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The Effectiveness of a Bio-Catalytic Agent Employed in the Bioremediation of Seawater Damaged by Crude Oil

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Abstract

Due to regular activities involving the excavation, cleaning and transportation of petroleum, oil spillage contamination has become one of the most prevalent and difficult issues in marine environments over time. The use of naturally generated surfactants has emerged as a desirable method for repairing oil spill damage to the environment. Many studies have shown that adding nutrients is an effective way to speed up the biodegradation of oil because microorganisms may use petroleum hydrocarbons as a source of carbon and energy, which favours and accelerates the rate of breakdown of the hydrocarbons. Using a qualitative investigation of its features, this study sought to determine the efficiency of a commercial bio-catalytic agent used in the biological rehabilitation of locations contaminated by crude oil. This bio-catalyst performed quite well in the tests that were conducted on it. For instance, the Crucial Micellar emulsification assays for Concentration (CMC) showed typical values of. With the use of a bio-catalytic agent solution and an aeration system, a considerable decrease in chemical oxygen demand, turbidity and total petroleum hydrocarbon content was seen in all of the samples. The sample that contained the most bio-catalytic agent solution had the highest level of water quality. After 30 days of clean up, it showed an effectiveness of 81.537% in removing total petroleum hydrocarbons.

Keywords: Non-ionic surfactant; Bioremediation; Crude oil; Seawater; Bio-catalyst; Environmental impacts

Introduction

The hydrocarbon sector has had significant expansion over the past few decades, and it is currently one of the most crucial linkages in the global economic and social development. The deployment of energy and water intensive platforms for producing water as well as the rise in overall demand for both have been largely attributed to population growth. The frequent exploitation of hydrocarbon sources as a result of this excessive energy consumption has occurred without taking into account the effects on terrestrial, aquatic and aerial ecosystems. Due to their high level of toxicity, suppression of plant and animal growth, limited biodegradation potential, poor reactivity and mutagenic and carcinogenic properties, petroleum derived hydrocarbons pose a serious hazard to the environment. The preceding assertion agrees with Adams' assertion oil contamination in bodies of water results in an impermeable coating that swiftly obstructs gas exchange and sunlight, causing the food chain to break down and a series of concurrent physical and chemical changes that slow down the normal degradation process and render it poisonous. This may result in significant structural changes in the communities of phytoplankton and other marine animals and plants. Nine million tonnes of petroleum hydrocarbons are released annually worldwide into aquatic ecosystems, primarily into estuaries and marine waterways. In fact, the Gulf of Mexico oil spill, which is regarded as one of the worst incidents in history, spilled roughly 600,000 tonnes of crude oil into the ocean. The primary causes of hydrocarbon and derivative contamination in maritime environments are ordinary ship and boat cleaning activities, unintentional oil spills on the water's surface and mishaps associated with the discovery and transportation of crude oil.

Discussion

Although traditional oil removal techniques like physical extraction are frequently used as a first line of defence, it is rare that they completely clean up oil spills. These processes frequently employ conventional physical techniques including ultrafiltration membranes, evaporation and grease traps.

To treat this kind of contamination, chemical techniques like gas and ozone injection, chemical precipitation and ion exchange are frequently used. The issue with these technologies is that they are expensive to implement and run and occasionally they result in the transfer of pollutants to other media. The alternatives to physical and chemical treatment techniques must be developed due to adverse effects on the environment, food safety, human health, the integrity of fauna and flora species and the stability of petroleum hydrocarbons. They must be quicker, more efficient and more environmentally benign than the natural biodegradation processes. An alternative option that satisfies these criteria is bioremediation processes, which have gained popularity since the early 1990's when they were hailed as the ideal response to oil spills. By employing organisms, this approach aims to clean up contaminated areas. It takes into account the microorganisms' metabolic processes and how they will convert the contaminant into biomass and carbon dioxide for this purpose. Surfactants, which are chemical substances with high surface activity, are being used as a result of recent advancements in sustainable technology. They can boost the

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circumstances and outcomes of bioremediation. A type of natural surfactant called a bio surfactant is one that is obtained from plants, animals or microbes. They are chosen to clean up locations that have been contaminated by petroleum hydrocarbons due to their biodegradability and low toxicity. They are perfect for treating oil impacted areas since they may be created using low cost materials and industrial waste as a synthetic base. Its exceptional biodegradation capacity, detoxification of industrial effluents and great efficacy in situations of severe salinity, pH and temperature also demonstrate their adaptability.

Conclusion

Surfactants are also essential to incorporate when creating hybrid nanofluids because they can enhance the rheological and thermophysical characteristics of this class of nanofluids. Its use makes it possible for hybrid nanofluids to remain stable for longer periods of time with uniform nanoparticle dispersion, improving thermal conductivity and reducing viscosity.