Demetallization of Crude Oil: Comparative Analysis of Deasphalting and Electrochemical Removal Methods of Ni and V

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Abstract : Extraction of the vanadium and nickel compounds is complex due to the high stability of porphyrin, nickel is catalytic poison which deactivates catalysis during the catalytic cracking of the oil, while vanadyl is abrasive and valuable metal. Thus, high concentration of the Ni and V in the crude oil makes their removal relevant. Two methods of the demetallization of crude oil were tested, therefore, the present research is conducted for comparative analysis of the deasphalting with organic solvents (cyclohexane, carbon tetrachloride, chloroform) and electrochemical method. Percentage of Ni extraction reached maximum of approximately 55% by using the electrochemical method in electrolysis cell, which was developed for this research and consists of three sections: oil and protonating agent (EtOH) solution between two conducting membranes which divides it from two capsules of 10% sulfuric acid and two graphite electrodes which cover all three parts in electrical circuit. Ions of metals pass through membranes and remain in acid solutions. The best result was obtained in 60 minutes with ethanol to oil ratio 25% to 75% respectively, current fits in to the range from 0.3A to 0.4A, voltage changed from 12.8V to 17.3V. Maximum efficiency of deasphalting, with cyclohexane as the solvent, in Soxhlet extractor was 66.4% for Ni and 51.2% for V. Thus, applying the voltammetry, ICP MS (Inductively coupled plasma mass spectrometry) and AAS (atomic absorption spectroscopy), these mentioned types of metal extraction methods were compared in this paper.
Keywords : electrochemistry, deasphalting of crude oil, demetallization of crude oil, petrolium engineering
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