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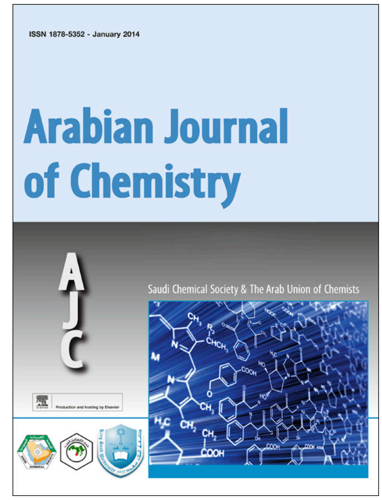

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Potential use of different kinds of carbon in production of decayed wood plastic composite

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Abstract This study investigated the mechanical, chemical structure and thermal properties of hot press molded wood plastic composite (WPC) panels produced from different amounts (30, 40, or 50% weight) of decayed *Pinus massoniana Lamb.* and polypropylene with chitosan(3 wt%) and different kind of carbon(2 wt%). The results were compared with the properties of WPC produced without carbon. The mechanical, chemical structure and thermal data showed that WPC with carbon was better than WPC without carbon, and the best condition to produce decayed wood plastic composite was hot pressing temperature at 170°C for12min, Carbon Nanotubes(CNT) and chitosan(CS) accounting for 2% and 3% of total mass, and the proportion of decayed wood and PVC is 40% and 60% .

KEYWORDS Wood plastic composite; Decayed wood; Mechanical properties; Chemical structure; Thermal properties

1. Introduction

Wood plastic composite is a low-carbon and environmentally friendly materials which refers to composite material that contains wood and plastic (Ashori, 2013). WPC has many advantages such as a light weight, corrosion resistance, dimensional stability, recyclable and so on, which is widely used in outdoor construction, logistics and decoration, etc., WPC products have commonly substituted for solid wood in today's applications, which can effectively solve the waste fiber and plastic products caused by waste of resources and the problems of environment pollution (Selke, 2004; Liu, 2011).

Wood decay is a exacerbation of wood by mainly enzymatic activities of microorganisms (Srivastava, 2013). Brown-rot decay is the most common kind of decay of wood in use (Iii, 1997). The most severe kind of microbiological deterioration of wood is fungi due to that can cause rapid structural failure (Iii, 1997). Brown-rot fungi usually degrades the hemicelluloses and cellulose to destroy wood, which will not change the lignin extensively (Flournoy, 1991). Lignin is a complex aromatic polymer which bundles the cell walls that will prevent access of enzymes to the cellulose and hemicelluloses (Iii, 1997). As the surface of the wood fiber has strong polarity and water absorption, and the thermoplastic surface has non-polarity or less polarity, the composite material can be prepared by mixing the two materials because of poor interface compatibility (Hosseinihashemi, 2011; Kord, 2014).

Nowadays, many countries face the problem of lack of wood resources in wood composite industry because most of them do not have abundant forested areas. As the growing demand for WPC in many industries, find new lignocellulosic resources has been imminent. Sound wood is used in the production of particleboard , fiberboard and others while decayed wood has no economic value. This was because reduced yield and its diminished quality. Therefore, decayed wood is not allowed to be uesd in wood-based panel industry and decayed wood usually be fired. However, the decayed wood may play an important role in plastic composite industry. Use of inexpensive decayed wood is important for the long-term sustainability of the WPC industry, so that WPC industry may be the most efficient industry to fully use decayed wood (Ayrilmis, 2015).

As the surface of the wood fiber with strong polarity and water absorption, while the surface of the thermoplastic has a non-polar or less polar, the mechanical properties of the composites prepared by mixing the them are poor (Yang, 2010). At present, the researchers found that chitin, chitosan and lignin amine natural polymer compounds can improve the interface properties of composite materials (Xu, 2014). Carbon can be filled in the gap between plant fibers and thermoplastics to enhance the role. Xu studied the effects of chitosan addition and particle size on the thermal and rheological properties of wood fiber/polyvinyl chloride composites (Xu, 2014). It was shown that when the mass fraction of chitosan was 30% and the particle size was 65 -90μm, the heat resistance, the glass transition temperature and the thermal stability are all improved effectively. With the increase of the amount of chitosan and the decrease of the particle size, the melting time of the composites