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Significant of Indigenous Identified Microbes on Oily Sludge Treatment

Abstract

The aim of this review is to illustrate the effect of defined consortia on oily sludge treatment by estimating TPH degradation.

Keywords: Indigenous; TPH; Bioremediation

Editorial

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Introduction

Previous studies indicated that water and soil contaminated directly or indirectly by hydrocarbons due to improper oil dispense create serious environmental problems [1,2]. Hydrocarbons are the main oil constituent release by industrial and domestic sources, accumulation of dispensed oil and oil derivatives released, 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 to the ecosystem [6]. Biological method was developed for such treatments [7], although physico-chemical treatments was the method of choice [2,8], however, it is expensive, soil destructive and produce toxic contaminants to ecosystem [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 (Phosphorus, Nitrogen, Sulfur) was reported to enhance bioremediation in oily sludge contaminated soil [2,6,7]. It had been reported that indigenous microbes to addition of indigenous microbes 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] a 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 significant 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 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 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 [2,3,18-22]. 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 therefore 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 to increase 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 consortia prepared from naturally existing microorganisms from oily sludge site , 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 significant treatment effects [26,27]. Since toxicity is major problem and must be resolved [1,2]. The aim of this review is to illustrate effect of indigenous consortia prepared from natural habitat on degrading hydrocarbon which could be measured by estimation degradation rate of TPH degradation.

Methods

Different designed experiments were conducted to obtain

bioremediation. Some researcher designed in situ bio-stimulation [2], other researchers conducted Laboratory experiments [5] where nutrients were added in different concentration. In all cases Total petroleum hydrocarbon (TPH) removal rate enhancement have to be measured and estimated after suitable addition of nutrients to consortia type [28,29]. Consortia preparation was adapted by following isolation and Characterization techniques 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 biochemical features to genus bacillus. 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 still 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 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. Our review indicates that defined consortia have significant effect on sludge treatment measured by TPH degradation rate.

References

1. Battikhi MN (2014) Bioremediation of Petroleum Sludge. J Microbiol Exp 1(2): 1-3.
2. Liu W, Luo Y, Teng Y, Li Z, Ma LQ (2010) Bioremediation of oily sludge-contaminated soil by stimulating indigenous microbes. Environ Geochem Health 32(1): 23-29.
3. Mrayyan B, Battikhi MN (2005) Biodegradation of total organic carbons (TOC) in Jordanian petroleum sludge. J Hazard Mater 120(1-3): 127-134.
4. Mrayyan B, Battikhi MN (2004) Bioremediation of Total Petroleum Hydrocarbon (TPH) in Jordanian Petroleum Sludge: cases study. WRSTSD 1(2):138.
5. US Environmental Protection Agency (1994) ARCS Remediation Guidance Document. EPA 905-B94-003, Great Lakes National Program Office, Chicago, USA.
6. Mandal AK, Sarma PM, Singh B, Jeyaseelan CP, Channashettar VA, et al. (2013) Bioremediation: An environment friendly sustainable biotechnological solution for remediation of petroleum hydrocarbon contaminated waste. ARPN Journal of Science and Technology 2(Special Issue): 1-12.
7. Ting YP, Hu HL, Tan HM (1999) Bioremediation of petroleum hydrocarbons in soil microcosms. Resource and Environmental Biotechnology 2: 197-218.
8. Alamri SA (2009) Use of microbiological and chemical methods for assessment of enhanced hydrocarbon bioremediation. Journal of Biological Sciences 9(1): 37-43.
9. Semple KT, Reid BJ, Fermor TR (2001) Impact of composting strategies on the treatment of soils contaminated with organic pollutants. Environ Pollut 112(2): 269-283.
10. Okoro SE, Adoki A (2014) Bioremediation of crude oil impacted soil utilizing surfactant, nutrient and enzyme amendments. J Bio Env Sci 4(4): 41-50.
11. Thayer AM (1991) Bioremediation: innovative technology for cleaning up hazardous waste. Chem Eng News 69(34): 23-44.
12. Jakson AW, Pardue JH, Araujo R (1996) Monitoring crude oil mineralization in salt marshes: Use of stable carbon isotopes ratios. Environ Sci Technol 30(4): 1139-1144.
13. King RB, Sheldon JK, Long GM (1998) Practical Environmental Bioremediation: The Field Guide. (2nd edn), CRC Press/Lewis Publishers, Boca Raton, Florida, USA, pp. 184.
14. Karick N (1977) Alternation in petroleum resulting from physical-chemical and microbiological factors. In: DC Malins (Ed.), Effect of petroleum on arctic and Subarctic Environments and Organisms, Nature and Fate of Petroleum. Academic Press Inc., New York, USA, pp. 225-299.
15. Scrag A (1999) Environmental Biotechnology, Pearson Education Limited, Edinburgh.UK:114-116.
16. Riser-Roberts E (1998) Remediation of Petroleum Contaminated Soils: Biological, Physical and Chemical Processes. CRC Press, Boca Raton, Florida, USA, pp. 576.
17. Madigan MT, Martinko JM, Dunlap PV, Clark DP (2010) Brock Biology of Microorganisms. (12th edn), Benjamin Cummings, USA.
18. Balba MT, Awadhi N, Al-Daher R (1998) Bioremediation of oil-contaminated soil: Microbiological methods for feasibility assessment and field evaluation. Journal of Microbiological Methods 32(2): 155-164.
19. Wrenn BA, Venosa AD (1996) Selective enumeration of aromatic and aliphatic hydrocarbon degrading bacteria by a most-probable-

