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**Enhancement of crude oil bioremediation using multiple factorial design and a molecular technique**Tarek H Taha<sup>1</sup>, Reda K Shaaban<sup>2</sup> and Gihan H Abd Elsamie<sup>3</sup><sup>1</sup>Genetic Engineering & Biotechnology Research Institute, Egypt<sup>2</sup>Ameria Petroleum Refining Company, Egypt<sup>3</sup>University of Alexandria, Egypt

**Statement of the Problem:** Crude oil spills are systematically occurring during transportation, production and refining of petroleum and petroleum products causing serious ecological and health problems. Physical and chemical treatments have been used for remediation of crude oil but with limitations of 10-15% of spilled oil. Recent studies are depending on the bioremediation process which is cost competent method with no disturbance for original ecosystem. In addition, the biodegradation process capable of producing safe and eco-friendly end products (CO<sub>2</sub> and water).

**Purpose:** To describe the variables that positively and/or negatively control the biodegradation process using Plackett-Burman design, identification of the bacterial isolates that collectively enhance the process using PCR-DGGE and finally, determination of the most preferable immobilization matrix that protects the microbes and improves the bioremediation process.

**Methodology:** Different bacterial consortia were isolated from Mediterranean Sea and tested for their oil biodegradation capability. The microbial content of the best degrading consortium was compared with that of the other consortia and the most potent isolates were determined using PCR-DGGE. The selected consortium was submitted to one variable at time optimization (OVAT) followed by Plackett-Burman design. Different matrices have been used for immobilization of microbial cells and their oil biodegradation capacity was compared with free cells.

**Findings:** The obtained results showed that four bacterial isolates were responsible for the highest oil degradation percent and the best polymeric matrix was a blend of alginate and PVA. Finally, polymeric matrix and nitrogen source showed the most positive variables that control the biodegradation process.

**Conclusion & Significance:** Bioremediation is an environmental solution for oil spill problems that could be improved by using a collection of microbial isolates rather than single isolate. The enhancement of the process could be achieved by protection of these strains using immobilization matrices.

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