Short description

Biological Oil Decomposer System

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Biological Oil Decomposer System

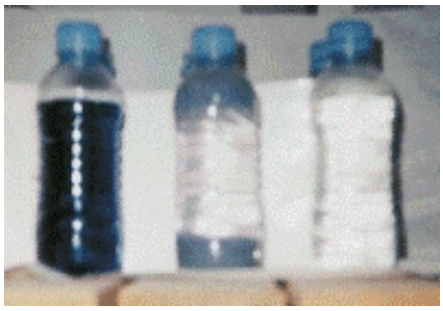
1. The Process

The offered oil decomposer system is a technologically advanced bioreactor that is designed to destroy oils, hydrocarbons and petrochemicals in water, using a bio-catalytic process. The actually used systems at existing project sites typically reduce the hydrocarbon content in the feed stream from 2000-5000 ppm. down to 10 ppm. or less in the discharge stream. For purification of tanks there is applicated an organic solvent before decontamination of the waste water.
The system includes a micro diffused aeration circuit that provides optimum oxygenation to the water. In addition a specially designed solution re-circulation system is also provided in order to maximise the surface reactions, where oils and hydrocarbons are destroyed. The bioreactor breaks down oils through accelerated microbial attack above and below the oil surface.

The offered systems are available in a broad range of sizes and configurations. Each process application is designed to achieve maximum decontamination of the wastewater, so as to produce a treated effluent that is in conformance with EPA, EU and other international standards
The systems can be configured as individual reactors operating in parallel or multi-stage reactors operating in series, depending upon the specific requirements of the process. They are continuously dosed in order to maintain a maximum catalytic environment.
Certain strong contaminants require the introduction of specially prepared media into the bioreactor, in order to enhance the decontamination process by providing a static and/or suspended biomass. The media promotes a high level of biological activity throughout its surface area as well as within its micro-pores. The selection and configuration of the biocatalytic media is application dependent.

The biological process is a simple, economic and revolutionary method of accelerating natural processes for cleaning-up pollution in soils and water.
The fundamental principles behind the Process are as follows: The earth is endowed with an in-built cleansing mechanism through the activities of micro-organisms, which act in concert on land and in water to break down pollutants to their primary components. For example, the ocean has some 20 to 25 families of microbes that break down long and short polymeric chains in hydrocarbons in order to reduce them to carbon dioxide and water. A great deal of inter-relationships exists between the micro-organisms. Certain families break down complex polymeric chains to smaller chains. Other families reduce the small chains to even smaller chains, until complete degradation of the hydrocarbons to carbon dioxide and water is achieved. The same principle applied for the degradation of sewage, agricultural wastes and most types of organic wastes on land and in water. However, the key limitation with respect to these natural process is one of time. For example, complete natural degradation of crude oil in water or solid sewage on land, requires a period of up to 4 to 6 months.

The offered process relies on the enhancement and acceleration of these natural microbial activities.
The Process introduces nutrients, vitamins and bio-stimulants, typically referred to as "micronutrients", including an active ingredient, and depurites containing specific selections of biocatalysts, minerals, vitamins and trace metals, which sharply catalyze the performance of these natural microorganisms. For example, the process is capable of degrading crude oil to carbon dioxide and water within a period of 18 to 24 hours in a well-mixed and aerated system. Similarly, the process is able to eliminate foul odours in sewage within 1 to 3 hours and to degrade fats and oils within 24 hours. The process basically accelerates nature, by catalyzing the local, indigenous microorganisms with all-natural micronutrients. Unlike most biological process used in the environmental industry today, the offered process does NOT rely on introducing foreign bacteria (or enzymes) that have been externally conditioned or genetically engineered, into an ecosystem to accomplish contaminant degradation. The process works purely on accelerating local, indigenous microorganisms, which is a very important factor with respect to environmental safety and ecosystem conservation.



All ingredients are produced from naturally occurring substances with the use of any artificial chemical substances. The key ingredients/reagents are available in powder and liquid form. These reagents can be easily sprayed on land or dosed into process streams with minimal cost and complexity.

Comparison with External Bacteria and Enzyme Processes

The process is the most advanced biological process in the world for decontamination of wastewaters and soils. This document provides a comparison of the process with conventional bioremediation and enzyme processes.

