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The product distribution and thermal degradation mechanisms of fast pyrolysis of polyurethane waste by Py-GC×GC/TOF-MS/FID

Aim

A new online-pyrolysis rig will be used to study the fast pyrolysis process of polyurethane waste. The pyrolysis will be modelled with a simplified and global kinetic model. The conclusions of this work can play an important role in the conversion of plastic waste into chemicals.

Justification

Plastics are one of the most versatile materials in the world today and play a vital role in our daily life. Plastics are now considered the key material in numerous sectors such as construction, medical, engineering applications, automotive, aerospace, leisure, electronics, packaging, food and others. However, the percentage of plastic waste ended up in the landfill still very high that it occupied a huge space. Most types of plastic are not biodegradable. In fact, they are extremely durable. This means the majority of polymers manufactured today will persist for decades and probably for centuries, if not millennia. Polyurethane, as typical plastic material, has also increasingly been used during the past thirty years in a variety of applications due to their comfort, cost benefits, energy savings and potential environmental soundness.

In order to reduce the pollution of plastics to the environment and convert it into chemicals, testing have resulted in a number of recycling and recovery methods for polyurethanes that can be economically and environmentally viable. It is noted that the fast pyrolysis is an important technology to create gas and oil under heated, oxygen-free conditions.

Many research papers have been published regarding the potential of various types of plastics in pyrolysis processes for liquid production. It should be noted that the product yield and quality heavily depend on the set-up parameters. Therefore, this work will focus on the effect of the main affecting parameters on the fast pyrolysis process of polyurethane waste. The main parameters include temperature, residence time, pressure, different catalysts usage and flow rate.

Program

In this work, the fast pyrolysis experiments of polyurethane waste will be performed using Py-GC×GC/TOF-MS/FID.

- The experimental data will be obtained using Py-GC×GC/TOF-MS/FID. The detailed product information and the effects of various reaction conditions will be discussed.
- Identify all the possible reaction steps and search for new conversion pathways for the formation of the experimentally observed products.
- Develop a global model for the fast pyrolysis of polyurethane waste and provide guidelines to polyurethane waste and for scale-up of the fast pyrolysis process.

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