Potential and application of thermophilic anaerobic bacterial consortium (TERIL146) for enhanced oil recovery

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Microbial enhanced oil recovery (MEOR) is potentially useful to incremental oil recovery from a reservoir beyond primary and secondary recovery operation using microorganisms and their metabolites. In accordance to the source of MEOR, microorganisms used can be of two types exogenous or indigenous. Indigenous microorganisms have greater advantages compared to injected microorganisms as they are well adapted to reservoir conditions. In present study, fifteen oil/water samples were collected from a carbonate oil reservoir of heavy oil belt of North Gujarat, India. It has around 108 MMt of oil in place reserve of 12-17 API\(^0\) oil with viscosity ranging between 60 to 559 cp. Geochemical characterization demonstrated oils contains, 330-1050 ppm carbon, 25-78 ppm hydrogen, 24-80 ppm nitrogen, 7.5-35 ppm sulfur, 8 to 50.06% aromatic hydrocarbons. Anaerobic, thermophilic and fermentative enrichment cultures were obtained from the fifteen oil/water samples (TERIL150-TERIL162). Metabolites such as CO\(_2\), CH\(_4\), H\(_2\), ethanol, butanol, acetone and acetate and bio-surfactants were detected. Mixed culture of TERIL146 showed the highest activity among all the mixed cultures screened, growing under 60 to 100\(^\circ\)C, 0 to 5% NaCl and 5 to 9 pH. Analysis of the 16S rRNA gene of the TERIL143 consortium showed that the predominant taxon was *Methanothermobacter* sp., *Thermoanaerobacter* sp., *Gelria* sp. and *Thermotoga* sp. using universal 16S and archaean primers. Consortium TERIL143 showed production of metabolites methane (12 mM), carbon dioxide (4 mM), hydrogen (10 mM) and volatile fatty acids (2050.83 mg/L). It also produces extracellular bio-surfactant at 70\(^\circ\)C under anaerobic conditions in mineral medium supplemented with 1% crude oil. Degradation of large alkyl chain was seen with TERIL143 for viscosity reduction of the crude oil under anoxic condition. Produced organic acids and gases could help in dissolution of carbonates, represurization of wells and changes the surface properties of rocks as well as physical properties of crude oil which may improve the fluid rheology and permeability. Therefore, consortium TERIL143 would be a promising candidate for the enhanced oil recovery.

Biography

Meeta Lavania has completed her PhD in the year 2005 from National Botanical Research Institute CSIR in Microbiology. She is the Fellow of The Energy and Resources Institute, a premier leading biotechnology organization. She is in research since the year 2000 and published more than 35 papers in peer reviewed journals and has been serving as an Editorial Board Member of repute.

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