ETHIOPIAN STANDARD

ES 6418:2021

First edition
06-01-2021

Preservation of bamboo part- 2: for non-construction purpose

ICS:91.080.20
Published by Ethiopian Standards Agency

Foreword

This Ethiopian Standard has been prepared by the Technical Committee for Bamboo and Bamboo Products (TC 99) and published by the Ethiopian Standards Agency (ESA).

In developing this standard reference is made to the following

- IS 1902:2006, Preservation of bamboo and cane for non-structural purpose - Code of practice, published by bureau of Indian Standard, BIS.

This draft standard is developed in collaboration with International Bamboo and Rattan Organization (INBAR).

Acknowledgment has been made for both organizations for their contribution to the national standardization.

Preservation of bamboo part- 2: for non-construction purpose

1. Scope

This standard covers the types of preservatives and methods of treatment of bamboo, used both indoor and outdoor for non-construction purpose. It also includes recommendation on the choice of treatment depending on the various uses to which the bamboo is put.

This standard does not cover the treatment of bamboo meant for construction purpose, which is covered separately in ES 6417.

2. Normative References

ES 1950, *Structural use of timber- Code of practice for the preservative treatment of Structural timber*

ES 6435, *Specification for creosote oil for use as wood preservative*

ES 6436, *Preservation of timber- code of practice*

ES 6442, *Code of practice for preservation of bamboo for structural purpose*

ES 6438, *Specification for water soluble types of wood preservatives*

ES 6439, *Specification for water soluble type wood preservative - Copper-chrome-arsenic (CCA) wood preservatives*
ES 6440, *Specification for water soluble type wood preservative - Copper-chrome-Boron (CCB) wood preservatives*

3. Terms and definitions

Terms and definitions stated in ES 6416 and ISO/DIS 21625 shall apply

4. Recommended preservatives

4.1. The type of preservatives for treatment of bamboo shall be as given in clause 4 of ES 6436.

4.2. The following are the various preservatives recommended for treatment of bamboo for non-construction purposes.

a) Coal tar creosote- This is a fraction of coal tar distillate with a boiling point range above 200°c and is widely used admixed with fuel oil. A creosote fuel oil in the mixture in the ratio of 3:7 is found suitable. The fuel oil insures stability of creosote against evaporation and leaching from the treated bamboo.
The creosote used shall confirm ES 6435.

b) Copper and zinc naphtenutes/abieates –These are copper and zinc salts of Naphthenic/ abietic acids.

c) Boric acid-borax- This has been used successfully against lyctus borers. A mixture in a ratio 1:1.5 found more suitable. A typical composition of this preservative comprises copper sulphate.

d) Copper-chrome-arsenic (CCA) composition-A typical composition of this preservative comprises copper sulphate ($CuSO_4 5H_2O$), arsenic pentaoxide ($As_2O_5\ 2H_2O$), and sodium or potassium Dichromate ($Na_2Cr_2O_7 2H_2O$ or $K_2Cr_2O, 2H_2O$) in proportion of 3:1:4 conforming ES 6439.

e) Acid-copper-chromate composition- A typical composition of this preservative of 1.68 parts

chromic acid (Cr_2O3) (equivalent to 2.5 parts of sodium dichromate), 50 parts of copper sulphate
($CuSO_45H_2O$) and 47.5 parts of sodium dichromate ($Na_2Cr_2O_72H_2O$): conforming to ES 6438.

f) Copper-chrome-boron (CCB) composition – This consists of boric acid (H3BO3), copper sulphate ($CuSO_45H2$ O), sodium or potassium Dichromate ($Na_2Cr_2O_72H_2O$ or K_2Cr_2O, $2H_2O$)in proportion of 1.5:3:4 conforming ES 6440.

g) Copper-8-equinolinate – This is an organometallic compound with typical composition of 10 percent copper-8-equinolinate,10 percent nickel-ethyl hexanoate and 80 percent inert ingredients. The preservative finds above the ground application and is suitable for sapstain and mold control. It is greenish brown in colour, odourless and toxic to both wood decay fungi and insects and insects and have low toxicity to humans and animals.