Conventional Bioremediation with Externally Cultured Microorganisms.
The commercial scale biological decontamination of polluted waters started some 80 years ago, with the use of bacteria, which were externally cultured and then dosed into the polluted water. This approach, which is typically known as conventional bioremediation, has significant disadvantages, which include the following:

- The process of decontamination was slow, requiring larger and more expensive equipment.
- The externally cultured bacteria frequently failed to settle into their new environment, resulting in their death after a short period of plant operation. Loss of bacterial populations can be catastrophic in biological processes as the decontamination process comes to a complete stop.
- It was discovered later that the introduction of new bacterial species in an environment had the potential to create side effects, which could have disastrous effects on the existing ecosystem. This is why, countries such as Brazil do not permit the inoculation of external bacteria during environmental clean-up operations, e.g. after oil spills.
- It was also discovered later that some externally cultured bacterial species underwent evolution in their new environment, resulting in the production of less effective strains after a few months of operation. Hence, while the processes appeared to perform initially, they failed later.
- Externally cultured bacterial processes often do not deliver the low concentrations of contaminants in the treated water that are required by the law. Hence, as legislation becomes more stringent, such processes are expected to become obsolete.

Enzyme Processes

In the late 1960's, biological decontamination processes were developed which used enzymes that were extracted from externally cultured bacteria in a controlled environment. The idea was to replace the in-situ activity of the bacteria with the enzymes. This approach was also found to have significant limitations, which include the following:

- Enzymes are relatively unstable compounds, which can lose their activity during storage, particularly at higher temperatures.
- Enzymes are very sensitive to the chemical environment of the water. Hence, they can be quickly deactivated by certain types of contaminants. They are also sensitive to fluctuations in pH and conductivity.
- Enzyme processes are based on a specific dosage of enzymes per cubic meter of wastewater of known contaminant levels. Once the enzyme is consumed, the process stops. There is no form of auto-generation of the enzymes, which caters to varying contaminant concentrations. Therefore, the plant operator has very little flexibility with respect to fluctuations in effluent quality.
- Enzymes are also specific to the type of contaminant that is to be hydrolysed. Hence, if the type of contaminant changes, or if new contaminants are introduced to the water, the process is unable to produce the required results.
- To date, enzyme processes have suffered from a high failure rate, indicating an unacceptable investment risk for the customer. Plants designed for enzyme treatment cannot be easily converted to handle other technologies.
- Enzymes are expensive on a per litre basis. In cases where very low concentrations of contaminants are required in the treated water, it is often necessary to dose large quantities of enzymes in order to meet legislative standards. As environmental regulations get more stringent, enzyme processes become less attractive from an economic viewpoint.

The offered process

Bearing in mind the limitations of externally cultured bacteria and enzymes, the industry has moved towards processes that are more technically and economically efficient and less risky. The process represents a state-of-the art technology in the industry today, offering the following advantages:

- The process does not require the introduction of externally cultured micro-organisms into an environment. The entire biological treatment is accomplished by indigenous organisms that are currently present in the environment.
- The process is robust and does not suffer from failure due to loss of microbial populations because the indigenous organisms are well conditioned to their environment. The process also includes dosage of natural plant extracts that provide protection to the microbial cell walls, thus mitigating population loss due to high toxicity.
- The process uses naturally occurring plant extracts, including an active ingredient, which sharply accelerates the performance of the indigenous microorganisms. For example, ocean microbes require up to 6 months to completely decompose crude oil into carbon dioxide and water. The same organisms can be catalysed to achieve complete decomposition of the crude oil in less than 24 hours.

Cleaning a Bitumen plant

- Since the process achieves decontamination rapidly, its associated equipment is usually very compact and economical.
- The process is highly flexible and can handle significant fluctuations in the types and concentrations of contaminants in wastewaters.
- The process is capable of delivering very low concentrations of contaminants in treated waters, thus enabling compliance with the most stringent legal standards. For example, a plant that currently uses the process **in a shipping port to treat oil contaminated bilge water from ships**, consistently delivers hydrocarbon concentrations of less than 10 ppm, while the legal limit is set at 25 ppm. This lower target is achieved at no extra cost to the client.

Application in a shipping port

- The process represents the fastest, most flexible and economic approach to water and soil decontamination in the world today.

2. Equipment

Bioreactor

Control unit

3. General Benefits

- Supports the ISO14001, IPPC and EMS management policies and qualifications.
- Made from natural materials and therefore it is non-hazardous and biodegradable.
- Non -Toxic to marine life, certified.
- Low cost.