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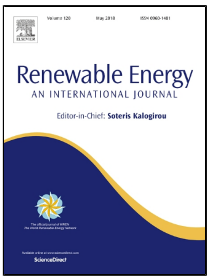

Research on the Pyrolysis Process of Crumb Tire Rubber in Waste Cooking Oil

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Research on the Pyrolysis Process of Crumb Tire Rubber in Waste Cooking Oil

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Abstract: The use of waste cooking oil (WCO) in crumb tire rubber (CTR) pyrolysis not only improves the safety and controllability of the preparation process, but also recycles these two waste resources effectively. In this study, WCO was used as the solvent to pyrolyse CTR at high temperature to prepare waste rubber oil (WRO). The changes of CTR in molecular structure and rheological properties during thermal energy accumulation were explored through thermogravimetric analysis, Fourier transform infrared spectrometer, gel permeation chromatography and dynamic shear rheometer. The compatibility of CTR with virgin asphalt before and after pyrolysis was described by segregation test. Results show that, with the rise of temperature, depolymerized and broken rubber macromolecule in CTR continue to crack into molecules with less molecular weight, while more of natural rubber and carbon black are released. The rheological properties of WRO have changed greatly, i.e. the decreased zero shear viscosity, the improved flowability and the better plasticity. Complex chemical reactions occur during the pyrolysis of CTR, but no new functional group is generated except for the released natural rubber. The segregation test shows that, the compatibility of CTR with virgin asphalt can be improved by adopting WCO for pyrolysis.

Key words: crumb tire rubber; waste cooking oil; pyrolysis; molecule structure; rheological property

1. Introduction

With the rapid development of domestic automobile industry, the consumption and import volume of rubber are increasing. According to statistics [1], 1.11 billion cover tires were produced in China in 2014, accounting for more than 30% of the global tire production, ranking top in the world. Meanwhile, China has the largest tire scrappage in the world, and more than 10 million tons of waste tire are produced every year, but the harmless utilization rate is only 60%, lower than that of about 90% in developed countries [2]. When the waste tire disposal becomes a worldwide environmental and economic challenge [3], as the country with the largest production and scrappage of

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