

## Microwave and Conventional Pyrolysis of Coffee Hulls at Different Temperatures for a Hydrogen Rich Gas

J.A. Menéndez<sup>a</sup>, Y. Fernández<sup>a</sup>, A. Domínguez<sup>a\*</sup>, J.J. Pis, J.M.Valente Nabais<sup>b</sup>, P.J.M. Carrot<sup>b</sup>, M.M.L. Ribero Carrot<sup>b</sup>

<sup>a</sup>Instituto Nacional del Carbón (INCAR) CSIC, Apartado 73. 33080 Oviedo, Spain

<sup>b</sup>Dpto. de Química, Universidad de Evora, Rua Romao Ramalho 59, 7000-671 Portugal

\* E-mail: [padilla@incarcsic.es](mailto:padilla@incarcsic.es)

Coffee beans are covered with an endocarp, more commonly referred to as hulls or "parchment". Before the beans can be roasted, the parchment must first be removed by means of hulling. The hulls are pressed into small pellets which are then incorporated into agricultural soil as an organic fertilizer. The resulting fertilizer, however, cannot be regarded as very effective and the process is merely employed as a means of disposal. The aim of this research work was to study the effects of microwave-assisted and conventional pyrolysis on the hydrogen production, fraction yields and calorific values of the resultant products. Approximately, 15 g of cylindrical pellets (approx. 3 mm d x 2 cm L) was pyrolysed under a N<sub>2</sub> atmosphere (60 mLmin<sup>-1</sup>) at 500, 800 and 1000 °C. The pyrolysis experiments were carried out using an electrical oven and a single mode microwave oven [1].

Table 1. Composition of the gases obtained from the pyrolysis of the residue at 800 °C in the microwave (MW) and in the electric furnace (EF)

	MW (vol.%)	EF (vol.%)
H <sub>2</sub>	40.97	26.07
CO	31.75	20.20
CO <sub>2</sub>	16.90	39.03
CH <sub>4</sub>	7.54	11.21
C <sub>2</sub> H <sub>4</sub>	2.27	1.72
C <sub>2</sub> H <sub>6</sub>	0.58	1.77

The preliminary results showed that microwave-assisted pyrolysis gives rise to lower char and oil yields and a higher gas yield than conventional pyrolysis in an electrical oven. In addition, microwave oven pyrolysis produces a gas which is richer in both hydrogen and syngas and has a higher calorific value than that obtained in a conventional oven.

### References

1. J.A. Menéndez, A. Domínguez, M. Inguanzo, and J.J. Pis, *Journal of Analytical and Applied Pyrolysis*, 71 (2004) 657.