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Significant of identified indigenous microbes on oily sludge treatment

Abstract

The aim of this review is to illustrate of role of defined consortia on oil sludge treatment.

Keywords: indigenous, TPH, bioremediation

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Introduction

Previous studies shown that water and soil contaminated directly or indirectly by hydrocarbons due to improper oil dispense which create serious environmental problems.[1,2] Hydrocarbons are the main oil constituent release by industrial and domestic sources, which considered the most serious hazardous problem. Accumulation of dispensed oil and oil derivatives released and separated in oil Refinery and from storage tanks create huge environmental hazard.[1–4] Therefore controlled and monitoring system was adapted to prevent the release of hydrocarbon in the ecosystem and classified it as human health hazard.[5] Oil sludge derivatives are carcinogenic and should be treated probably before disposing into the ecosystem.[6] Biological method was developed for such treatments,[7] although physico-chemical treatments was the method of choice,[2,8] this method is expensive, soil destructive and contaminate soil and water with toxic additives.[9] Due to these facts physico-chemical treatments considered less feasible[10] and searching for cheaper ,simpler and hazardless approach for oil sludge treatment was necessary.[11]

Enhancing activity of the indigenous microbes by addition suitable nutrients was reported to enhance bioremediation in oily sludge contaminated soil.[2,6,7] It had been reported the use of indigenous microbes to accelerate hydrocarbon degradation rate and hens become a major method for restoration of oil polluted environment[1,2,12] where, hydrocarbon contaminants were metabolized by groups of Heterotrophic bacteria and fungi[13] this technique known as bioremediation.[1,14] However, bioremediation still considered complex process with multiple requirements such as isolation of the degrading microorganisms and investigation of manure type to achieve better degrading rate within oil sludge.[1,2,5] Adding to that biodegradation in nature require succession degrading activity and multiple consortia attack might be needed.[1–4] Obviously an intermediate compound will resulted and further degrading microorganism will be required for subsequent degradation.[1,14]

Indigenous microorganisms in soil are self adapted to hard condition they break down pollutants to utilize carbon as energy source for building cells blocks and energy source to grow where contaminants will break down to Carbon dioxide and water as end products.[1,15] Microorganisms exhibit metabolic diversity with endless biotechnological applications.[1,16] One application of bioremediation is utilization of enzymes produced by microorganism.[1,16,17] Enzymes addition as bioremediation agent have been reported to increases significantly biodegradation rate.[1,5,16] Therefore biological treatment (bioremediation) appears to be promising method for treatment of organic matter particularly hydrocarbon.[1,2,3] This technology is environmentally hazardless and simulates natural processes leading to complete destruction of hazardous compounds into innocuous products.[18] Further studies followed supported this technology.[2,3,19–22] Successful hydrocarbon removal still difficult target to achieve in spite of attempts of researcher to find the best approach due to the fact that other parameters are required to increase biodegradation rate, some of these factors are bacterial growth, population diversity, metabolic pathways, toxicity of contaminant chemical, nature of pollutants and biomass concentration.[1–4]

One of the major environmental hazardous problems in underdeveloped countries is dumping oil sludge generated from Oil refinery and urgent treatment policy is needed to solve this problem.[1] One of the suggested biotreatment policy was to utilize organisms existed in the Oil contaminated sites and optimizing their growth factors and requirements for better biodegradation.[1–4,23] Although, many studies provide evidence of bioremediation effective treatments of oil sludge, the major obstacle is the difficulty in the strategic approach to achieve high degradation rate. Significant biodegradation rate could be achieved by utilization of naturally existing microorganisms in the oily sludge site, this prepared consorti can be used for future oily sludge bioremediation application.[1,3,4,24] Other studies showed that there are no standard policy for cleaning hydrocarbon from Oil sludge[2,3,25] although ,some guidelines were developed for oil concentration however, petroleum contains toxic compounds which should be monitored using bioassays techniques for better treatment effects.[26,27] Toxicity of the oily sludge contaminated soil is other problem that should be resolved for better treatment.[1,2] The significant of using indigenous bacteria on TPH soil clean up was reported[4] however, the aim of this review is to show significant consortia prepared from identified microorganism from natural oil sludge habitat on TPH degradation.

Methods

Different designed experiments were conducted to obtain bioremediation. Some researcher designed in situ bio-stimulation,[2]

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other researchers conducted Laboratory experiments[5] where nutrients were added in different concentration. In all cases TPH removal percentage enhancement have to be measured and estimated after suitable addition of nutrients to prepared Consortia.[28,29] Isolation and characterization techniques were followed according to Battikhi et al.[30]

Discussion

Different studies reported that bacterial consortia prepared from microorganisms isolated from natural Oil sludge habitat are able to degrade and metabolize hydrocarbon aerobically and TPH degrading rate was enhanced.[1,4] Other study showed resemblance of isolated microorganism from natural oil sludge habitat to the genus Bacillus[30] although, further confirmatory tests are still required to support similarity.[1,24] However, the effect of such consortia on hydrocarbon degradation estimated by measuring TPH removal rate was reported[1,4,30] There are still other factors to be considered for better degradation rate such as toxicity which has significant role on biodegradation[1,2] and on TPH % removal.[3,4,27,30]

Conclusion

Several reviews showed that the significant of Consortia type and concentration for better biodegradation rate of Oil sludge contamination.[1–4] The role in this review is to illustrate the significance of preparing consortia of identified isolated organism which exhibit high percentage similarity matrix in term of morphological and biochemical to known genus or even species . This concept may play important role in biodegradation process and may lay a guideline for further suitable consortia preparation keeping in mind that other environmental factors should be considered and environmental factors such as pH and toxicity have to be optimized however, further research is needed. Bioremediation techniques have certain specificity where different polluted site have unique characteristics and different treatment strategy might be required.[1,4,5] Official evaluation of criteria also required to validate the success of certain strategy. The success of biodegradation treatment strategy reported to require a multidisciplinary approach where different teams of scientists such as microbiologist, geologists are integrated[1,4] although, some guidelines were developed mainly for TPH concentration decreasing rate however, other petroleum contents with various toxicity and mutagenicity should be considered. Some of these compounds have low aqueous solubility, therefore the usage of the write Consortium type supplemented with suitable manure will increase the rate of bioremediation measured by percentage TPH degradation rate. Having said that if defined consortia use for Oil sludge treatment the percentage of degradation will surely increased.

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Conflicts of interest

Author declares that there is no conflict of interest.

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