5. Methods of treatment

5.1. Details of treatment by surface application (brushing, dipping) soaking hot and cold process, vacuum/pressure process; fast fluctuating pressure (FFP) process and boucherie process are given in ES 6436

In addition to methods described in ES 6436, diffusion process, modified boucherei process and steeping or butt end treatment (capillary rise) methods as applicable to the treatment of freshly cut bamboo are given in 4.1.1, 4.1.2 and 4.1.3, respectively

5.1.1.Diffusion process

In this process, freshly cut bamboos are kept submerged in solutions of water soluble preservatives, when inorganic ions diffuse in to the green material.

Note: The rate of diffusion depends upon the mobility of the ions. The penetration of the ion depends up on the moisture content of the material, its anatomical structure, the mobility of the diffusion ions, the temperature of the solution and the period of immersion in the treating solution.

5.1.2. Modified boucherie process

- A suitable container is used for keeping the treatment solution, which shall be of water-soluble type.
- The container is provided (at the bottom) fitted with stop-cocks and rubber tubes to which are attached the freshly cut bamboos with branches on. In order to secure leak-proof contact between the rubber tubes and bamboo, suitable metallic clumps on other device should be used.
- The tanks also fitted with a screw cap to which is attached to a motor car tire tube valve (see figure 1).
- The tank is filled with a treatment solution to about two-thirds of the volume and after righting the cap, air is pumped through the valve to a pressure of 0.1 to 0.14N/mm^2 which could be easily measured using a pen-gauge side tubes. Under this pressure, the treating liquid forces the sap out of the walls and septa of the bamboo through the open end and takes its (sap's) place in course of time.
- After a few preliminary experiments, the concentration of the treating solution and the period of treatment can be fixed to obtain request absorption of the preservative.
- The bamboo is taken off in the completion of the treatment.

Branches of treated bamboo also get treated and are therefore required to be disposed off carefully as the same will not degrade naturally and are like to pose hazard due to presence of toxic chemicals. This should preferably be burnt in the open and ashes buried under ground or be disposed off by any suitable method.

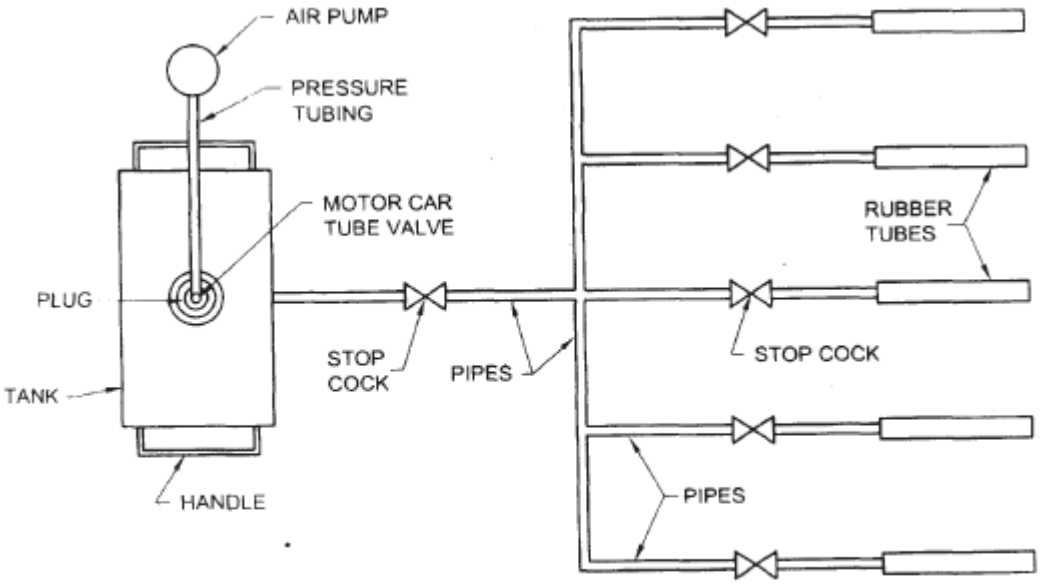

Figure 1: Schematic diagram for modified boucherie process

5.1.3. Steeping or butt end treatment (capillary rise) method

Freshly cut bamboo up to 1.8 m length can be treated by this method.

