

SULFUR AROMATIC COMPOUNDS IN HEAVY PETROLEUM FRACTIONS – STRUCTURAL STUDIES OF IMPORTANCE TO DESULFURIZATION

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Desulfurization of petroleum products is one of the major processes in refineries. Dominating today is the hydrodesulfurization which uses hydrogen under high pressure and elevated temperatures in a catalytic reaction producing H₂S. Many alternative processes are being studied world-wide, including chemical and photooxidation, adsorption, biodesulfurization, etc.

Often it seems that heavier petroleum fractions are more difficult to desulfurize which means that more of the polycyclic aromatic sulfur heterocycles (PASH), being the toughest sulfur-containing compounds to desulfurize, remains in the product. We have started a project to study the structure of PASHs that are refractory to HDS in order to see if structural reasons can account for their refractory nature.

Vacuum gas oils and vacuum residues are the main object of study, containing compounds in a molecular weight range of up to ca 800 Da. We employ a series of liquid chromatographic separations to sort the compounds according to defined but different molecular characteristics in each step, followed by analysis using ultra-high resolution Fourier-transform ion cyclotron resonance mass spectrometry.

Examples will be shown that illustrate the gain in knowledge possible using this multidimensional chromatographic approach. Examples before and after desulfurization will be given, including the use of different catalysts and different temperatures.

The use of an adsorptive process for the desulfurization of a diesel fraction has also been studied, this time using capillary gas chromatography. For an identification of the remaining sulfur-containing species, the synthesis of the possible candidates is required.