INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN: 2278 – 0211 (Online)

Development Of Black Body Radiation Trough For Preservative Treatment Of Sympodial Bamboos In Ghana

Steiner Rudolf
College of Art & Social Sciences
Kwame Nkrumah University of Science and Technology, Kumasi
Abena Akyeabea Oteng
College of Art & Social Sciences
Kwame Nkrumah University of Science and Technology, Kumasi
Kwame Kyere
University of Education, Winneba

Abstract:

A rectangular trough of length 240cm, width 120cm and depth 30cm was designed and built with 2.5 cm angle iron and 3mm aluminum plate. An 8mm glass plate was fitted to the trough to serve as lid, to allow penetration of sun light for eventual warming of the trough. The powdering and ultimate disintegration of bamboo which comes as a result of poor preservation practices are unbearable to users of bamboo crafts. A solution has been found in the engineering of an all in one black body radiation trough for preservative treatment of sympodial bamboo species in Ghana. Energy from the sun, and the black body radiation properties of the trough enhancing utmost heat maintenance is available in keeping the temperature of the trough warm enough for effectual leaching out of starch, wax and sugar from the bamboo and eventual penetration of chemical preservatives for the preservation of bamboo.

Keywords: *Bamboo; energy; preservation; black body; preservatives*

1.Introduction

Sympodial bamboo has an established tradition as a building and manufacturing material in Ghana. This material is extensively used in many forms of structures such as housing, furnishing, cabinetmaking and paneling. A significant consideration, which restricts the use of bamboo, is its durability. Steiner et al (2010) said sympodial bamboo is subject to attack by fungi and insects and this brings the anticipated life of the bamboo to not more than five years. Steiner, et al (2008) affirmed that because of the lack of any toxic constituents and the presence of sugar and starch in bamboo, bamboo forms a ready food source for a variety of organisms. Jayanetti and Follett (1998) opined that there is significant quantity of starch in green bamboo that makes it more attractive to borer beetles. They claimed that soluble sugars form the main nutrients for degrading organisms and that if these can be removed or reduced from the culm, the risk of decay will be significantly reduced.

The Department of Integrated Rural Art and Industry, KNUST, teaches students to manufacture works of art in Sympodial bamboo, they also train local craftsmen to fabricate Sympodial bamboo into useful artifacts, unfortunately the department lacks the facilities for giving preservative treatment to bamboo that operates on solar energy to help reduce the cost of fuelling facilities that operates on gas or electricity for preservation of sympodial bamboo. Steiner et al (2008) explained that the preservation treatment facilities used by some industries and institutions to get better the life expectancy of sympodial bamboo are not environmentally friendly, for the reason that they use wood as fuel, they pose health hazards to users in their operations and they are deficient in the use of energy, that is, much of their energy input is lost into the atmosphere. Some operate on gas which is always not obtainable and others electricity which is by a long way expensive.

In this paper an attempt has been made to devise a facility for giving preservative treatment to Sympodial bamboo that will is environmentally friendly, function with modest or no health hazards, and operates on solar energy.

2.Materials And Methods

The method adopted for the construction of the black body radiative trough for preservative treatment of sympodial bamboo is basic. It is made simple to enable readers, understand and follow the procedures in the construction of similar trough for preservative treatment of sympodial bamboo.

This particular facility embraces diffusion in water, and chemical treatment and this is line with what Ubidia (2002) and Jeyantti and Folleti (1998) said, that preservation of bamboo is made either in a boiler or in a diffusing trough. This structure has been designed to solve the current problem of environmentally unfriendliness, inefficient use of energy, the health hazards associated with preservation procedures and the inability of some preserved bamboo resisting pest attack.

This black body radiative trough for preservative treatment of sympodial bamboo is a rectangular container or trough of length 240cm, width 120cm and depth 30cm, in which submersion of bamboo is done to provide preservative treatment to sympodial bamboo. (fig..1a and b). It is an aluminum container fashioned to take bamboo less than 240 cm in length. Over the trough is an 8mm glass plate of length 240 cm and width 120 cm that allows energy from the sun to warm the trough and the leather black oil paint coating on the trough to improve heat retention properties of the trough.

