Advances in Natural Science **ISSN 1715-7862 [PRINT]**
Vol. **4**, No. **1**, **2011**, pp.37-41 **ISSN 1715-7870 [ONLINE]**
www.cscanada.net **www.cscanada.org**

The Optimization Tests of Robiniapseudoacacia/ Wastepaper Composite Particle Board*

DING Fang[1]

ZHANG Qiuhui[2]

LIU Zhigao

Abstract: This article research that how the single-factor variable affect the MOR and thickness swelling rate of the particle board via orthogonal experiments. The optimum condition of the maximum MOR value is 20% resin content, 120℃ hot pressing temperatures, 10 minutes hot pressing time and the proportion of Robiniapseudoacacia/ wastepaper(w/w) is 1/1. Under this situation the MOR of composite particle board is 15.4MPa and the thickness swelling rate is 16.37%. The order of the factors from majority to minority influence is resin content > proportion of Robiniapseudoacacia/ wastepaper (w/w) > hot pressing time> hot pressing temperatures.

Key words: Robiniapseudoacacia; Wastepaper; Orthogonal Experiments; MOR

DOI: 10.3968/j.ans.1715787020110401005

The study uses the Robiniapseudoacacia/ wastepaper composite particle board and research the technological parameter in order to discovering the feasibility of the experiments. Utilizing the Robiniapseudoacacia/ wastepaper composite particle board instead of chipboard and fiberboard will effective reduce the use of wood and relieve the shortage of the forestry resources. The research of Robiniapseudoacacia/ wastepaper composite particle board will benefit environment and save energy.

1. MATERIAL AND METHOD

1.1 Materials

Particle of Robiniapseudoacacia: Crushed into needle-like debris, screened by separating sieve after drying.

Particle of wastepaper: Office paper be crushed by shredder

Adhesive: using urea-formaldehyde adhesive, the curing time is 60s, viscosity is 60-150s and ph=8.2.

* **Beijing Forestry University, Key Laboratory of Wood Science and Engineering, Ministry of Education**
[1] Ding Fang, Female, Master graduate student, Beijing Forestry University, Beijing, China. Research Area: Wood composite materials and adhesive.
† Corresponding Author.
[2] Zhang Qiuhui, Female, PhD, Graduate advisor, Beijing Forestry University, Beijing, China. Research Area: Wood composite materials and adhesive.
‡ Received April 10, 2011; accepted June 10, 2011.

1.2 Method

Weight the urea-formaldehyde adhesive, particle of Robiniapseudoacacia and wastepaper according to the experiment proposal and then use the glue blender to blending the material in some order. After stirring, pave the mixture as 300 mm×300 mm plate, the density is 0.8g/cm^3 and put the plates in the relevant devices in order to hot pressing under a set degree. The maximum pressure is 5MPa the temperature in the process is 160℃ and the plates have the thickness of 10mm(10mm thickness gage) after the hot pressing. Pressure to regulate the thickness of the slab, maintaining the pressure in a certain time, then the use of sub-type pressure relief method. After putting the plate aside for 24 hours, using the pulling bench saw to cut the plate in into several regulated samples, choose 3 samples in each row, testing them and get the average value.

The consumption of the Robiniapseudoacacia/ wastepaper composite particle board:

Total weight= number of products×density of the products×Volume of products

The consumption of the adhesive:

Adhesive amount= (1-water ratio)× total weight/amount of solid content in the adhesive

We adopt orthogonal list L_9 (3^4) to arrange the factor and the level of the testing base on the analysis of the orthogonal experiments for Robiniapseudoacacia/ wastepaper composite particle board. After all the experiments, based on the MOR value we can find the optimum condition and deal with the liquidation process of the MOR value for composite particle board.

2. RESULT AND ANALYSIS

2.1 Result

The measure of MOR value and thickness swelling rate is based on GB/T 17657-1999. The table 1 has shown the proposal and the result of the orthogonal experiments for Robiniapseudoacacia/ wastepaper composite particle board.

Table 1
The Proposal and the Result of the Orthogonal Experiments

Number	Resin content（%）	Hot pressing temperatures（℃）	Hot pressing time（min）	w/w	MOR (MPa)	Thickness swelling rate（%）
1	15	120	8	1:2	6.4	29.60
2	15	140	10	1:1	8.8	28.75
3	15	160	12	2:1	6.2	26.34
4	20	120	10	2:1	11.5	15.33
5	20	140	12	1:2	8.2	26.33
6	20	160	8	1:1	11.8	20.60
7	25	120	12	1:1	9.3	14.35
8	25	140	8	2:1	7.6	15.79
9	25	160	10	1:2	8.4	15.32

2.2 The Influence and the Analysis of Every Factor to the MOR

2.2.1 The Influence of Resin Content to MOR

From figure1 we can know that when the resin content goes up the MOR value increases at first and the goes down. In the experiments when the resin content is 20% we can get the maximum of the MOR value, when the resin content is bigger than 20% the MOR begin to decrease. The over amount of the resin content will lead the board become crumbly and MOR value goes down. From the cost considerations, the high amount of the resin content is not fit for the promotion in the market since the experience prices.

