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Process simulation of plastics pyrolysis for the production of fuels and chemical feedstock

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Low-density polyethylene (LDPE) is a type of polyolefin plastic, which is a common domestic plastic waste. Polyolefins account for 57% of the total amount of plastics present in household waste, of which polyethylene is the most abundant type of this group. In this study, Aspen HYSYS (a process simulation package) is used to design, simulate and optimize two proposed processes for the pyrolysis of LDPE in order to produce liquid hydrocarbons that are suitable for biofuel production. The first proposed process consists of a simple pyrolysis simulation that generalised the process products into three groups, while the simulation of the second process takes into consideration a more complex product description. The main aim of this study is to contribute to pollution prevention and treatment by providing a valuable mechanism that will improve the research on plastic pyrolysis. The simulation results show that it is possible to simulate and optimize the LDPE pyrolysis process using Aspen HYSYS with more accuracy than other methods that have been applied before. The results of the complex simulation model show a greater agreement with the experimental data compared to the simpler model. Therefore, the description of the process was more detailed, improving the quality of the predictions of the pyrolystates. The more detailed product description, not only has increased the prediction accuracy of the pyrolysis process performance, but also the process diagram is more detailed, providing more complete operational specifications, including the duties needed for the LDPE pyrolysis process.

Biography

Nasir M A Al-Lagtah joined Newcastle University International Singapore (NUIS) on January 2014 as a lecturer in chemical engineering. Before that, he was a lecturer (teaching focused) at Manchester University UK. He obtained his PhD in chemical engineering from Queen's University of Belfast in 2008. His research interests include further utilization of lignin residue (biorefinery by-product), production of biodiesel using heterogeneous catalysts, modelling and simulation of bioenergy processes using Aspen Plus (thermal conversion of lignin, biodiesel production, glycerol (biodiesel by-product) utilization to produce value-added products.

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