ABSTRACT

Bioremediation of Petroleum Wastes: kinetic modelling of the process and development of an algorithm for optimisation of nutrient addition

Deoraj Ralph Chadeesingh

The hazardous nature as well as the alarming volumes of non-aqueous liquid and solid wastes generated by the petroleum industry pose serious problems not just in terms of the risks posed to human health but also to various forms of animal and plant life and the ecosystem in general. The need to dispose of such wastes in an environmentally acceptable as well as cost effective manner presents not just a technical challenge but a critical imperative. Bioremediation via the land-treatment technique has evolved as one of the most favourable options in this regard in the last few decades. This technology is still only evolving and a survey of the literature reveals critical 'gaps', three of which are addressed in this report.

First, an improved model based on Michaelis-Menten kinetics is developed to facilitate improved predictions of the rate as well as extent of contaminant degradation. Secondly, a new quantitative algorithm in regards to the addition of nutrients to stimulate microbial activity and consequently optimal biotransformation of the contaminants is presented. Further, a natural, local source of microorganisms has been identified to improve the degradation process via bioaugmentation, thus presenting an alternative to the use of genetically engineered microbial strains – an approach vigorously resisted by many environmental agencies and governments.

Keywords: Bioremediation, biodegradation, kinetics, bioaugmentation, biostimulation, land-treatment, landfarning.