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High energy fuel production by optimization of waste polymers pyrolysis

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Polymers are among the most popular materials used in modern societies. The applications of polymers go from high corrosion and temperature long-lasting components to one-time use applications containers; such as those used for food, beverages, liquids and a number of products consumed in our daily life. It is estimated that worldwide, more than 100millions of tons of plastic are wasted every year after one single use. Due to its high stability, most of these materials remain undegraded for decades, polluting the land, air and water with the consequent negative impact on humans and animal life. In recent years, an alternative that has called the attention is the use of pyrolytic process to transform wasted materials into fuels and other chemicals compounds, as an alternative to reduce the amount of material disposed of and at the same time, to generate products of economic interest. In this project, a pyrolytic process was implemented in order to thermally decompose High-Density Polyethylene (HDPE) into products with applications as fuel with high energy content. The HDPE was initially evaluated in a Thermogravimetric analyzer Q500, with this information the pyrolytic reactor was adjusted at 600°C, at a heating rate of 20°C/min and flow of 40mL/min of N_2. 25g of HDPE with a mean particle size of 5mm were treated during 25minutes. After that, the pyrolysis products were analyzed by Fourier-Transform Infrared Spectroscopy to determine its higher heating value (HHV) and the functional chemical groups present. Additionally, a second test was performed, reducing the HDPE mass to 15g and increasing the temperature to 700°C. The obtained results from the first test showed that the products obtained have an HHV of 47MJ/kg, which is an encouraging finding, considering the HHV of diesel and gasoline are 45 and 44MJ/kg respectively. With respect to the second evaluation, the results proved that an increase in the reaction temperature decreases the density of the products which facilitates its manipulation and application as high energy fuel.

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