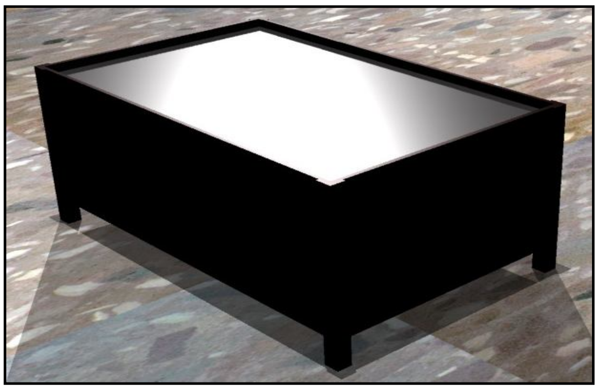

Figure 1a: A rhino representation of the black body radiative trough

Figure 1b: The Black Body Radiative Trough For Preservative Treatment of Sympodial Bamboo Species in Ghana (currently in use at the IRAI Dept KNUST.)

3.Bamboo Preservation In The Trough

Preservation using the black body radiative trough started with primary preparation and processing of the freshly harvested bamboo. The culms were crosscut to 220cm and the hard silica drenched epidermis was scraped off by planing and others were processed into splits and slivers. The inner lining of the splits, the lumen, was removed with a sharp strong knife and others planed like the epidermis to run parallel to the inner side. A long pointed 20 mm diameter iron rod was used to break through the nodes of the culm to make way for the liquid preservatives to run through. The processed culms, splits and slivers were tied up in bundles and parked into the black body radiative trough. 500 Liters of water was added to the bamboo just enough to cover it and the corresponding quantity of 10 liters of dursban 4E was also added. A galvanized metal mesh was placed on the bamboos and a supporting weight(stone) to keep the processed bamboo submerged. The lid was firmly fixed to the black body radiative trough.

Eight days of continuous submersion completed the preservative treatment for bamboo in the black body radiative trough. The bamboo in the black body radiative trough was hooked out and the trough was reloaded. The bamboo was hanged to allow draining of the preservatives into the ttrough. After draining, the bamboo was stacked for drying.

In all, three chemical preservatives were used for the project. These are dursban 4E, Pyrinex 48EC and Neemazal 0.3EC. The active ingredient in dursban 4E and pyrinex 48EC. is chlorpyrifos and it is in the quantity of 480 grams per liter and were used in the percentage of 2% , that is 20 mls of dursban or pyrinex was mixed with One liter of water for diffusion by submersion. The Neemazal is a Neem extract based insecticide containing 0.3% of Azadirachtin. 20 milliliters of neemazal was mixed with 1liter of water for preserving bamboo by submersion. Neemazal is a biological preservative, so it is suitable for items like ladles and cups. In all about 500 liters of water was used for the preservation by diffusion by submersion in the trough. Samples of bamboos treated with the three chemical(dursban 4E, and pyrinex 48EC and neemazal) , untreated bamboo, the preserved and split bamboo and the selected artifacts made from bamboo preserved in the black body radiative trough were exposed to termites and were observed for a month.

4.Results And Discussions

After the seventh day of this observation period the sample pieces were steadily covered with mud. The artifacts were not fully covered. the mud had covered only part of the piece by the seventh day. It was understandable that the presence of mud around the samples was a substantiation of the existence of termites on the pieces. The undisturbed termite mounds built up for eight to ten days. After the third week, it was observed by the reearchers that, parts of the mounds created around the pieces had given way, making visible several pathways of the termites as they move to and from different directions. It became apparent that the unpreservbed samples were totally infested and eaten up by the termites, because traces of the unpreserved could not be held in their labels. From the observation made it was seen that the unpreserved Bambusa vulgaris var vitata was the one which was severely attacked, since apart from the labels, there was not anything regarding the Bambusa vulgaris var vitata that was left for surveillance and description. This confirms the statement that was made by Baah, (2001) that sugar substance of Bambusa vulgaris var vitata which is an element of the primary food for debasing agents is very high and this makes the bamboo's natural resistance to insects very low. Comparing the other two unpreserved bamboo samples, it was seen that the Bambusa vulgaris has been eaten up and the Bambusa bambos although was attacked, still has some parts left behind. Upon closer surveillance of the Bambusa bambos, it was noticed that the whole lumen (the inner lining of bamboo) of the sample has been eaten leaving merely parts and pieces of the sample.