- After removing the branches, bamboos are made of stand vertically in troughs or drums containing solution of water born preservatives.
- Bottom end up to 250 mm is kept immersed and any loss of preservative due to up-take or evaporation is made up daily.
- The top end is kept wet by rapping with wet cotton cloth.
- Bamboo is inverted at least 7 days.
- The preservative is sucked by vessels and is distributed to neighboring cells by diffusion.

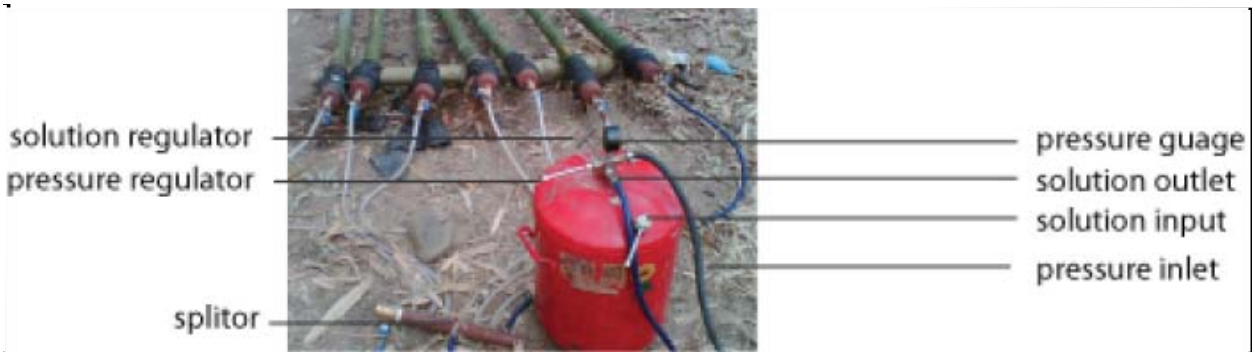

Figure 2: modified boucherie process

5.1.4. Steam boiling process

Bamboo is dipped into a tanker connected in the steam generating machine tanker connected with a machine dipped that contains water and chemical mixture.

6. Choice of preservative and method of treatment

6.1. The choice of preservative depends up on the use to which the treated material is put.

6.2. The recommended practice with regard to the preservative, their concentration, request absorption and method of treatment of bamboos for diverse purpose, is given in Table 1.

Table 1: Recommended preservatives, their concentration and absorption and the method of treatment of bamboo used for diverse purpose.

S no.	Diverse (non-structural) use of treated bamboo (2)	Recommended preservatives (3)	Concentration of preservatives (%) (4)	Absorption of preservatives kg/m^3	Method of Treatment (6)
1	Curtains, Mats exposed to weather	Copper-chrome-arsenic	6	5	Diffusion process, FFP process
	a) Freshly cut bamboo (split, silver)	Acid-copper-chromate composition and Copper-chrome-boron (CCB) composition	8		Diffusion process, FFP process
	b) Dry bamboo (split, silver)	Copper-chrome-arsenic (CCA) composition	4	5	Vacuum/ pressure process, steeping
		Acid-copper-chromate composition and Copper-chrome-boron (CCB)composition	6	8	steeping Vacuum/ pressure
		Copper and zinc naphtenutes/abieates	4% as copper for copper napthanates/ abietate	0.4 as copper	Socking brush
		6 percent as zinc (for zinc napthanates /abietate)	0.6 as zinc		Socking brush

Continued…..

