

Characterization of waxes obtained in HDPE pyrolysis

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Thermal pyrolysis of HDPE polyolefin has been studied in a conical spouted bed reactor. This technology is especially interesting because of the high selectivity to waxes. This high selectivity is due to the low residence times and high heating rates that reduce the secondary reactions and increase the yield of primary pyrolysis products (waxes) [1]. These have been obtained operating at 450, 500, 600 and 700 °C and a complete characterization of them has been carried out using different techniques.

Table1

Yields obtained at 450, 500, 600 and 700 °C.

T(°C)	Yield (%wt.)
450	80
500	67
600	53
700	12

GPC analysis

It consists in eluting the polymer in dissolution through a column filled of microporous gel, so the time that macromolecules need to pass through the column is inversely proportional to its molecular size.

Table2

Values of M_n , M_w and Polydispersity at 4 temperatures.

T(°C)	M_n	M_w	Polydispersity
450	1118	1734	1.55
500	1070	1558	1.46
600	986	1430	1.45
700	922	1247	1.35

As is observed in Table 2, values of average molecular weight decrease for waxes obtained at higher temperatures. This is due to the increase of cracking reactions and therefore, shorter chain products are formed with lower molecular weights.

Simulated distillation

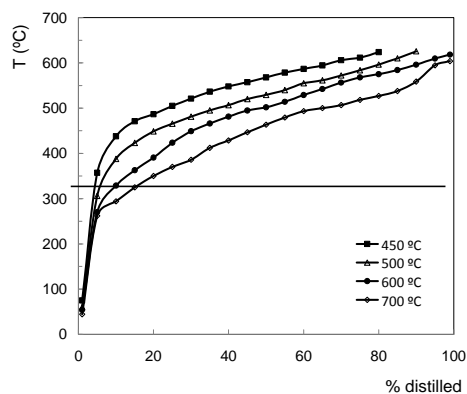


Fig. 1. Simulated distillation curves obtained.

The temperature of 343 °C has been set out as the low boiling point value for waxes. The fraction that distils between 343 and 525 °C (C_{20} - C_{40}) is called light wax [2]. It can be seen that the fraction of this lighter compounds is higher for waxes obtained at higher reaction temperatures, whereas the amount of the heavy fraction, boiling point higher than 525 °C, is higher for those obtained at lower temperatures.

FTIR analysis

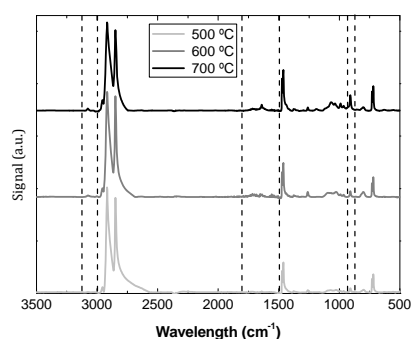


Fig. 2. FTIR spectrum for waxes obtained at 500,600 and 700 °C.

It is observed that the most significant peaks are the stretching bands of C-H bonds corresponding to the $-CH_2-$ groups and the $-CH_3$ terminal groups. The higher the temperature of reaction, the higher the intensity of the peaks in the region corresponding to olefinic bonds, 900-1000 cm^{-1} and around 1600 cm^{-1} [3,4]. At the temperature of 700 °C, a small peak corresponding to an aromatic bond appears at 3100 cm^{-1} .

References

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