Pyrolysis of waste tyres

Reference: Pyrolysis of waste tyres in an atmospheric static-bed batch reactor: Analysis of the gases obtained. C. Berrueco, E. Esperanza, F.J. Mastral, J. Ceamanos, P. Garcia-Bacaicoa, J. Anal. Appl. Pyrolysis 74 (2005) 245–253

Introduction: More than 6 million tons of waste tyres are produced per year in the world and most of them are dumped in landfills or in the open. This behavior is unhealthy, as well on the environmental level as on the loss of high-added materials. Therefore, many investigations are realized to find alternative treatments, as for example pyrolysis. To study this last, thermogravimetric method was used to obtain previous information about the thermal decomposition process of the tyre material. Then, the gas generated during the pyrolysis was analyzed by gas chromatography.

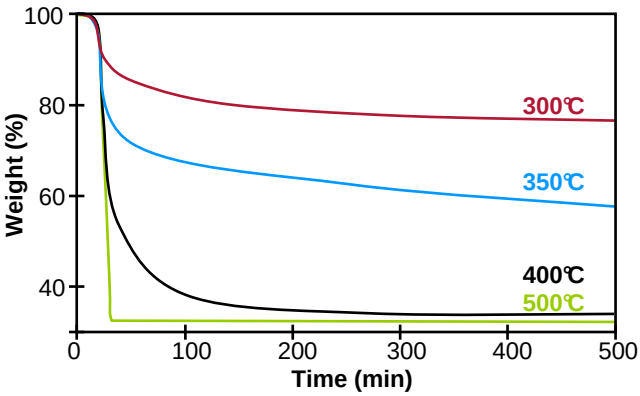

Fig.A. Weight loss curves (%) vs. time for different temperatures

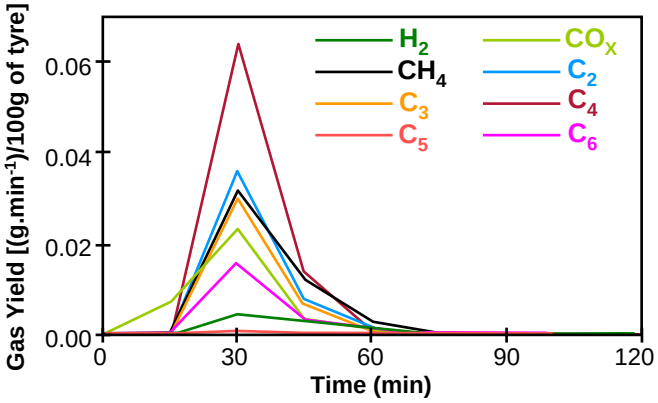

Fig.B. Evolution of gas composition in pyrolysis run

Experimental

The sample analyzed is a small particle size (20mg) of a used tyre type Michelin Radial X.

Thermogravimetric study can be conducted on a Setsys TGA with a nitrogen flow of 80cm^3.min^{-1} in order to maintain an inert atmosphere. Experiments were performed at isothermal temperature, between 300 and 600℃, until no further weight variation was observed. During this period, weight loss depends only on time.

Then, the gas generated during the pyrolysis was analyzed off-line by gas chromatography.

For more details ask for publication A0602

Instrument :

Setsys Evolution TGA (ambient to 1600℃)

Results

Analyses show that thermal decomposition of the sample occurs between 200 and about 500℃. For higher temperatures, the sample weight remained constant. When the temperature is lower than 500℃, total conversion did not happen and the smaller final solid residue obtained is 32% of the initial weight (Fig.A). In all cases, the weight loss mainly occurred between 15 and 35 min, and thereafter, the decomposition continued more slowly. We can note that, for temperatures higher than 450℃, the final conversion was independent on temperature and remained constant for the range of time studied.

Fig.B shows the variation of the different gases over time. The mains components in the gas are H_2, CO, CO_2 and hydrocarbons such as CH_4, C_2H_4, C_2H_6, C_3H_6, C_4H_8 and C_4H_6. For all the temperatures tested, results are similar and the maximum production of the different gases appears at between 15 and 45 min.