S no.	Diverse (non-structural) use of treated bamboo (2)	Recommended preservatives (3)	Concentration of preservatives (%) (4)	Absorption of preservatives kg/m^3 (5)	Method of Treatment (6)
	Furniture exposed in the weather (components):				
	a) Freshly cut bamboo(round) for legs and arms	Copper-chrome-arsenic (CCA) composition	4 to 6	5	Modified Boucherie process. Diffusion process, FFP process Process
		Acid-copper-chromate composition and Copper-chrome-boron (CCB) composition	6 to 8	8	
	b) Freshly cut bamboo(split) for parts other than those in (a)	Copper-chrome-arsenic(CCA) composition	4 to 6	5	Diffusion process FFP process Steeping Vacuum/pressure process Socking
		Acid-copper-chromate Composition and Copper-chrome-boron (CCB) composition	6 to 8	8	
2	C) Dry bamboo (round/split) for legs and arms	Copper-chrome-arsenic (CCA) composition	4 to 6	5	Vacuum/pressure process Socking
		Acid-copper-chromate composition, Copper-chrome-boron (CCB) composition	6 to 8	8	
		Copper and zinc naphtenutes/abieates	4% as copper (for copper napthenate/abetate)	0.4 as copper	Socking/brush
			6% as zinc copper (for zincnapthenate/abetate		
3	Furniture for interior (components) Including curtain, mats…				
	a) Freshly cut bamboo(round, split, sliver)	Boric acid-borax, Acid-copper-chromate composition , Copper-chrome-boron (CCB) composition	4 to 6	5	Modified Boucherei process Diffusion process, FTP process steeping

Continued…

		Boric acid-borax, Acid-copper-chromate composition , Copper-chrome-boron (CCB) composition	4	5	Steeping, vacuum/pressure process
3	b) Dry bamboo (round, split, sliver)	Copper and zinc naphtenutes/abieates	4% as copper (for copper napthenate/abetate	0.4 as copper	Socking/ brush
			6 percent as zinc (for zinc napthenate/ abietate)	0.6 as zinc	
	Basket ware				
	a) Agriculture use other than food staff : Freshly cut bamboo split; slivers)	Boric acid-borax, Copper-chrome-boron (CCB) composition, Copper-8-equinolinate	4 to 6	5	Diffusion process, FFP process
	Dry bamboo split; slivers)	Boric acid-borax, Copper-chrome-boron (CCB) composition, Copper-8-equinolinate	2 to 4	5	Steeping hot and cold, vacuum/ pressure process
		Copper and zinc naphtenutes/abieates	2% as copper (for Copper Napthenate /abetate	0.2 as copper	Socking/brush
			3% as zinc (for Zinc napthenate/ abetate	0.3 as zinc	
		Coal tar creosote	30:70	-	Hot and cold hot socking
	b) containers for Food stuffs including Fresh fruit, vegetables, tea-leaves etc Freshly cut bamboo(split, sliver)	Boric acid-borax	5	4	Diffusion process, FFP process
		Boric acid-borax	5	4	Steeping, vacuum/pressure process
4	Dry bamboo (split, sliver)	Copper-8-equinolinate	2% as copper	4	Momentary dip, brush
5	Finished/semi-finished laminated board	Copper-8-equinolinate	2% as copper	4	Momentary Dip, brush
6	Handicrafts	Copper and zinc naphtenutes/ abieates	1% as copper/zinc		Momentary deep
7	House ware	Copper-8-equinolinate	2% as copper	4	Momentary deep, brush
8	Kitchen ware	Boric acid-borax	5	4	Diffusion process, FFP process

7. Sampling for testing absorption and spread of preservatives

7.1. Representative samples for testing of preservative shall be cut from treated bamboo for the purpose of chemical analysis. The mass of the sample shall be about 100 g for bamboo, for every 100 kg of bamboo treated.