The samples that were preserved and split were also taken out, cleared of mud for very close inspection. The Bambusa bambos and the Bambusa vulgaris samples were not affected but part of the Bambusa vulgaris var vitata was eaten by termites and this was the part that was open to the termites as a result of splitting of the material. The other set of samples was also removed, cleared of the mud and examined for infestation by termites. Although it was experienced in the early stages of the test, that the termites have built mounds around the test samples, there was no proof of any part of the samples being affected, bug-ridden or eaten up by pest.

Taking into account the tests conducted so far and the active ingredients in the preservative, it was discovered that neemazal, as a biological preservative, was more suitable for the preservation of domestic products such as ladles, chopping boards, fruit trays and anything that will serve as a container for edibles(fig 2) and preservatives that contain active ingredient like chlorpyrifos must be used for the preservation of items like table legs, door frames, window frames and constructional material produced in bamboo (fig 3). Again, in the choice of material, it was found that although; all the three bamboo species preserved resisted pest and fungal attack, it would be better for one to be selective in the choice of bamboo for specific jobs. From the test results, it was obvious that bambusa bambos is more resistant to pest and fungal attack than the bambusa vulgaris and bambusa vulgaris var vitata..

Figure 2: Fruit tray. (Preserved with neemazal)

Figure 3: Window frame in bamboo (Preserved with dursban)

5.Conclusion

The preservation of the different bamboo species by diffusion was done in the black body radiative trough. For the number of times black body radiative trough has been used, the time taken for the bamboo to be preserved is eight days. The sun was able to provide the energy requirements of the black body radiation trough. On one sun-drenched day during the preservation by diffusion by submersion the temperature of the trough as taken by a thermometer was 51.2ºC. This is a confirmation that the quality of local raw material selected for the construction of the black body radiation trough was very good, and because of the black body, the energy input from the sun is retained and effectively utilized. In the preservation of split bamboo, it became obvious, that when the strips or splits are tied up in bundles, they are easy to load and unload from the black body radiation trough. The preservation of whole culm takes a lot of space and apart from the impossibility of the removal of the lumen, the scraping off of the epidermis and the breaking through of the nodes became a necessity, these were done to ensure improved capillary activity for the displacement of the sugar, starch and other ingredients in the bamboo that make it attractive to pest by osmosis and also the breaking through of the nodes to ensure thorough run through of warm preservatives through the bamboo and also to prevent explosion of trapped gasses in the internodes of the bamboo.

6.References

1. Baah Seth, (2001) Notes on Bamboo. University Press KNUST Ghana
2. Lionel Jayanetti & Paul Follet, (1998) Bamboo in construction, Trada Technology Ltd. India.
3. Steiner Rudolf, Boahin J.O.B.and Adu-Agyem Joe (2008) Development of a gas fired boiler for the preservative treatment of sympodial bamboos species in Ghana. Journal of rattan and bamboo vol 7 no.1&2 ISSN 0973-4449
4. Steiner Rudolf, Boahin J.O.B. and Adu-Agyem Joe (2010) Design and construction of a Preservative treatment plant for Bamboo. CASS Journal of Art and Humanities Vol.. 1 No.1 ISSN 0855-9813
5. Ubidia J.A.M, (2002) Traditional Bamboo Preservation in Latin America. Colour Max Publication Ltd. Los Angeles C.A.