J Pet Environ Biotechnol 2017, 8:3(Suppl)
DOI: 10.4172/2157-7463-C1-032

Removal of oil-contaminated produced water from wells using treatment with paraffin, beach sand and graphite

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A number of studies are currently being conducted to minimize the impacts caused by wastewater produced by the petroleum industry. In this respect, wastewater samples from the oil company PETROBRAS were characterized and treated with paraffin, beach sand and graphite to assess the removal efficiency of these hydrocarbon-containing materials. For this study, the affinity of oil with these adsorbing materials was assessed (chemical composition of paraffin and graphite and sand porosity). The samples were submitted to the adsorption process, varying their masses, but keeping the volume of the crude sample analyzed fixed. A comparative study was also carried out on the relationship between turbidity (Hanna turbidity meter) and oil and grease content (InfraCal analyzer). Tables and graphs were created based on the results of the study, showing the performance of the materials in the treatment of contaminated water. Paraffin and sand removal was approximately 68% and grafite 76%, but factors such as physical properties, granulometry and material behavior at varying temperatures should also be considered.

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Extending petroleum resources – Substitution of petro-products from glycerol

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Glycerol, because of its multi-functionality, is a potential source of many chemicals currently produced from petroleum sources. Being a byproduct of biodiesel manufacture, the availability of glycerol has been on the increase, but the same fact results in price fluctuations, which means that the best strategies to valorize glycerol must concentrate on high value products. Here, we discuss two possibilities for the upgradation of glycerol – via oxidation to glyceric and tartronic acids, and via hydrogenolysis to 1,3-propanediol. Glycerol oxidation, while a potential route to several high value chemicals, is a complex reaction, and directing it to desired compounds is a challenge. Catalysts such as Pd, Pt and Au, under alkaline conditions, favour the formation of glyceric and tartronic acids, but carbon chain scission leading to C2 and C1 compounds limits the selectivity. Both rate and selectivity of such catalysts are modulated in interesting ways by the catalyst support, with carbon supports providing the best performance. An analysis of the product spectrum under different reaction conditions suggests ways of reaction network reduction, based on which the network has been modeled, and the parameters evaluated for different catalysts. The consequences of possible transport limitations at the catalyst and/or the macro-level in a three phase reactor, especially on the selectivity of the reaction, have been evaluated. Hydrogenolysis of glycerol to 1,3-propanediol, precursor to poly (trimethylene) terephthalate, is again, a nonselective reaction since it involves attacking the secondary hydroxyl group of glycerol while leaving the two primary hydroxyls untouched. Multi-step chemical routes have been proposed, but yields have been poor. We have been experimenting on a strategy of chemically blocking the primary hydroxyls through derivatization, eliminating the secondary alcohol group, and de-derivatizing. The second step can be performed catalytically or non-catalytically. Some of the challenges associated with the reaction will be discussed on the basis of the results from our work so far.

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