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Optimization Preservation Of Betung Bamboo (Dendrocalamus Asper) With Hot Soaking Method Using ketapang leaves (*Terminalia catappa L*)

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Abstract:
This study aims to determine the optimization of the concentration of ketapang leaves and the time of immersion in absorption, retention, and weight loss of Betung bamboo (Dendrocalamus asper). The preservation method carried out is the cold immersion method using the central composite design. The results showed that the optimization for the retention, absorption, and loss of weight of Betung bamboo was at a concentration of 5-15 (%) and soaking time 40-60(hours). The result is retention weight loss 2 % while the MOR value is 1500 kg/m3. This weight loss, the value indicates that preservation using preservatives provides a very resistant value (SNI 79206) to the attack of powder beetles. It also shows that preserving with Ketapang leaves does not cause a change in mechanical properties

Keywords: *Dendrocalamus asper, Terminalia catappa, Composit central design, weight loss, MOR*

Introduction

Bamboo is one of the non-timber forest products that has long been used by the community, including as raw material for furniture, matting, carving, household furniture, musical instruments, and construction (Muslich, et al., 2014). Bamboo also has the advantage of being easy to plant, rapid growth rate, does not require special maintenance, is easy to obtain, is cheap, is easily processed, and in the direction of parallel fibers have better mechanical properties than wood. In the industrial world, bamboo can be used as structural composite panels such as plywood, particleboard, sandwich board, strand board that have strengths comparable to wood (Nurketamanda, et al., 2011; Jajang Suryana, 2012).

in terms of low durability due to the high proportion of parenchyma in bamboo culms. One of the bamboos that have high parenchyma is a type of Betung bamboo (Dendrocalamus asper). Bamboo preservation is carried out to increase the shelf life of bamboo and its economic value so that it is more resistant to attack by destructive organisms. Powder beetles that attack bamboo can be prevented by preserving using organic preservatives. Organic preservatives begin to be used today to avoid environmental pollution.

One of the chemicals that is suspected of having toxic chemicals for bamboo destroying organisms (powder beetles) is Ketapang. According to (Alegore, F., 2017). Ketapang (Terminalia cattapa L.) is one of the plants that can grow in nutrient-poor soils and is spread in almost all regions of Indonesia. Ketapang is known to contain allelochemical compounds such as flavonoids. Ketapang flavonoids can be indicated as pesticides or natural poisons for destructive insects or weeds in plants.

Based on the description above, this research is trying to find the optimum concentration of ketapang leaf powder and soaking time to prevent the attack of powder beetles (Dinoderus minutes). The design used to obtain bamboo durability optimization against powder beetle attacks is the surface response design (Response Surface Method). An optimization is a normative approach to identifying the best solution in making a problem decision. The optimization process is a step to minimize costs or use of raw materials and maximize the results or efficiency of the production process. (Box and Draper 1987).

Methodology

The materials used in this research are the leaves of ketapang (Terminalia catappa L.), powder beetle (Dinoderus minutus), bamboo betung test sample (Dendrocalamus asper). This study uses a central composite design (Central composite design / CCD) with a factorial experiment consisting of immersion time and preservative concentration. The factor level studied is the concentration of Ketapang leaf powder solution of 5% -10% (A) (Kasmudjo, 2010), and soaking time 60-90 hours (B). (Pangestu, et al., 2016). The experimental level for each factor (the independent variable) is coded to facilitate calculations, with a code value of 1 at the largest level, a value of -1 at the smallest level, 0 for the central point, and an axial point (IαI = 1.414).

Result

The test variable used was weight loss in the preservative concentration variable of 5% -15% and soaking time of 40-60 hours using Design Expert 6.0 design. The response values can be seen in table 1.

Table 1. The response of Weight Loss and Mechanical Properties of Betung Bamboo Preservation (Dendrocalamus asper) Using Hot Soaking with Preservatives leaves of Ketapang (*Cerbera manghas)*

