Revaluation of plastic waste to produce liquid fuels from the use of fluorinated gamma alumina catalysts

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Plastic is a material immensely present in modern life. Due to their versatility, durability and innovation capacity, the plastic materials have contributed to the development and progress of society. The world plastic production reached 348 million tonnes in 2017, an increase of nearly 4% over 2016. In Europe the total converter demand for plastics was 51.2 million tonnes in 2017, distributed in several sectors such as packaging, building and construction, automotive, electrical and electronic, household, leisure and sports, agriculture, among others. Moreover, it is expected that the plastic production to reach 500 tonnes a year by 2020. Because of the increase in the production and consumption of plastics, the production of plastic residues has also been increasing, which has generated major concerns regarding the waste disposal. In recent years these concerns have been intensified due to the increase in pollution of the environment mainly from the seas by plastic products. According to the UN, 10% of human-generated pollution is from plastic products, with half of the plastics being used only once. The spread of plastic is such that 83% of the world's drinking water contains traces of plastic particles. The first solution to this problem is the reduction, reuse and recycling of these materials. Conscious disposal of plastic waste by the population and companies and efficient management by the government would certainly minimize this problem. Meanwhile, an efficient solution that has been hard studied in the last decades, has been the catalytic pyrolysis of plastics. In this work different plastics (HDPE and PP) were used in a 500 mL autoclave reactor on fluorinated gamma alumina catalysts with different fluorine content (2, 4, 8 and 20 wt%) with the objective to produce liquid fuels. Only liquid and gas were formed at the end of the pyrolysis process. The pyrolysis oils were separated into three fractions after going through a simple distillation process (light, intermediate and heavy fractions). Under thermal heating, the conversion into light products (liquid fractions and gas) from PP reached 86.6% in the absence of catalysts and it increased to values higher than 90% when fluorinated γ-alumina were used. For HDPE, the conversion increased from 54.5% in the absence of catalyst to 84.2% when γ-alumina/F_20% was used. The use of fluorinated catalysts increased iso-paraffin and aromatic content and decreased olefinic content in the liquid fractions. The γ-alumina/F_20% catalyst showed great catalytic performance by reducing the temperature required for degradation of PP at 340 °C and HDPE at 380 ºC, compared to temperatures required in the thermal degradation alone

Biography: Raiana Tomazini de Oliveira is a chemical engineer by profession and is currently pursuing a PhD in Nanoscience, Materials and Chemical Engineering at the Chemical Engineering Department, University of Rovira i Virgili in Tarragona (Spain). She holds a BSc in Chemical Engineering at the School of Engineering, Fluminense Federal University (UFF) in Niterói (Brazil), and a master's degree in Chemical Engineering at the Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering (COPPE) of the Federal University of Rio de Janeiro (UFRJ) in Brazil. Her research line is the chemical recycling of plastics with emphasis on the catalytic pyrolysis process that focuses on two areas, polymer engineering and catalysis. Raiana is from a city called Cachoeiro de Itapemirim in the state of Espírito Santo, where, as in most Brazilian cities, the selective collection of plastic materials has recently been implanted and she is passionate about issues that minimize environmental impacts.

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