## ABSTRACT

The aim of this thesis work to develop and investigate the performance efficiency of the indigenous bacterial consortium to mitigate the petroleum hydrocarbon pollutants of the industrial petroleum sludge. Four hydrocarbon degrading potential bacteria have been isolated by enrichment technique from petroleum refinery sludge of Indian Oil Corporation Ltd. Haldia, West Bengal, India, and identified as Dietzia lutea IRB191, Dietzia lutea IRB192, Staphylococcus warneri BSM19, and Stenotrophomonas pavanii IRB19. The degradation of total petroleum hydrocarbon (TPH) of petroleum refinery sludge was in the range of 58-65% individually in laboratory-scale mineral salt medium within 28 days of incubation. To enhance the degradation of the TPH, a bacterial consortium was developed, which resulted in 77.3% of degradation under optimized laboratory conditions of pH, temperature, and concentration of petroleum sludge 7, 34 °C, and 2% (w/v), respectively, within 15 days of incubation. Further, a novel two-step bioaugmentation strategy was implemented, which contributed 91.5% of TPH degradation resulting 18.4% higher efficiency than the single-step bioaugmentation process (77.3%). This bioaugmentation strategy was first reported till date on hydrocarbon degradation. The implementation of a concomitant bioaugmentationbiostimulation strategy involving the indigenously developed bacterial consortium and poultry litter extract showed the best performance by mitigating the TPH up to 90.3  $\pm$ 3.7% in 21 days. Finally, the laboratory microcosm study revealed that the combinatorial approach of bioaugmentation and biostimulation with poultry waste was evidenced to be an efficient strategy for TPH degradation. Thus, this combinatorial approach proved to be more efficient in degrading TPH in an eco-friendly manner and hence, may pave the way for better management of petroleum hydrocarbon pollutants while providing a sustainable solution to the disposal of poultry wastes. Considering scanty information on the application of poultry waste as an amendment for TPH degradation, this thesis would surely contribute to the scientific society and research group of petroleum hydrocarbon degradation.

**Keywords:** Industrial petroleum sludge; Total petroleum hydrocarbon; hydrocarbon degrading bacteria; Bacterial consortium; Biodegradation; Bioaugmentation; Biostimulation; Two-step bioaugmentation strategy; Nutrient amendment; Bioremediation