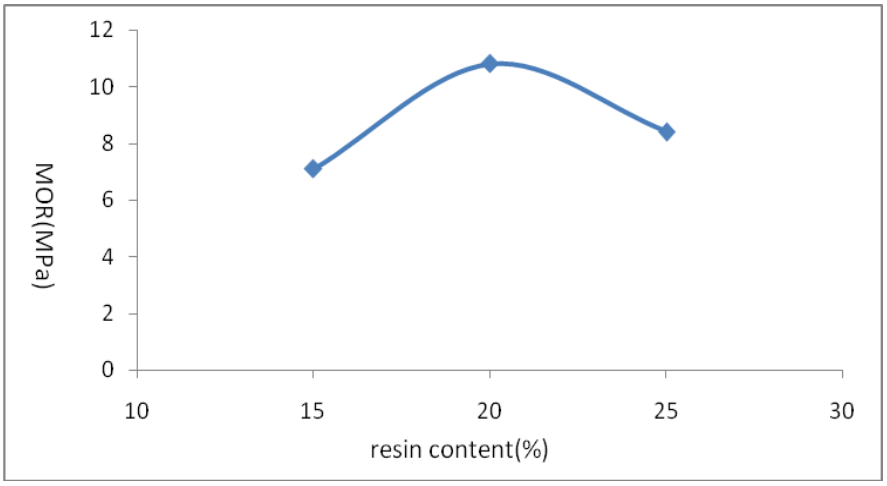

Figure 1
The Influence of Resin Content to MOR

2.2.2 The Influence of Hot Pressing Temperatures

From figure 2 we can know that when the temperature goes up the MOR value decreases at first and the goes up. In the experiments when the temperature is 120℃ we can get the maximum of the MOR value. The above unreasonable curve infers that there may be the bleaching agent in the wastepaper. That will lead the difference between the measured value and the true value.

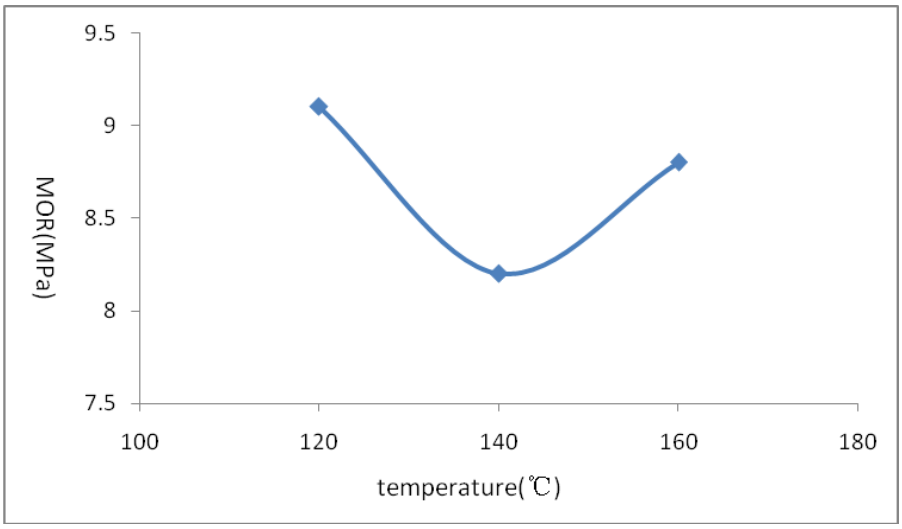

Figure 2
The Influence of Hot Pressing Temperatures

2.2.3 The Influence of Hot Pressing Time

From figure 3 we can know that when the time goes up the MOR value increases at first and the goes down. In the experiments when the time is 10min we can get the maximum of the MOR value. The over long time will cause the MOR value shrink because the using urea-formaldehyde adhesive become solid during the process. Meanwhile the short hot pressing time is not enough for the urea-formaldehyde adhesive to become solid and decrease the bonding strength.

