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污水高级氧化技术的研究现状及其新进展

记笔记

赵霞 ISMOILOV Bakhrom 李亚斌 李响 张航 胡涛
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摘要：高级氧化技术(AOPs)在污水处理方面具有高效、快速、无二次污染等特点而受到研究者的广泛关注。本文介绍了高级氧化的技术理论,并对Fenton法、超声氧化法、O3法、超临界水氧化法、光催化氧化法、催化湿式氧化法和过硫酸盐氧化法的新进展进行了综述,并从工业化应用的角度探讨了污水高级氧化技术的发展趋势。

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关键词：高级氧化; 羟基自由基; 硫酸根自由基; 氧化;
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Opportunities and challenges of the Sponge City construction related to urban water issues in China

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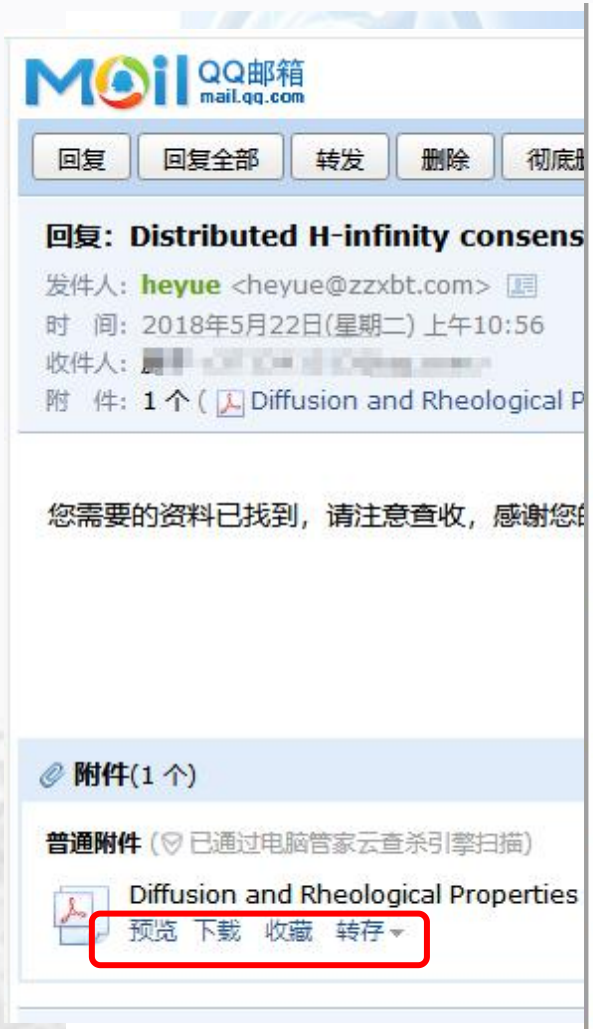
City is an effective approach to solving the urban water issues, particularly for the waterlogging. In this study, both the urban issues emerged at the stage of rapid urbanization in China and the demands as well as problems of Sponge City construction related with the water issues were investigated,



Diffusion and Rheological Properties of Asphalt Modified by Bio-Oil Regenerant Derived from Waste Wood

Bin Sun [1] and Xinxing Zhou2

阅读全文

Abstract: To decrease the usage of energy and improve waste recovery, dynamic simulations are conducted to understand the diffusion mechanism and rheological properties of bio-oil regenerated asphalt. A new simplified model of bio-oil modified asphalt (BMA) is built to calculate diffusion coefficients, diffusion driving force, viscosity, solubility parameters, and ductility. The calculated diffusion coefficients of bio-oil, asphaltenes, saturates, and resins are 4.5 × 103 cm2=s, 3.6 × 104 cm2=s, 4.2 × 104 cm2=s, and 5.1 × 104 cm2=s at 298 K, respectively. Results indicate that the bio-oil diffuses faster than asphaltenes, saturates, and resins, and that it can increase the ductility of asphalt and improve asphalt's elastic property. Moreover, potential energy is the key driving force of diffusion. There is no chemical reaction involved in the diffusion process of BMA and bio-oil can both reduce the viscosity of asphalt and soften it. DOI: 10.1061/(ASCE)MT.1943-5533.0002138. 2017 American Society of Civil Engineers.

Author keywords: Molecular simulation; Diffusion; Rheological properties; Regenerant; Bio-oil modified asphalt.

Introduction

The crude oil industry uses a refining technology and is more advanced than the asphalt industry, which has a limited inventory. The annual world production of biomass with a potential energy application is currently estimated to be approximately 3,000 billion kg (3 billion tons) for forest residues, and between 1,100 and 3,100 billion kg (1.1 and 3.1 billion tons) for agricultural residues (Mohan et al. 2006; Xue et al. 2014). Moreover, it is widely accepted that the biofuel combustion of waste wood, which is a type of agricultural residue, does not contribute to the greenhouse effect (Yang and Suciptan 2016). It is also acknowledged that an asphalt modification is an effective way of reducing the use of base asphalt and that other products can be used to reduce asphalt consumption, such as using waste cooking oil as modified asphalt and epoxy modified asphalt (Sun et al. 2016c; Chen et al. 2014b; Burke and Hesp 2011; Bai et al. 2016). Using such materials could improve the rheological properties of aged and base asphalt, while simultaneously reducing the consumption of base asphalt. In addition, alternative materials that can partially replace asphalt, such as bio-oils derived from microalgae, waste wood, swine manure, and leather waste, can be employed to reduce its use. The generation of bio-oil occurs through fast pyrolysis, in which biomass materials

implicates that the work is taking full advantage of waste wood to produce bio-oil regenerant and replace the asphalt.

The rheological properties of bio-oil regenerant derived from waste wood are similar to those of an asphalt binder. Therefore, bio-oil regenerant derived from waste wood resources could improve the high-temperature stable performance of asphalt binders; however, there has been an unfavorable effect on their low-temperature performance (Yang et al. 2013). Bio-oil regenerant could also significantly improve the asphalt mixture fatigue performance, and it is known that polymer modified bio-oil performs better than original and dewatered bio-oils (Yang et al. 2014). Some previous research has indicated that the bio-oil is susceptible to aging attributable to high temperature (Yang et al. 2013; Raouf and Williams 2009; Onochie et al. 2013). However, other research has indicated that if waste coffee is used as a solvent in the traditional asphalt binders, the aging properties of asphalt could be improved (Zofka and Yut 2012; Mills-Beale et al. 2012). In addition, bio-oil derived from swine waste could enhance the low-temperature crack resistance performance of asphalt (Fini et al. 2011). It is also known that microalgae contain a substantial amount of liquid, similar to fruit-oil seed. Thus, bio-oil produced from microalgae could improve the rheological properties of asphalt (Harman-Ware et al. 2013). Microalgae have already shown

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