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The assessment of marginal prevention costs on bamboo preservation method

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Abstract

Due to its low durability, the bamboo preservation is needed to prolong the bamboo lifespan. Although the preservatives have a great impact to make bamboo lifespan longer, some of bamboo preservation methods use chemical additives that have a negative impact on environment. Since there are so many kinds of bamboo preservation used, the observation study was carried out to reveal the bamboo preservation methods used by society in Indonesia. Three kinds of bamboo preservations were assessed, they are traditional method, modern method and the one which does not belong to traditional or modern one but it is generally used by some of society (trial-error). The object of the study is to assess the impact of bamboo preservation method used by society. Life Cycle Assessment (LCA) method and eco-costs as marginal prevention cost were used as a tool analysis of this study.

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Keywords: bamboo preservation method; environmental impact; LCA; eco-costs; marginal prevention costs

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1. Introduction

Bamboo preservation method is divided into two types: the traditional methods that use natural processes and modern methods that involve technologies and chemical additives. Table 1. Shows the current bamboo preservation methods used by society:

Table 1. Types of Bamboo Preservation Methods

Bamboo Preservation Method	
Traditional Method	Modern Method
Soaking	All traditional method that add chemical additives
Lime washing	Spraying
Smoking	Dyeing
Boiling	Pressure Tank
Diffusion	Hot and Cold
	Sap replacement

Due to the number of bamboo preservation methods that exist in society, it takes a long time to assess the overall preservation methods. Besides, the characteristics of bamboo preservation method in each region will be different depending on the society knowledge on the preservation techniques and the availability of curing agent. For example In Indonesia, the traditional bamboo preservation methods are mostly done by soaking and lime washing, as well as a small portion is done by boiling and spraying [1]. Unlike in Philippines, most of the traditional preservation is done by incubation in a bamboo grove, while in India and Costa Rica bamboo preservation is done with bamboo construction techniques such as plaster, as well as fumigation is largely conducted in Colombia and Japan [2].

So did with modern methods, in Indonesia, Vertical Soak and Diffusion (VSD) is performed by the majority of bamboo preservation plant with chemical additives such as borax-boric acid, borax-boric-acid which are also used for soaking process in Thailand. Dip diffusion with Copper Chrome Boron (CCB) is conducted in Costa Rica, the tank pressure is in Taiwan and Boucherie method is in India [2].

In addition, preservation method by the addition of chemicals is known to be the most effective and efficient because it takes a short time with the bamboo durability is longer [3] [4]. The chemical used in the bamboo preservation is Zinc Chloride/Copper Sulphate, Borron, Sodium Penta Chloro Phenate (NaPCP), Copper Chrome Arsenic (CCA) and Copper Chrome Boron (CCB) [5].

Although it helps bamboo to prolong its lifespan, the use of chemicals in bamboo preservation process turns out to add new harmful problems. It is disclosed that Copper Chrome Arsenic (CCA) is one of the most well know curing agents that is commonly used to preserve bamboo and wood, but its usage should be restricted because it is toxic to humans [6]. In addition, the use of several preservation techniques that have been developed requires high temperatures during the curing process [4] and the use of tank pressure needs fuel and high combustion temperatures that lead to the consideration of energy consumption.

Due to the positive and negative impact of bamboo preservation method to the environment, Life Cycle Assessment (LCA) is needed to assess the potential damage of bamboo preservation. Although bamboo is considered as an environmentally friendly material, just a few environmental impact assessments using LCA is used for bamboo. The study discussed by Richard Murphy [7] focuses on the comparison of the use of bamboo stem (Guadua) combined with mortar (based on traditional techniques of Baharaque) as a structural material for social housing in Colombia with a similar house built with stone and concrete. The research results reveal that the environmental impact of bamboo is about a half of the concrete. The study focuses solely on bamboo stems obtained from the surrounding environment (not industrial)