Study on Effects of Wet-dry-oxidation Stabilization on Castanopsis Fissa/PVC Composite

XIE Xue-tian, LI Kai-fu, YAN Xue, GUAN Li-tao
(College of Forestry, South China Agricultural University, Guangzhou 510642, China)

Abstract: Wet-dry-oxidation aging was studied using climatic box. The results showed that different light stabilizers had great impacts on wood plastic composites' flexural properties and tensile strength decreased greatly meanwhile tensile elongation at break and impact ductility decreased a little except for those added with HALS and UV300 after wet-dry-oxidation aging. Wet-dry-oxidation aging mechanism of wood-plastic composite was also discussed by means of FTIR.

Key words: wood plastic composites; light stabilizer; wet-dry-oxidation aging
CLC number: TS653 Document code: A Article ID: 0529-6579 (2007) Sl-0237-02

Khan Mubarak A. considered that wood plastic composites have a good stability under water heating aging[1]. and Sun Zhanying thought water is the most critical factor in weather resisting property[2]. Under the condition of wet-dry-oxidation, the paper studies mechanical property, chromatic aberration and Wet-dry-oxidation aging mechanism with adding different light stabilizers to Castanopsis fissa/PVC (WPC). It is aimed to provide protecting methods and elongate its operational life span for WPC.

1 Materials and methods

Compositions for preparing Castanopsis Fissa/PVC composite were listed in Table 1 and Table 2. First Fissa was 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 (Table 2). Finally modified castanopsis fissa and modified were added to the extruder with lubricant (olefin) to get castanopsis fissa/PVC composite.

Climatic temperature alternate proof box is set as circle of high and low temperature. Each circle is 33.5 h and will take 24 circles which I will take 33.5 days as a whole.

Testing chromatic aberration every four circles and testing tensile-strength, flexural strength, compression strength and impact flexibility after 12 and 24 circles with precise mechanical testing machine. After 24 circles, the flour of before and after aging samples were obtained from 120 eyes of screen mesh and made into samples by KBr. The changes of WPC were observed by FTIR. In the paper their weights are separately as 0.2, 0.2, 0.2, 0.2, 0.2.

Table 1 The composition of Castanopsis Fissa/PVC Composite

Materials	Weight (g)
PVC	100
Wood flour	50
$CaCO_3$	10
Aluminate	1.5
DBP	7
GMS	2
Rare earth stabilizer	5
Hard paraffin	1.5
Liquid paraffin	1.5

Table 2 The composition of light stabilizer

Light stabilizer	0#	1#	2#	3#	4#	5#	6#
Weight	0	0.4	0.7	8	4	8	0.7

0#—— blank; 1#—— benzotriazole; 2#—— HALS; 3#—— ZnO;
4#—— pigment phthalocyanine greep; 5#—— TiO_2; 6#—— UV300

2 Results and discussion

2.1 Mechanical property

The mechnical property are tested and different light stabilizers have significant differences in WPC. Flexural strength and tensile-strength are deeply dropped after circles. Tensile strength are lightly dropped after 24 circles except phthalocyanine green and TiO_2. Impact flexibility are slightly increased in adding HALS and UV300, and adding others are a lit

①收稿日期: 2007-01-10
作者简介: 谢雪甜 (1979年生), 女, 硕士研究生; 通讯联系人: 李凯夫, E-mail: kfli@scau.edu.cn

tle dropped after 12 circles. Adding HALS and UV300 increased a little after 24 circles. After 12 circles, HALS has the highest remark in weighted score, followed by phthalocyanine green, TiO_2 is the lowest. After 24 circles, ZnO is the highest, followed by phthalocyanine green and blank is the lowest. It is believed that phthalocyanine green has a visual effect on wet-dry-oxidation aging.

2.2 FTIR analyse

The larger absorption strength of carbonyl is, the better wet-dry-oxidation stabilization is. The sequence of absorbency is as follows: HALS> blank> azimidobenzene> phthalocyanine green> TiO_2 > ZnO> UV300. The hydrolytic reaction of cellulose and additive to ester is not free radical reaction, so light stabilizers have nothing to do with it. The larger absorption strength of carbon-oxygen bond is, the fewer cross linking reaction is, and the better light stabilizers do to PVC. The sequence of carbon-oxygen bond is azimidobenzene> TiO_2> blank> HALS> phthalocyanine green > UV300> ZnO.

3 Conclusions

Different light stabilizers had great impacts on wood plastic composites, the conclusions are as followed.

(1) Different light stabilizers had great impacts on mechanical property of WPC. Flexural strength and tensile strength are dropped a lot after wet-dry-oxidation aging. Tensile extensibility and impact flexibility increased a little adding HALS and UV300, and others declined. Chromatic aberration had an increased trend.

(2) From the spectrum of FTIR, lignin and semicellulose degraded a little and cellulose degraded much under the effects of water, heat and PVC thermal decomposition which turned into carbonyl and superoxide. Heat accelerated the moving of water and resulted in the loss of additives which caused aging of WPC.

References:

[1] KHAN MUBARAK A. Effect of moisture and heat on mechanical properties of wood and wood-plastic composite[J]. Polymer-Plastics Technology and Engineering, 1993, 32(1—2): 5—13.

[2] SUN Z Y, LI D G, GE J. Analysis on the weathering of wood wood plastic composities by using differential scanning calorrimetry[J]. Engineering Plastics Application, 2005, 33(8): 54—56 (in Chinese).

黎蒴栲/PVC复合材料湿热氧稳定性的研究

谢雪甜, 李凯夫, 闫 雪, 关丽涛

(华南农业大学 林学院, 广东 广州 510642)

摘 要: 采用气候箱设置温湿度交变的循化对木塑复合材料进行湿热氧老化试验, 结果表明不同光稳定剂对黎蒴栲/PVC复合材料各项力学性能影响显著。湿热氧老化后木塑复合材料弯曲性能和拉伸强度均大幅度下降; 拉伸断裂伸长率和冲击韧性, 添加了受阻胺和 UV300的稍有上升外, 其余的稍有下降; 并通过 FTIR谱图分析湿热氧老化前后基团的变化, 得出湿热氧老化机理。

关键词: 木塑复合材料; 光稳定剂; 湿热氧老化

中图分类号: TS653