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Microbiological aspects study of bioremediation of diesel-contaminated soils by biopile technique

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The aim of this study was to restore diesel-contaminated soils by means of a biological process and to determine microbial metabolism which accompanies biodegradation of hydrocarbons. Restoration of diesel-contaminated soil was achieved using the biopile technique. The principle was to optimize conditions for biodegradation of contaminants in the soil after excavation (ex situ). Indeed, after 40 days. The predominant microbes recovered from the microcosms were bacteria and the achieved rate of soil decontamination was 70%. Synergy was recorded between yeasts and bacteria for diesel biodegradation. This is called cometabolism. This analytical method is a new approach in microbiological analysis of the microorganisms responsible for the biodegradation of hydrocarbons. Original results were obtained consisting of two different bacteria growth phases during the biodegration of diesel in the biopile.

1. Introduction

The contamination of soil caused by accidental leakage or chronic release of crude oil and refined products to the environ- ment occurs each year with growing industrialization and demands for energy (Udiwal and Patel, 2010). If left unaddressed, these spills can adversely affect human health and the environment (CCME, 2008; Sanscartier et al., 2011). Although biodegradation of petro- leum hydrocarbons may be successfully conducted under controlled conditions (Pala et al., 2006; Rodríguez-Rodríguez et al, 2011). Nevertheless, the contamination of sandy soil by petroleum derivates has not widely been reported (Al-Turki, 2009).

Among different techniques, biological treatment is well acknowledged as highly efficient process for soil treatment containing high biodegradable percentage of petroleum compounds (Nano et al., 2003; Fallgren and Jin, 2008). In fact, the most significant environmental recovery mechanism is biodegradation (Sanscartier et al., 2009). The biodegradability of petroleum products released into the environment depends not mainly on the intrinsic biodegradability proprieties of the pollutant, but also on the presence of appropriate microorganisms in soils (Solano-Serena et al., 2001; Gallego et al., 2011). Bioremediation is the use of some techniques to accelerate contaminant biodegradation. Physical and metabolic interactions of the microbial community contribute to dynamic nature of this system. They use different methods to reach hydrocarbons. Bioremediation effectiveness depends on the physicochemical characteristics of the treated soil and the environmental conditions required by the microorganisms involved in the hydrocarbons biodegradation (Costes and Druelle, 1997; De la Torre-Sanchez et al., 2006; Gallego et al., 2011). .This study is based on the bioremediation of diesel-contaminated soils using Biopile technique during 83 days. A new approach in microbiological analysis of the microorganisms which is responsible for biodegradation of hydrocarbons of biopile is presented.

2. Materials and methods

2.1. The biopile description

The Biopile was designed and built in the Laboratory. Essentially, this biopile consisted of a waterproof container with a slight bottom slope.

The tank comprised of a recovery drain with a function to collect leachate water and a perforated plastic PE (semi permeable)

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