

International Conference on

ENVIRONMENTAL MICROBIOLOGY & MICROBIAL ECOLOGY

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International Conference on

ECOLOGY, ECOSYSTEMS & CONSERVATION BIOLOGY

July 11-12, 2018 | Toronto, Canada



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Use of water separated from crude oil in the cultivation of wood trees and economic plants and biofuels production through phytoremediation

Oil-mining companies have to subject waste water to expensive treatment before it can be discharged on land or at sea to comply with environment regulations. This study aims at developing an economically valid and applied comprehensive solution that takes advantage of oil-contaminated brackish salty water disposed by the General Petroleum Company in Egypt, maximizes its economic value and ensures its safe use in the environment. Three fields in RasSidr site of the company were inspected. Two main common plant species to RasSidr, Tamarix nilotica tree and Phragmites australis grass, that are tolerant to salinity along with Pongamia pinnata tree that is a leguminous and suitable for the RasSidr environment and grow close to saline-tiled beaches were used. These plants together with their associated bacteria of endophytes and rhizosphere that utilize crude oil as a carbon and energy source was considered a useful combination of bioremediation agents. Initially, soil characteristics were determined by analyzing soil samples taken at depths of 25 cm and 50 cm, and bacterial content of soil around the roots and within plant tissues was examined. Discharged water (@50 m³day⁻¹) was used in irrigating plant fields in amounts sufficient to plant needs only. Growth parameters of plants were assessed four times in an interval of two months. Preliminary results indicated that growth rates in plant length, number of branches and stem girth, and chlorophyll content of oil-polluted water-irrigated plants of the two plant species were not significantly different ($p \leq 0.05$) from plants irrigated with fresh water. The number of bacteria in the soil increased significantly ($p \geq 0.05$) over time, and the color of residual oil in the soil was fading, indicating its decomposition. Soil under Tamarix nilotica contained similar quantities of microorganisms in both coastal saline-alkali soil and inland arid region indicating that colonization of the plant provided stable growth conditions for microorganisms. These plants and endophytes and rhizosphere combination played the main rule in the in-situ bioremediation process, and were efficient in removing around 70 % of the initial traces of crude oil within two months. They also provide safe environment and promote plant growth. They were able to decompose hydrocarbons and residues of crude oil as they possess special physiological mechanisms (PGPR) turns polluted water to safe water for human and environmental, and meanwhile achieving the objectives of this work. These results indicated that Tamarix nilotica and Phragmites australis are promising agents for treating oil-polluted salty wastewater in other fields of crude oil mining.

Biography

Elsayed El-Meleigy is Professor Emeritus, Faculty of Science, Suez Canal University and president of General Syndicate of Scientific Professionals in Egypt. He obtained his PhD in 1989, Ain Shams University, and spent postdoctoral sabbaticals in Purdue University, USA (2000). He has a Bachelor in Shari'ah Law, Al-Azhar University (2004). He is a member of the Supreme Council of Universities and Faculty of Science, Suez Canal University. He authored numerous cultural and scientific books in plant physiology. Professor El-Meleigy supervised many PhD and MSc Thesis and examined many others. He is a member of many scientific organizations and participated in numerous conferences and scientific events at national, regional and international levels. He offered hundreds of public lectures, carried out many projects and activities for the community. He attended specialized courses in Egypt, America, and Germany, and took consultancies in the fields of plastics, paints, inks, adhesives, dry-ink pens and detergents.

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