Abstract

The presence of sulfur in crude oil poses enormous challenges as regards its negative environmental and economic impact. As such, the safety of the equipment is at high risk during the processing of Al-Ahdabcrude oil(3.9wt% sulfur) because of its sour nature.The present research work therefore is aimed at reducing the sulfur content of Al-Ahdab crude oil prior to processing by subjecting it to five different treating methods namely: solvent extraction, oxidation, combined oxidation/solvent extraction, oxidation assisted by adsorption and combined oxidation/extraction assisted by adsorption using relatively mild conditions.

The desulfurization efficiency was investigated firstlyusing extraction desulfurization. Different solvents have been tested including acetonitrile, acetone and methanol. The measured sulfur content of the crude oil, obtained after 30 minutes contact time indicated that acetonitrile has the higher ability to extract sulfur compounds than acetone and methanol respectively giving desulfurization efficiency of 28.5%,using 3:1 solvent/oil ratio.

The second desulfurization mode studied was oxidation, using hydrogen peroxide as an oxidation agent. The results indicate that the desulfurization efficiency increases with increasing reactiontemperature (35-60 ℃), reaction time (15-60 min) and mixing speed(100-500 rpm). Also H_2O_2/Formic acid system showed higher performance as compared to H_2O_2/HCL withdesulfurization efficiency 7.2% and 4.14% respectively. The best operating conditions were 60 ℃, 500 rpm and time and 60 minutes reaction time.

On using combined oxidation/solvent extraction with acetonitrile, the desulfurization efficiency was enhanced from 7.2% to 31.5%.

The effect of operation variables on the oxidation desulfurization of crude oil using hydrogen peroxide as an oxidizing agent and activated carbon as a catalyst was studied. The sulfur content in crude oil was decreased from 3.9% to 2.622% at60 ℃, 500 rpm and time and 60 minutes reaction time, corresponding to a desulfurization efficiency of 32.8%.

The highest desulfurization efficiency achieved was 42.5%% on using combined oxidation/extraction assisted by adsorption treating method.

In this study an artificial neural network (ANNs) (consisting of two hidden layers and twenty neuron in each layer) was used for modeling the experimental data. Theoutput tracks the targets very well and the R^2-value was 0.999.