

Isolation and Molecular Characterization of Microorganisms with Potential for the Degradation of Oil and Grease from Palm Oil Refinery Wastes

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In this study we isolated and characterized native microorganisms with the ability to degrade oil and grease (O&G) and evaluated their potential for the treatment of POMEs from a palm oil refining process. Yeast and bacterial isolates were obtained from solid and liquid wastes from a grease trap of a palm oil refining process, based on their ability to use palm oil as sole carbon source in solid medium. Molecular identification of microorganisms was performed by PCR techniques, revealing that isolates corresponded to *Candida* and *Bacillus* species, with a high degree of similarity with reported O&G-degrading organisms. Five out of these isolates showed lipolytic activity evidenced by changes in the turbidity, colour and produced a substantial decrease in O&G concentrations in liquid MBS cultures containing palm oil. These isolates promoted the highest O&G decrease in POME samples with 56 %, 77 %, 78 %, 76 % and 79 % O&G removal after 72 hours respectively. A microbial consortia composed of five degrading yeasts produced a O&G reduction up to 84 % in POME samples after 48 hours, evidencing a synergic effect of the microorganisms. The results of this study showed that bioaugmentation of polluted wastewaters from palm oil extraction with native microorganisms isolated from oily residues can be efficiently used to greatly improve the removal of grease, oils and organic matter.

1. Introduction

The palm oil industry is currently a world leader in the supply of oils and fats and one of the sectors of the highest economic importance because of the versatility of applications of their by-products, such as cooking oil, special fats, margarines, soaps, detergents, cosmetics, toothpastes, candles, lubricants, biofuels and electric power, among many others. Currently there are about five million hectares of palm planted in the world, representing 16 million tons of annual production. Colombia is the first producer of palm oil in America and the fourth largest in the world after Malaysia, Indonesia and Nigeria (USDA 2015). Much of this oil is obtained from the African oil palm (*Elaeis guineensis* Jacq.) and hybrids with other species as well. However, the improper disposal of wastes from oil refining -containing oils, fats, polluted effluents and sludges- causes a deterioration on the environment and human health because of their carcinogenic, toxic and polluting effects. One of the main wastes derived from palm oil processing are the palm oil mill effluents (POMEs), an oily wastewater generated from milling activities. POME composition include high amounts of oil and grease (O&G), total suspended solids (TSS), chemical oxygen (COD) and biochemical oxygen demand (BOD) which counts for the majority of the contaminant effects on watercourses due to their highly polluting properties and acidic nature. The uncontrolled disposal of these wastes into water bodies may produce important effects such as an alteration of pH, an increase in the organic matter, BOD, COD, and prevention of the passage of light and oxygen generating eutrophication and potentially, toxic compounds (Rupani et al. 2010). Thus, treatment of POMEs is important to avoid environmental pollution of water bodies.