The University of Nottingham

UNITED KINGDOM · CHINA · MALAYSIA

PROGRAMME & ABSTRACTS

9th European Conference on COAL RESEARCH AND ITS APPLICATIONS

Organised by the Coal Research Forum
http://www.coalresearchforum.org

10th - 12th September 2012

Chemical and Environmental Engineering
The University of Nottingham
Nottingham, UK

Sponsored by
Energy Generation and Supply Knowledge Transfer Network, Alston Power Systems,
British Carbon Group, Drax Power, IEA Clean Coal Centre,
International Power, Scottish and Southern Energy

Pyrolysis of blends of coal and tyre wastes in a fixed bed reactor and a rotary oven

B. Acevedo, C. Barriocanal*, R. Alvarez
INCAR-CSIC [Spain]

Abstract:
Find a use for the huge amount of wastes derived from tyre rubber has been the subject of intensive investigation in recent years. Combustion, gasification and pyrolysis have been proposed as the most appropriate technologies for exploiting a waste which contains a high amount of carbon and possesses a high calorific value. Pyrolysis is a process that allows the decomposition of waste tyres into gas, pyrolytic oil and char, all of which are highly useful products. Tyre pyrolysis gases have a very high calorific value and can serve as a source of energy in the pyrolysis process itself. The oil produced is a complex mixture of compounds that can be employed as a fuel. The char produced also has various potential uses: (i.) as a fuel, (ii.) as low quality carbon black and (iii.) as activated carbon. The aim of the present work is to study the pyrolysis of blends of tyre wastes with coal in order to try to increase the char yield, reduce the ash content of the chars produced and determine the influence of the type of reactor on the yields and characteristics of the products. Experimental Two furnaces with different configurations a fixed bed reactor and a rotary furnace were used for the experiments. The raw materials used in the pyrolysis experiments were the tyre crumbs and fluff/fibres obtained as a waste from the grinding and shredding of car and truck scrap tyres. A high volatile matter coal was selected for blending with the two wastes. A thermogravimetric analysis of the coal blends and the tyre wastes was carried out using a TA Instruments SDT 2960 thermoanalyser. 10-15 mg of each sample was heated to 850 °C at a rate of 5 °C/min under a nitrogen flow of 100 ml/min. Pyrolysis tests were carried out at 5 °C/min up to 850 °C in the two furnaces. The elemental analysis was carried out by 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 topography of the fractured surfaces of the chars was studied on a Zeiss DSM 942 scanning electron microscope. The textural properties of the chars were studied by means of N2 adsorption at 77 K on a Micromeritics ASAP 2420 apparatus. Results and discussion A themogravimetric study of the decomposition of the wastes and the blends was carried out. It was found that no apparent interaction occurred during the process. The pyrolysis study involved the carbonizations of the two wastes and their blends with coal (1:1) in the two different type of furnace. The mass balances indicate that the main differences are to be found in the gas and tar yields. The elemental composition of the chars and their textural characteristics were analyzed and the differences were related to the different configurations of the furnaces.

Acknowledgements :
The research leading to these results has received funding from the Spanish MICINN project reference CTM2009-10227.. BA. thanks the Government of the Principado de Asturias for the award of a predoctoral grant with funds from PCTI-Asturias.

* Corresponding Author. Email: carmenbr@incar.csic.es