

STUDY ON THE VALORIZATION OF PETROLEUM RESIDUA FOR OBTAINING USEFUL PRODUCTS

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The petroleum industry has recently been affected by various factors, such as resource limitation, high acquisition and processing costs, legal norms regarding the environment and technological reasons. As a result, this sector is forced to move towards both production and benefit maximization by reconsidering all possibilities to valorize the heaviest residua, which used to be neglected. Therefore, deep and integrated processing imposed. Simple, economical and relatively efficient thermal and chemo-thermal processes regained an important role in the refinery technological stream.

Theoretical and experimental studies also focused on those classic processes, in order to establish new graphical and mathematical connections which could allow the correlation between various physical and chemical characteristics of increasingly heterogeneous feedstock and products, estimation of technological yields inclusively. All these actions lead naturally to the efficient process design, control and supervision, with significant increase in products' quality and quantity.

One primary aim of the present study consists in valorizing petroleum residua through delayed coking, with a complete description of feedstock and products, especially for a series of Russian crude oils which haven't previously been analyzed. The possibility to anticipate the quality and yields of all products, coke's textural properties inclusively is of extreme importance.

Another important aspect of this research consists in the valorization of petroleum residua in order to obtain fuel emulsions with glycerol, the study of their physical, chemical and combustion properties, as well as writing a Mathcad program for calculation of the emulsions' flame temperature. In this way, the possibility to use both petroleum residua (such as heavy fuel oil) and biodiesel residua (the glycerol obtained during biodiesel preparation) as a new, not yet standardized fuel.

This thesis shows the results of a study carried out during November 2006-June 2009 on a delayed coking industrial plant, regarding pertinent observations on different feedstock processing especially mixing residua and the study carried out during 2009-2010 on glycerol-heavy fuel oil emulsions. The scope of this thesis is also the possibility of using technical glycerol and its emulsions as fuel component in real combustion systems. Therefore, various emulsion compositions were tested for stability, physical and chemical characteristics, combustion and environmental impact.

The main scope of this research is to establish the actual optimal process to valorize petroleum residua, maximizing the yield in useful products.

The secondary objectives of the study concerns:

- Description of viable options for valorizing petroleum residua, such as delayed coking and mixing, in an integrated residua management;
- Analyzing the delayed coking process in an industrial plant, based on the feedstock and products' quality;
- Analyzing the possibility to mix petroleum residua with the glycerol obtained during biodiesel synthesis by forming new fuels, which haven't made the object of any standard yet;
- Estimating the yields in coke and liquid products for some Russian crude oils, which haven't made the object of such a study earlier;
- Correlating the physical and textural characteristics of coke with feed stocks' characteristics;
- Evaluating the combustion efficiency, based on flame temperature and gas emission, for glycerol-heavy fuel oil emulsions in a real combustion system.