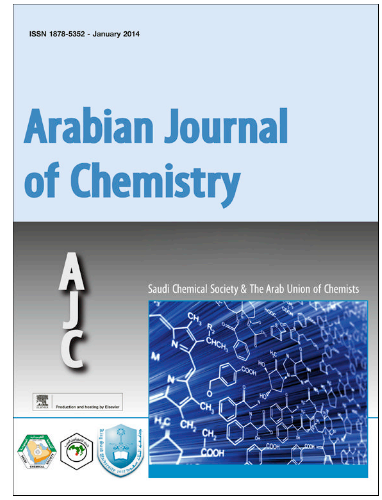

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Abstract To disclosed the internal factors for the growth of mycelium and Lentinus edodes, Quercus Linn wood, which was biotransformed during the artificial cultivation of Lentinus edodes, were synergistically characterized by TGA/DTG, FT-IR and NMR. The results showed that the different ingredients of hemicellulose decreased during steam explosion and biodegradation of Lentinus edodes, however hemicellulose content continued to increased. FT-IR showed that the transmittance of the characteristic peaks in hemicellose gradually increased after decreased after steam explosion and biodegradation of Lentinus edodes. TGA/DTG curves that thermal stability and maximum thermal degradation rates of hemicelloses were contiguous after steam explosion and biodegradation of Lentinus edodes. Structural determination based on FT-IR and ^{1}H, and 2D-HSQC NMR analyses showed that the alkali-extractable hemicelluloses shared the structure composed of (1→4)-linked β-D-xylopyranosyl backbone with 4-O-methyl-R-D-glucuronic acid attached to O-2 of the xylose residues and L-arabinose attached to O-3 of the xylose residues. And it revealed that the extractable hemicelluloses retained original structure without cleaving chemical linkages. Furthermore, a small amount of other minor hemicelluloses (β-glucans) including xylans in the extractable hemicelluloses could be identified by NMR and other approaches.

KEYWORDS Hemicellulose of Quercus Linn wood; Steam explosion; Biodegradation of Lentinus edodes; TGA/DTG; FT-IR; NMR; HSQC

1. Introduction

With the increase of global energy requirements and greater environmental awareness, alternatives to fossil fuels as energy sources have been widely followed on. Photosynthesis conversion solar energy into the storage of energy in the form of plant cell-wall polymers. The energy stored in these polymers could be accessed in many ways, ranging from simple burning to complex bioconversion processes. Currently plant cell walls were considerable biomass resources of biofuels and other chemicals. What's more, lignocellulosic biomass, which contained the agricultural residues, forestry waste and municipal solid waste, presented a sustainable and renewable source for the production of liquid biofuels such as bioethanol (Taherzadeh et al., 2008; Razali and Said, 2017). That was, lignocellulose feedstock was considered to be an attractive raw material for liquid fuel and the production of chemicals and materials. As most often being a by-product from food and feed production, lignocellulosic biomass did not compete with the production of edible crops (Chen et al., 2010; Petersson et al., 2007) and had the potential to be the feedstock for the production of a considerable proportion of transport fuels if cost effective conversion processes were available (Kristensen et al., 2008; Halim and Phang, 2017). The major components in lignocellulosic biomass were cellulose, hemicellulose and lignin. Hemicellulose sugars are the second most abundant carbohydrates in nature and its conversion to ethanol could provide an alternative liquid fuel source for the future (Jeffries et al. 2006; Shamsuddin et al., 2017). However, hemicelluloses, which were restricted to poales and a few other groups, composed of different fiveand six-carbon monosaccharide units (Rubin et al. 2008; Ghafar et al., 2017). The detailed structure of the hemicelluloses and their abundance varied widely between different species and cell types. Especially, the biosynthesis of xylans and beta-(1→3,1→4)-glucans remains very elusive, and recent studies have led to more questions than answers. Hence, the effects of hemicelluloses on biomass digestibility need to be revealed.

In the plant cell wall, hemicelluloses were bound to lignin and cellulose, and detailed isolation procedures were required to separate these components from plant raw material (Hansen et al. 2008; Khan et al., 2017). Removal of hemicelluloses in a pure form from plant cell wall involved hydrolysis of ester and ether bonds, which linked the hemicelluloses to lignin (Aziz and Hanafiah, 2017). A number of methods were used to isolate and richen hemicelluloses from plant sources, including extraction with alkali, dimethyl sulfoxide, water, methanol, steam or microwave treatment (Hansen et al. 2008; Wen et al. 2010; Wen et al. 2011). These methods were developed for characterization purposes, but it could also be used as a preparative method. Besides, hot water could be used as a