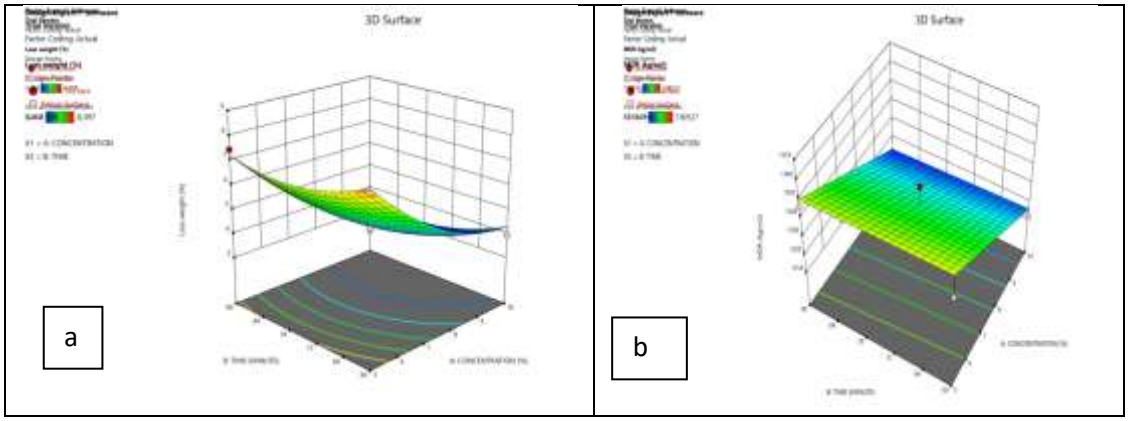
Factor 1	Factor 2	Response 1	Response 2
konsentrasi (%)	Lama perendaman (menit)	Loss weight (%)	MOR (kg/m2)
3,96447	75	8,397	1369,27
5	60	7,654	1341,63
5	90	7,456	1346,29
7,5	53,7868	6,321	1344,24
7,5	75	4,153	1323,78
7,5	75	4,765	1342,67
7,5	75	4,234	1321,23
7,5	75	4,182	1342,12
7,5	75	4,234	1332,21
7,5	96,2132	4,853	1332,45
10	60	3,942	1311,43
10	90	3,462	1311,21
11,0355	75	3,569	1310,41

The weight loss value in Table 1 shows the lowest weight loss value at a concentration of 11,033% (3,569%), and the highest weight loss value at a concentration of 3% (8,397%). The average value of weight loss in this study was 5.170%, this value is classified as higher if seen in the study (Nurul et al., 2009) with the Boucherie-Morisco method and boron preservatives produce a weight loss value that is lace that is 4.64 % But if compared with the results of the control in the study showed that the value of the test sample that was given better treatment than the control value. While the weight loss value equation is:

Y = 32.52-2.49X1-0.407X2 - 0.00188X1X2 + 0.127 X12 + 0.00265 X22. The equation above shows that the most influential factor for weight loss is the concentration of the preservative solution.

The results showed that in terms of weight loss against powder beetle attacks that were given treatment had a weight loss value of 3.569% included in the class 1-III resistance, namely bamboo is very resistant to powder beetle attacks with values between <2.0% and 4.4- 8.2%. Compared to controls having endurance classes, the average test sample included class V, which is very poor so the bamboo test samples that were treated were more resistant than those that were not given any treatment at all.

In Table 1, this study shows that a low concentration and a short soaking time have a high weight loss, this is because the longer soaking time the more solution that enters the bamboo pore and the longer the immersion time the water content in the bamboo will increase. According to research (Bonita 2015) which states the amount of weight loss is affected by the amount and amount of water, size and density of bamboo. This is in accordance with Hamzah Research et al. 2016, weight loss in test samples with preservative concentrations 0.5% greater than test samples with treatments of 0.75% and 1%.



Gambar 1. Grafik Tiga Dimensi Kehilangan Berat (a) dan Nilai MOR (b) Bambu betung yang Diawetkan dengan Larutan Daun Bintaro

In the three-dimensional curve in Figure1, it will be seen that preservative concentrations play a reactive role in reducing weight loss. The higher the concentration of preservatives causes, the lower the weight loss value. Conversely, if the concentration of preservatives decreases, the weight loss will increase. A suitable preservation method can increase bamboo's resistance to destructive microorganisms and be able to maintain MOR values (MOR values of preserved bamboo are the same as controls).

The optimum conditions of MOR values were predicted at 5% preservative concentration and soaking time of 60 minutes, with MOR values of 1350 kg / cm2. Then after adding the time to 66 minutes with a fixed concentration, the MOR value remained at the MOR value of 1350 kg / cm2, while the lowest shear strength was at a preservative concentration of 10% and the duration of soaking 90 minutes with the value of 1310 kg / cm2. This condition shows that the preservative concentration plays a reactive role in reducing the MOR value of bamboo. Increasing concentration, and soaking time, the bamboo MOR value will be smaller.

Conclusion

The most influencing factor for shear strength and weight loss is the large concentration of preservatives both in laminated bamboo that is processed by SC-CO2 impregnation before lamination or after lamination. The results of the optimization of preservation with bintaro leaf heat soaking gave a value of 4.9% weight loss and MOR value of 1338.42 kg / cm2. This optimum value was achieved at a concentration of 6.74%, and the soaking time was 76 minutes.

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