World Academy of Science, Engineering and Technology
International Journal of Energy and Environmental Engineering
Vol:18, No:02, 2024

Experimental Study on Two-Step Pyrolysis of Automotive Shredder Residue

Authors : Letizia Marchetti, Federica Annunzi, Federico Fiorini, Cristiano Nicolella

Abstract : Automotive shredder residue (ASR) is a mixture of waste that makes up 20-25% of end-of-life vehicles. For many years, ASR was commonly disposed of in landfills or incinerated, causing serious environmental problems. Nowadays, thermochemical treatments are a promising alternative, although the heterogeneity of ASR still poses some challenges. One of the emerging thermochemical treatments for ASR is pyrolysis, which promotes the decomposition of long polymeric chains by providing heat in the absence of an oxidizing agent. In this way, pyrolysis promotes the conversion of ASR into solid, liquid, and gaseous phases. This work aims to improve the performance of a two-step pyrolysis process. After the characterization of the analysed ASR, the focus is on determining the effects of residence time on product yields and gas composition. A batch experimental setup that reproduces the entire process was used. The setup consists of three sections: the pyrolysis section (made of two reactors), the separation section, and the analysis section. Two different residence times were investigated to find suitable conditions for the first sample of ASR. These first tests showed that the products obtained were more sensitive to residence time in the second reactor. Indeed, slightly increasing residence time in the second reactor managed to raise the yield of gas and carbon residue and decrease the yield of liquid fraction. Then, to test the versatility of the setup, the same conditions were applied to a different sample of ASR coming from a different chemical plant. The comparison between the two ASR samples shows that similar product yields and compositions are obtained using the same setup.

Keywords : automotive shredder residue, experimental tests, heterogeneity, product yields, two-step pyrolysis
Conference Title : ICWETP 2024 : International Conference on Waste-to-Energy Technology and Pyrolysis
Conference Location : Barcelona, Spain
Conference Dates : February 05-06, 2024