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# Study on the Heavy Oil Degradation Performance and Kinetics of Immobilized Bacteria on Modified Zeolite

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**Abstract :** Heavy oil pollution generated from both natural and anthropogenic sources could cause significant damages to the ecological environment, due to the toxicity of some of its constituents. Nowadays, microbial remediation is becoming a promising technology to treat oil pollution owing to its low cost and prevention of secondary pollution; microorganisms are key players in the process. Compared to the free microorganisms, immobilized microorganisms possess several advantages, including high metabolic activity rates, strong resistance to toxic chemicals and natural competition with the indigenous microorganisms, and effective resistance to washing away (in open water system). Many immobilized microorganisms have been successfully used for bioremediation of heavy oil pollution. Considering the broad choices, low cost, simple process, large specific surface area and less impact on microbial activity, modified zeolite were selected as a bio-carrier for bacteria immobilization. Three strains of heavy oil-degrading bacteria Bacillus sp. DL-13, Brevibacillus sp. DL-1 and Acinetobacter sp. DL-34 were immobilized on the modified zeolite under mild conditions, and the bacterial load (bacteria /modified zeolite) was 1.12 mg/g, 1.11 mg/g, and 1.13 mg/g, respectively. SEM results showed that the bacteria mainly adsorbed on the surface or punctured in the void of modified zeolite. The heavy oil degradation efficiency of immobilized bacteria was 62.96%, higher than that of the free bacteria (59.83%). The heavy oil degradation process of immobilized bacteria accords with the first-order reaction equation, and the reaction rate constant is 0.1483 $d^{-1}$, which was significantly higher than the free bacteria (0.1123 $d^{-1}$), suggesting that the immobilized bacteria can rapidly start up the heavy oil degradation and has a high activity of heavy oil degradation. The results suggested that immobilized bacteria are promising technology for bioremediation of oil pollution.

**Keywords :** heavy oil pollution, microbial remediation, modified zeolite, immobilized bacteria
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