATER II (OSE II) comprises enzymes, biosurfactants, nutrients, and other components required for full life cycle and biodegradation. When OSE II is added to a spill, there is no need to wait for the proximal bacteria to release sufficient enzymes or biosurfactants because they are already present in the product. This process can take several minutes, depending on the consistency of the spill. As the bio surfactants work, the enzymes bond to broken down hydrocarbon structures, generating digestive binding sites.

OIL SPILL EATER II requires between 2 and 24 hours penetrating the molecular wall of fresh crude oil. OIL SPILL EATER II takes around 3 to 15 minutes to penetrate the molecular wall of light-end petroleum or gasoline. However, after OIL SPILL EATER II is sprayed on the land, it attaches itself and finally engulfs the oil, regardless of where the oil or light petroleum has spread on ocean waves, rivers, or streams. Furthermore, once sprayed with OIL SPILL EATER II, the oil cannot adhere to the beach, rocks, or any equipment in its path.

If OIL SPILL EATER II is to be used on ocean spills or in intertidal zones, mix it with ocean water. Mix OIL SPILL EATER II with water from a lake, river, stream, or pond before using it on land. These procedures and application instructions apply to both heavy and light end hydrocarbons. The OSEI Corporation defines Light End Hydrocarbons as BETX, gasoline, and lighter solvents. Heavy End Hydrocarbons include crude oil and halogenated hydrocarbons.

Use of OSE II:

OSE II can be used virtually everywhere that can sustain microbial life.



Optimum Conditions:

- **pH:** 7.0
- **Temperature:** 72ºF
- **Salinity Ranges:** Fresh water to salt water
- **Maximum and Minimum pH:** 3.5 - 8.0
- **Maximum and Minimum Temperature:** 28ºF - 128ºF
- **Enzyme Shelf Life:** Up to 5 years when properly stored
- **Enzyme Optimal Storage Conditions:** 72ºF is optimal, enzyme range is freezing to 120ºF, never leave OSE II in direct sunlight for more than a couple of hours

Advantages of OSE II

- The Oil Spill Eater promotes and accelerates natural biological processes.
- OSE II, when coupled with fresh or salt water and oxygen, quickly decomposes crude oil and other organic compounds, finally converting them to carbon dioxide and water.
- Oil Spill Eater II is safe for humans, animals, plants, and marine life. It is not toxic, even if consumed accidently. It does not irritate even the most delicate skin.
- OSE II has no recognized allergens that can cause cutaneous, respiratory, or other allergic responses.
- The OIL SPILL EATER II is 100% biodegradable.
- OSE II has a shelf life of 5 years when stored at temperatures below 120 degrees Fahrenheit.
- Freezing does not affect OSE II, but cold conditions can decrease its reaction rate slightly.
- The product remains stable and reactive in pH ranges of 3.5 to 11.7.
- OSE II is safe for electrical insulation and painted surfaces, as it does not include corrosive compounds or metal trace elements.
- OSHA in Anchorage, Alaska has decided that no specific protective apparel or safety equipment is required.
- OSE II helps control unpleasant odors from hydrocarbons.
- OSE II's natural biodegradation process eliminates odors rather than masking them.
- OSE II reduces fire hazards through emulsification and solubilization.
- OSE II is simply applied with a pumper truck, fire hose, or pump-up hand sprayer.
- On water, OSE II can be deployed via omni barge, helicopter, plane, or any eductor system.
- OSE II eliminates the need for skimmers and disposal, cleaning docks, driftwood, boats, rubber gear, and shorelines. It converts hydrocarbons to CO2 and water, requiring no subsequent cleanup.

Case Studies

Sustainable Oil Spill Management: SUEZ UK's Success Story with OSE II

In this case study, SUEZ Recycling and Recovery UK, a prominent waste management firm dedicated to sustainable resource recovery, utilized OSE II to address elevated Total Petroleum Hydrocarbon (TPH) levels in the byproducts arising from their street sweepings washing operation. Initially, the high TPH levels in the filter cake rendered the waste hazardous and unsuitable for other applications. OSE II was administered in both the main water reservoir and directly onto the filter cake stockpile using a handheld sprayer. After several days, TPH levels decreased to comply with non-hazardous standards. These levels remained consistently low, requiring only one further application to the water tank after a two-month period. Direct spray application persisted where tank dosing was impractical due to the frequent changes in water. SUEZ affirmed the effectiveness of the treatment and showed interest in employing OSE II for additional hazardous situations, such as hydraulic oil spills.

OSE II Speeds Up Soil Recovery for Dunton Environmental Projects

Dunton Environmental, an expert in cutting-edge ground remediation, was looking for a quicker and safer method to lower Total Petroleum Hydrocarbon (TPH) levels in polluted soils. Following a successful trial, they implemented Oil Spill Eater II (OSE II) to enhance bioremediation for larger stockpiles of soil. By mixing OSE II with water and applying it during soil aeration, they increased microbial activity, which accelerated the natural decomposition of hydrocarbons into harmless CO_2 and water. This approach was in line with Dunton's objectives for efficient, on-site soil recovery in brownfield projects.

Conclusion

An extremely effective, sustainable, and natural way to clean up waste and soils contaminated by hydrocarbons is to use Oil Spill Eater II (OSE II). Compared to traditional techniques, it offers

many advantages, including lower costs due to in-situ treatment, elimination of hazardous waste classification, and a decreased requirement for additional cleanup activities. Because OSE II is non-toxic, biodegradable, and made of natural materials, it is safe for the environment and doesn't require any personal protection equipment (PPE) when applied. As a result, it poses no risks to workers, plants, or animals. OSE II's ability to effectively and considerably lower Total Petroleum Hydrocarbon (TPH) levels has been demonstrated through practical implementations in projects such as those by Dunton Environmental and SUEZ Recycling and Recovery UK.

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