World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

Desulfurization of Crude Oil Using Bacteria

Authors : Namratha Pai, K. Vasantharaj, K. Haribabu

Abstract : Our Team is developing an innovative cost effective biological technique to desulfurize crude oil. 'Sulphur' is found to be present in crude oil samples from .05% - 13.95% and its elimination by industrial methods is expensive currently. Materials required :- Alicyclobacillus acidoterrestrius, potato dextrose agar, oxygen, Pyragallol and inert gas(nitrogen). Method adapted and proposed:- 1) Growth of bacteria studied, energy needs. 2) Compatibility with crude-oil. 3) Reaction rate of bacteria studied and optimized. 4) Reaction development by computer simulation. 5) Simulated work tested by building the reactor. The method being developed requires the use of bacteria Alicyclobacillus acidoterrestrius - an acidothermophilic heterotrophic, soil dwelling aerobic, Sulfur bacteria. The bacteria are fed to crude oil in a unique manner. Its coated onto potato dextrose agar beads, cultured for 24 hours (growth time coincides with time when it begins reacting) and fed into the reactor. The beads are to be replenished with O2 by passing them through a jacket around the reactor which has O2 supply. The O2 can't be supplied directly as crude oil is inflammable, hence the process. Beads are made to move around based on the concept of fluidized bed reactor. By controlling the velocity of inert gas pumped , the beads are made to settle down when exhausted of O2. It is recycled through the jacket where O2 is re-fed and beads which were inside the ring substitute the exhausted ones. Crude-oil is maintained between 1 atm-270 M Pa pressure and 45°C treated with tartaric acid (Ph reason for bacteria growth) for optimum output. Bacteria being of oxidising type react with Sulphur in crude-oil and liberate out SO4^2- and no gas. SO4^2- is absorbed into H2O. NaOH is fed once reaction is complete and beads separated. Crude-oil is thus separated of SO4^2-, thereby Sulphur, tartaric acid and other acids which are separated out. Bio-corrosion is taken care of by internal wall painting (phenolepoxy paints). Earlier methods used included use of Pseudomonas and Rhodococcus species. They were found to be inefficient, time and energy consuming and reduce the fuel value as they fed on skeleton.

Keywords : alicyclobacillus acidoterrestrius, potato dextrose agar, fluidized bed reactor principle, reaction time for bacteria, compatibility with crude oil
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020