Study on Soil Corrosion Resistance of Castanopsis Fissa/PVC Composite

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Abstract: Seven light stabilizers such as benzotriazole, HALS, ZnO, pigment phthalocyanine green, TiO_2 and UV300 were used to study the soil corrosion resistance of castanopsis fissa/PVC composite. The experimental results demonstrated that pigment phthalocyanine green showed the best stability for the composite, whereas ZnO showed the worst. The strength of shearing, elasticity modulus, tensile strength, elongation at break and impact toughness of composite buried for seven months was -2.3, -10.6, 15.4, 17.5 and -4.6 higher than that of composite un-buried. FTIR analysis consisted well with the mechanical results. A mechanism was also proposed to explain the soil corrosion of castanopsis fissa/PVC composite.

Key words: Wood plastic composite; Castanopsis fissa; PVC; Corrosion resistance
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1 Introduction

Wood plastic composite (WPC) is an intimate mixture of wood and plastic. Now it has gained popularity due to the low cost of recycled wood or plastic to the manufactures, the excellent strength properties and decay resistance. It has widely applications in construction, infrastructure, automotive parts and furniture[1]. Initially, it was assumed that thermoplastic material completely encapsulated the wood component of WPC, providing protection against water absorption and therefore against biological and water damage[2-5]. Recent study has shown that such WPC is not immune from the biological degradation[4-5]. The importance of the protection of WPC against fungal decay is reported to be possible through the addition of light stabilizers.

2 Experimental

Fissa was first premixed with $CaCO_3$ and then mixed with coupling agent (DL-411-A). At the same time, PVC was premixed with heat stabilizer (DBP) and light stabilizers. Finally modified castanopsis fissa and modified were added to the extruder with lubricant (olefin) to get castanopsis fissa/PVC composite.

The composites were buried in soil (pH=6.23) for 7 months. The eroded samples were first washed by water then dried in a convection oven.

Static mechanical properties of the eroded samples were measured on a computerized-controlled AG-I-50 tester according to ASTM D1621 standard. Surface layer of the eroded samples was scratched and milled to powder for FTIR (IR100) analysis.

3 Results and Discussion

3.1 Mechanical Properties

Experimental results revealed that all light stabilizers affected the mechanical properties of composites significantly. Composite containing pigment phthalocyanine green has the highest weighted score (-19.7), whereas ZnO has the lowest score (-65.3). Composite containing pigment phthalocyanine green also has the best mechanical properties, the variety ratios in strength of shearing, bending elasticity modulus, tensile strength, elongation at break and impact toughness are -2.3, -10.6, 15.4, 17.5 and -4.6 lower than the composite without light stabilizer. Composite containing HALS has better mechanical stability. The variety ratios in strength of shearing, bending elasticity modulus, tensile strength, elongation at break and impact toughness are -0.2, 11.6, 9.9, 7.7 and -4.9 lower than the composite without light stabilizer. So we can conclude than HALS is also a good light stabilizer to castanopsis fissa/PVC composite.

3.2 FTIR analysis

Surface layer of composites un-eroded and eroded was scratched and milled to powder for FTIR analysis. The results showed that main change occurred in 1500 ~1300 cm^{-1} ranges. This range contains lignin carbon

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librations in 1468 ~ 1460 cm^{-1}, CH_2 in 1435 ~ 1422 cm^{-1} and CH_3 in 1380 ~ 1377 cm^{-1} and 1468 ~ 1460 cm^{-1}. Absorbency of blank, composites containing ZnO and TiO_2 increased after corrosion, whereas the absorbency composites containing benzotriazole, HALS, pigment phthalocyanine green and UV300 decreased after corrosion. We can conclude that in the first three composites, the amount of C-H decreased by corrosion of lignin is higher than amount of C-H increased by chain-break and browning reaction of PVC. Whereas in composites containing benzotriazole, HALS, pigment phthalocyanine green and UV300, the trend is on the reverse.

During corrosion period, under the action of oxidation and water aging occurred to PVC and chromophore groups such as —C=O created, and the absorbency of —C=O increased. The higher the Absorbency of —C=O, the serious aging of castanopsis fissa/PVC composite. The sequence of absorbency is as follows: blank> ZnO> TiO_2> UV300> pigment phthalocyanine green> benzotriazole> HALS. Its obvious that HALS showed highest stabilization than other agents.

4 Conclusions

Seven light stabilizers showed different stabilization to Castanopsis Fissa/PVC Composite.

(1) Pigment phthalocyanine green, HALS and benzotriazole showed much better mechanical stability to castanopsis fissa/PVC composite, where ZnO showed the worst.

(2) FTIR analysis consisted well with the mechanical results. It revealed that HALS, benzotriazole and Pigment phthalocyanine green revealed have the better stabilization to castanopsis fissa/PVC composite.

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黎蒴栲 /PVC复合材料耐土壤腐蚀性的研究

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摘 要: 选择了苯并三唑、受阻胺、氧化锌、酞菁绿、二氧化钛和 UV300等七种光稳定剂制备黎蒴栲 /PVC复合材料, 考察其对复合材料耐土壤腐蚀性的影响, 发现添加酞菁绿的复合材料耐土壤腐蚀性最好, 添加氧化锌的复合材料耐土壤腐蚀性最差。分析了复合材料土壤腐蚀前后的力学性能和 FTIR数据, 提出了一种黎蒴栲 /PVC复合材料土壤腐蚀的机理。

关键词: 木塑复合材料; 黎蒴栲; PVC; 耐土壤腐蚀性

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