number procedure. Can J Microbiol 42(3): 252-258.

20. Jorgensen KS, Puustinenn J, Suortti AM (2002) Bioremediation of petroleum hydrocarbon-contaminated soil by composting in biopiles. Environ Pollut 107(2): 245-254.

21. Ding KQ, Luo YM, Sun TH (2002) Bioremediation of soil contaminated with petroleum using forced-aeration composting. Pedosphere 12(2): 145-150.

22. Sabate J, Vinas M, Solanas AM (2004) Laboratoryscale bioremediation experiments on hydrocarbon-contaminated soils. International Biodeterioration and Biodegradation 54(1): 19-25.

23. Rahman KS, Banat IM, Thahira J, Thayumanavan T, Lakshmanaperumalsamy P (2002) Bioremediation of gasoline contaminated soil by a bacterial consortium amended with poultry litter, coir pith and rhamnolipid biosurfactant. Bioresour Technol 81(1): 25-32.

24. Houseman MH, Moore KO (1993) Compositional changes during landfarming of weathered michigan crude oil-contaminated soil. J Soil Contam 2(3): 245-264.

25. Salanitro JP, Dorn PB, Huesemann MH, Moore KO, Rhodes IA, et al. (1997) Crude oil hydrocarbon bioremediation and soil ecotoxicity assessment. Environ Sci Technol 31(6):1769- 1776.

26. Płaza G, Nałecz-Jawecki G, Ulfig K, Brigmon RL (2005) The application of bioassays as indicators of petroleum-contaminated soil remediation. Chemosphere 59(2): 289-296.

27. Guo C, Sun W, Harsh JB, Ogram A (1997) Hybridization analysis of microbial DNA from fuel oil-contaminated and noncontaminated soil. Microb Ecol 34(3): 178-187.

28. Boopathy R (2000) Factors limiting bioremediation technologies. Bioresour Technol 74(1): 63-67.

29. Bharathi S, Vasudevan N (2001) Utilization of petroleum hydrocarbons by *Pseudomonas fluorescens* isolated from petroleum-contaminatioed soil. Environ Int 26(5-6): 413-416.

30. Battikhi MN, Mrayyan B, Atoum M (2009) Classification of bacterial isolates of the Jordanian oil refinery petroleum sludge. Int J of Environment and Pollution 36(4): 418-435.

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