Environmental Biotechnology

Screening of biosurfactant producing bacteria for application in microbial enhanced oil recovery

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Kazakhstan is one of the largest oil producers in the world. But, at present, the most oil fields of country have entered to the final stage of development, which characterized by drop in production rates. A promising way to increase the oil recovery from depleted oil reservoirs by ecologically friendly method is the use of microorganisms with high metabolic activity. The aim of our work is screening biosurfactant producing bacteria for application in microbial enhanced oil recovery. The screening of biosurfactant producing bacteria was carried out by determining the emulsifying activity of isolates and quantitative determination of produced biosurfactants by spectrophotometric method. Interfacial tension between crude oil and biosurfactant solution was determined using the ring detachment method. Active bacterial isolates were identified based on morphological and 16S rDNA sequence analysis. From 4 oil reservoirs of west Kazakhstan on different nutrient media 35 bacterial isolates were isolated. Among them 4 bacteria posessed the greatest emulsifying activity – more than 70%. Isolate Zh 105-9 produced the largest amount of biosurfactants (more than 10 mg/l). Interfacial tension between crude oil and biosurfactant solution produced by strain Zh 105-9 reduced to 38.6 mN/m. This strain was identified as *Bacillus* sp.

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Determining the optimal operational parameters for denitrification in a biological filter

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Water is essential for life. Groundwater, besides surface water, represents one of the most important source of drinking water. The presence of nitrates in water intended for human consumption or as a consequence of its occurrence in drinking water treatment flows due to the oxidation of ammonium by biological nitrification, implies the inclusion of a biological denitrification step in order to ensure the compliance of human consumption water quality with the current legislation and in order to avoid diseases such as methemoglobinemia. Experiments were conducted in a pilot scale biological filter which was filled with expanded clay as a filter media. The bioreactor was feed with a groundwater source intended for drinking water. The experiment objective was the determination of the optimal operating parameters, such as loading rates, biological reaction time, filtration rates, etc., in order to achieve maximum denitrification. Scanning electron microscopy investigations, revealed insights into the granules morphology and structure such as size, pore dimensions, presence of bacteria.

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Cloning, characterization and paper treatment of a new lignin peroxidase derived from *Acinetobacter calcoaceticus*

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The main structural components of wood are the polysaccharides, cellulose, hemicelluloses, and lignins. Lignin provides strength and rigidity to plants and is rather resistant towards degradation. To improve the bioprocessing of lignocellulosic feedstocks, effective degradation methods of lignin are in demand especially in paper industry.

Microbial and enzymatic degradation of lignocellulosic materials is one of the nature's most important biological reactions. Several types of enzymes available to bacteria that enable them to act on lignin. One of the most important lignin degrading enzymes is lignin peroxidase. *Acinetobacter calcoaceticus* T1 is a lignin degrading strain collected from forestry wastes around Trabzon. Lignin peroxidase (AccLiP) of this strain has been cloned, expressed, purified and characterized with and without heme. Heme has increased the stability of the enzyme 8-fold. Optimum conditions for delignification were 5% pulp consistency, 5 μg/ml enzyme and 50 μM H_2O_2 for pulp treatment. The kappa (κ) number of the pine kraft pulp used is 50, which is a very hard pulp type to bleach. AccLiP has decreased its κ number up to 41.03, signifying its higher effectivity, therefore, it is suggested that AccLiP may have more effectivity on the commonly used pulps, like eucalyptus.

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Cyanide removal by different fungal species

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Cyanide is an important chemical compound which causes toxic, carcinogenic and mutagenic effects on living organisms. Although cyanide and its derivatives are mainly acquired from untreated industrial effluents, they are also produced by a variety of microorganisms, algae, plants and animals as an invasive or defensive metabolite. Accordingly, cyanide contaminates soil and water both of by deterioration of these organisms and discharging untreated cyanogen wastes from industrial effluents. Therefore, it is very important to take precautions against cyanide including wastes and to treat them with low costs. Accordingly, in this study, potassium cyanide, potassium hexacyanoferro (II) trihydrate, potassium tetracyanonickelate (II) hydrate and sodium ferrocyanide decahydrate were used as cyanide sources in order to examine cyanide removal efficiencies of different fungal species as *Fusarium graminearum*, *Fusarium equiseti* and *Aspergillus parasiticus*