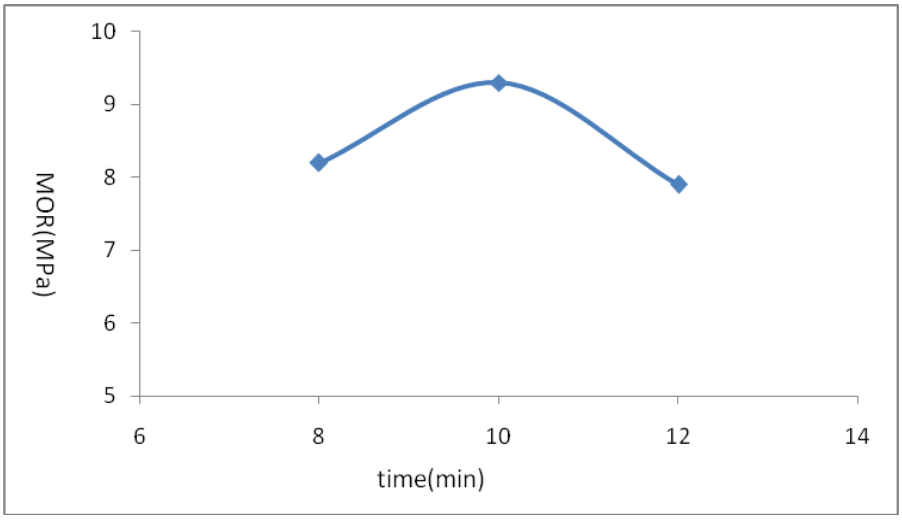

Figure 3
The Influence of Hot Pressing Time

2.2.4 The Influence of Proportion of Robiniapseudoacacia/ Wastepaper (W/W)

From figure 4 we can know that when content of Robiniapseudoacacia goes up the MOR value increases at first and then goes down. In the experiments when the ration is 1:1 we can get the maximum of the MOR value. The large amount of the Robiniapseudoacacia will make the structure of the board became loose than the regulation. On the other hand，the low content of Robiniapseudoacacia will lead high adsorption of adhesive and decrease of MOR value.

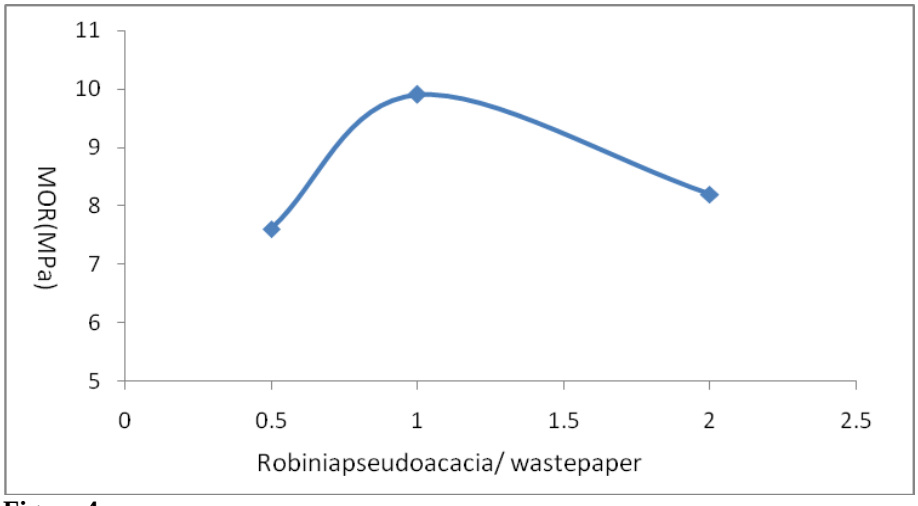

Figure 4
The Influence of Proportion of Robiniapseudoacacia/ Wastepaper

2.3 Optimum Processes

We choose the MOR as the standard to get the extreme difference R value, the resin content is 3.367, the hot pressing temperature is 0.867, and the hot pressing time is 1.667 and the proportion of Robiniapseudoacacia / wastepaper (w/w) is 2.300. From that we can conclude the resin content is the most important factor and other parameter is not very critical. From that we can conclude the order of the factors from majority to minority influence is resin content > proportion of Robiniapseudoacacia/ wastepaper (w/w) > hot pressing time> hot pressing temperatures. The final proposal is 120℃ hot pressing temperatures, 10 minutes hot pressing time and the proportion of Robiniapseudoacacia/ wastepaper (w/w) is 1/1. Under this situation MOR value is 15.4MPa and the thickness swelling rate is 16.37%.

ACKNOWLEDGEMENTS

This work was financially supported by the construction project of Beijing municipal education commission and wood carbon fiber chemistry reaction, the subtle structure and its regulation technology research (201004057).

REFERENCES

China Paper Association. (2007). The annual report of China's paper industry in 2006, *China Pulp & Paper Industry, 28* (6), 5-15.

SONG, HU.(2005). Research on Hornification of Recycled Fiber, *South West Pulp and Paper, 34*(4), 28-31

SHAO Suying, HU Kaitang. (2002). Hornification of Recycled Fiber, *China Pulp and Paper, 2*, 57-60