7.2. The sample obtained in 6.1 shall be powdered either by a hand file or by means of suitable powdering machine or converted into small chips (about 10mm long, 2 mm wide, and 1 mm thick) by using a suitable knife. The powder of chips thus prepare shall be thoroughly mixed and a liquid of 10 to 20 g taken for chemical analysis.

8. Testing of preservative in treated bamboo

8.1. Determination of absorption of preservative

The net absorption of the preservative chemicals in bamboo shall be determined by chemical analysis of treated material and shall be compared with the figures obtained from the weight of the material before and after treatment. The final sample obtained in 6.2 shall be used for the analysis.

8.2. Determination of presence of the preservative

8.2.1. The penetration of the following preservatives in the treated bamboo may be tested by the visual color reaction method given in Annex 1

a) Copper-chrome-arsenic

b) Acid-copper-chrome (ACC) composition

C) Copper-chrome-boron (CCB) Composition, and d) Boric acid and borax

8.2.2. Preservative other than those referred to in **7.2.1** do not give definite color reaction

Annex A
Method for the determination of presence of preservatives by color

REA A1 Copper-chrome- arsenic composition, acid-copper-chrome composition and Copper-chrome-boron composition

A-1.1 Copper

A-1.1.1 Preparation of reagent
Dissolve 0.5g of chrome azurols concentrate and 0.5g sodium acetate in 80 ml water and dilute the solution to 100ml.

A-1.1.2 Test
Spray the solution to obtain in A-1.1.1or deep into it. a reasonable dry boring or cross-section of the bamboo to be tested

A-1.1.3 Reaction
The material treated with the preservative quickly turns deep blue in color

A-1.2 Arsenic

A-1.2.1 Preparation of reagent

A-1.2.1.1 Solution 1- Dissolve 3.5Aml, ammonium molybdate in 90mldistilled water and add 90ml boric acid.

A-1.2.1.2 Solution 2- Dissolve 0.07g benzidine dihydrochloride in10ml cane acetic acid and add the solution to 90ml distilled water

A-1.2.1.3 Solution 3 – Dissolve 30h stannous chloride dihydrochloride in 100ml of 50 percent hydrochloric acid.

A-1.2.2 Test
Firs apply solution 1 on the cross section or boring by dipping or pouring. The entire surface must be saturated. After 2 minutes, shake of the excess solution and allow to dry for about 1 minute. Next apply solution 2 in the same as solution 1. Apply solution 3 by pouring the solution on a cross section, beginning at the untreated part.

A-1.2.3 Reaction
The entire wood surface will immediately turn bluish. It is necessary to wait for several minutes for the reaction to bring about the maximum color contrast.

A-2 Boric acid and borax and copper-chrome-boron composition

A-2.1 Preparation of reagent

A-2.1.1 Alcoholic extract of turmeric powder
Reflux 2g of turmeric powder with 100ml of 95 percent alcohol for 1h: cool it and filter

A-2.1.2 Extract of salicylic acid and hydrochloric acid. Saturate with salicylic acid a mixture of 80ml of distilled water and 20ml of 30 percent hydrochloric acid.

A 2.2 Test
Apply the alcoholic extract of turmeric powder obtained in A-2.1.1on a reasonable dry surface of the material to be tested. Allow the surface to dry for a few minutes and then apply the extract obtained in A-2.1.2

A-2.3 Reaction
The treated surface develops red color.

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Ethiopian Standards Agency

Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010.ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1998.

ESA's objectives are:-

- ❖ Develop Ethiopian standards and establish a system that enable to check whether goods and services are in compliance with the required standards,
- ❖ Facilitate the country's technology transfer through the use of standards,
- ❖ Develop national standards for local products and services so as to make them competitive in the international market.

Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government or ganizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/ or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.
Orders for all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch (Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed in from our website.

International Involvement

ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the International Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM).It is a founding member of the African Regional Organization for standardization (ARSO).

<u>More Information</u>?

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