

Study on Formaldehyde Emission from MDF during Aging

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Abstract: The formaldehyde emission from MDF and its physical and mechanical properties varies when the MDF experiences the aging under the effects of heat, light, oxidation, humidity and microorganism. However, how the above aging factors affect the physical properties and formaldehyde emission is not being reported. Here the experimental MDF aging was conducted in the weather box and indoor environment considering the following factors of heat, light, oxidation and humidity respectively. The mechanism of the physical properties and formaldehyde emission were studied before and after MDF aging. It is safe to draw a conclusion that the UF resin structure was being changed to cause the extra formaldehyde releasing after the aging process by observing the fact the dominant spectrum of amide. However, the results show that the total formaldehyde emission reduced after aging.

Key words: MDF; formaldehyde emission; ageing; infrared

CLC number: TB3 **Document code:** A **Article ID:** 0529-6579 (2007) S1-0239-02

1 Introduction

In storing and the use process, MDF receives the function of the heat, the light, the oxygen, the humidity, the microorganism and so on, its formaldehyde emission and the physical mechanics performance can be influenced. Only understand formaldehyde emission rule of MDF in the use process, MDF the formaldehyde emission can be truly grasped and evaluated.

The free formaldehyde in the UF has the direct relations to the formaldehyde emission quantity. Under neutrality or weak alkali condition, urea and formaldehyde addition react smoothly according to Schidknecht's elaboration, its reaction process is a reversible balance process. According to the characteristics of the adverse reaction, even positive and negative would attain balance, formaldehyde always existence in the liquid, this can draw a conclusion that if there have no another material to participate reaction on, the formaldehyde is forever stay in the UF. But the UF can be glued to the timber, remain the formaldehyde which didn't respond in the resin is absorbed by the timber. When it be heat, some of formaldehydes divert, some still remains in the timber.

2 Materials and Methods

(1) MATERIALS

UF and MDF sample

MDF Size: 1220×2440mm

Thickness: 15mm

(2) METHODS

We put the MDF samples in the weather box which carried on compulsive aging, and some in the indoor environment. We contrasted two kinds of circumstances the formaldehyde emission, the quantity variety and physical mechanics function change. In the meantime, the samples of compulsory aging were carried on infrared spectrum analysis to investigating rule that MDF emission formaldehyde during the period of using, which to provide theories of science to use and evaluate MDF.

3 Results and Discussion

As seen in Figure 1, the formaldehyde emission quantity increases along with the accelerated aging.

It reveals the MDF's formaldehyde the emission and the environment temperature has the index relations, the formaldehyde emission speed along with the temperature to speed up, if MDF was located in the environment humidity to become the linear direct ratio relations. Therefore, using climate box aging may accelerate the MDF formaldehyde emission speed. After the regression analysis, formaldehyde emission quantity (E) and cycle period (x) becomes the index relations, the relationship is

$$E = 19.526 e^{0.0876x}$$

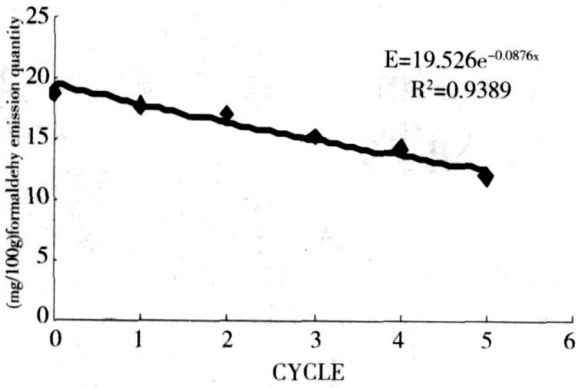


Fig. 1 MDF's formaldehyde emission quantity after accelerated aging

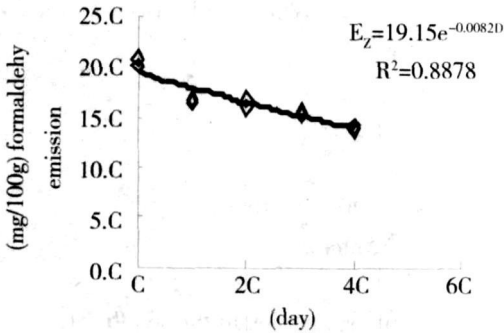


Fig. 2 Influence of formaldehyde emission by time placing indoor

MDF to place in indoor, the formaldehyde emission theories value and measure the average deviation of value as 0.27 mg/100 g actually, standard mistake is 0.13. Build up the relation between E_Q and E_Z . After mathematical analysis, we got the exponential relationship.

$$E_z = 0.9311 E_Q + 1.336$$

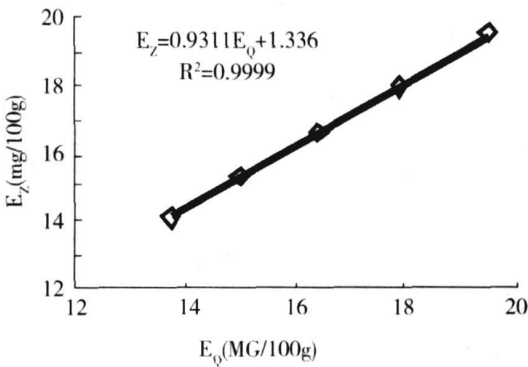


Fig. 3 The relationship between the E_Q and E_Z

4 Conclusions

- (1) The MDF formaldehyde emissions quantity and circulating (put in indoor and in the weather box) present to show exponential relationship.
- (2) Along with accelerate the increment of aging period combine of timbers fiber and the resins was stronger influenced. Formaldehyde emission quantity of the MDF accelerated aging has exponential relationship with that of the MDF placed indoor, which measured each 10 days.

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MDF老化过程中甲醛释放量的研究

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摘要: 将 MDF 放在气候箱中按设定的条件进行快速老化, 同时在室内环境中作对比试验, 比较两种条件下 MDF 甲醛释放量与力学性能的变化。MDF 甲醛释放量随着加速老化周期增加而不断减少, 与循环周期呈显著指数关系。加速老化对木材纤维与树脂之间的结合有较大的影响, UF 在高温高湿下体形结构受到破坏。MDF 加速老化后甲醛释放量与放置室内每 10 d 的 MDF 的甲醛释放量具有显著的指数关系。

关键词: MDF 老化; 甲醛释放量; 力学性能