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## CO-PYROLYSIS OF TYRE WASTES AND COAL. INFLUENCE OF CONDITIONS ON THE CHARACTERISTICS OF THE PRODUCTS

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### *Abstract:*

The economic and environmental problems associated with the generation of scrap tyres are increasing due to the enormous generation of such wastes. Pyrolysis is considered as an optimal and environmentally friendly method for the thermo-chemical conversion of wastes such as tyres. This process allows the decomposition of waste tyres into gas, pyrolytic oil and char, all of which are highly useful products. The aim of the present work is to study the pyrolysis of 1:1 blends of reinforcing fibre (RF) from tyre wastes with low rank bituminous coal in order to study the influence of the variables of the rotary reactor on the yields and characteristics of the products.

The variables under study were: rotatory speed, nitrogen flow, final pyrolysis temperature and heating rate. The chars obtained were characterized by elemental analysis, which was carried out in a LECO CHN-2000 for C, H and N, a LECO S-144 DR for sulphur and a LECO VTF-900 for direct oxygen determination. The textural properties of the chars were studied by means of N<sub>2</sub> adsorption at 77 K on a Micromeritics ASAP 2420 apparatus. The oils were studied by elemental analysis, the heating value and Fourier transform infrared spectroscopy (FTIR), the spectra were recorded on a Nicolet Magna-IR560 spectrometer.

Char yields were around 48±1 % in all cases. Nevertheless, there were greater differences in the oil and gas yields. The oil yield increased as the rotatory speed and nitrogen flow increased and the heating rate decreased. The final pyrolysis temperature, in the range studied, did not affect the mass balances.

Although the N<sub>2</sub> flow was the variable that had a greatest influence on the process, the characteristics of the chars were similar in all cases. The ash and carbon contents were around 9.4±1.5 %, 87.6±1.6 % respectively. The nitrogen isotherms obtained showed that these materials were mesoporous with a low BET surface area.

All the oils obtained had high and similar amounts of carbon and a similar heating value. However, the amount of hydrogen increased while oxygen and sulphur decreased when nitrogen flow was increased with the consequent decrease in the C/H ratio. Moreover, infrared spectrum of the oil obtained with the lowest nitrogen flow showed a different composition to the others, since the amount of oxygen compounds was higher. A reduction in the heating rate led to greater carbon and hydrogen contents but smaller nitrogen, sulphur and oxygen contents in the oil.

It can be concluded therefore that modification of the variables in this rotary reactor does not have an influence on the composition or textural properties of RF/Coal char. On the other hand modification of the nitrogen flow and heating rate produces changes in the oil composition and yield.

*Keywords:* rotary reactor, reinforcing fibre, tyre waste

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