

Pyrolysis of waste tyres

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 the latter, 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.

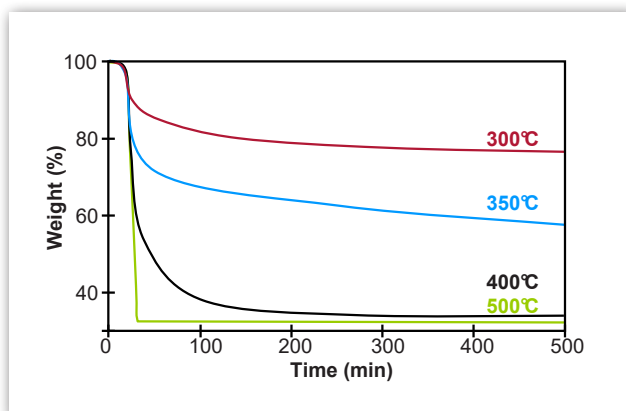


Fig.A. Weight loss curves (%) vs. time for different temperatures

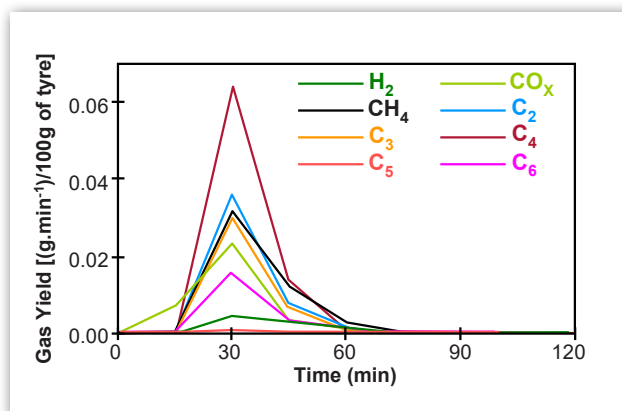


Fig.B. Evolution of gas composition in pyrolysis run

EXPERIMENT

The sample analyzed is a small piece (20mg) of a used tyre type Michelin Radial X. Thermogravimetric study can be conducted on a THEMYS TGA with a nitrogen flow of 80 cm³/min in order to maintain an inert atmosphere. Experiments were performed at isothermal temperature, between 300 and 600°C, until no further weight variation was observed. Then, the gas generated during the pyrolysis was analyzed off-line by gas chromatography.

RESULTS AND CONCLUSION

Analyses show that thermal decomposition of the sample occurs between 200 and about 500°C. For higher temperatures, the sample weight remained constant. When the temperature is lower than 500°C, 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°C, 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 H₂, CO, CO₂ and hydrocarbons such as CH₄, C₂H₄, C₂H₆, C₃H₆, C₄H₈ and C₄H₆. For all the temperatures tested, results are similar and the maximum production of the different gases appears at between 15 and 45 min.

INSTRUMENT

THEMYS TGA

**HIGH ACCURACY & VERSATILITY**

hang-down symmetrical beam balance, specifically designed for TGA application.

ULTRA-HIGH TEMPERATURE CAPABILITY

to 2400°C with a single furnace.

MODULAR ADAPPTIONS ALLOWING

TGA only, DTA only, TG-DTA, and TMA up to 2400°C, DSC only and TG-DSC up to 1600°C all in one instrument

EXTERNAL COUPLING CAPABILITY

designed for evolved gas analyzers (FTIR, MS, GCMS, MSFTIR, or FTIR-GCMS)

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