

A Review - Production of Ribbed Smoked Sheet in Chattogram Hill Tracts of Bangladesh and Assessment of Heavy Metals in Itself.

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Abstract: *Hevea brasiliensis* is a tree discharged white colored latex that is utilized to produce natural rubber. Generally, two types of rubber sheet such as Ribbed Smoked Sheet (RSS) and Air Dried Sheet (ADS) are produced in the world. Ribbed Smoked Sheet is the most popular than the Air Dried Sheet which is used for the production of huge end products like tyres, condoms, surgical gloves, balloons, adhesive, rubber band, carpet backing etc. It is produced by applying some steps named latex collection by tapping process, preservation, coagulation, sheet formation and smoke drying. Three samples of Ribbed Smoked Sheet were collected from the hilly area of Chattogram. Nine metals viz. Chromium (Cr), Cobalt (Co), Nickel (Ni), Manganese (Mn), Iron (Fe), Copper (Cu), Zinc (Zn), Lead (Pb), Cadmium (Cd) have been measured in these samples. The experiment revealed that the concentration of Cr, Co and Ni for all samples was found in Below Detection Limit. Mn was obtained in the range of (3.11 – 4.24) ppm where Fe, Cu, Zn, Pb and Cd were measured in the range of (19.06 – 27.28) ppm, (1.98 – 4.40) ppm, (0.75 – 5.22) ppm, (BDL – 4.13) ppm and (BDL – 1.73) ppm respectively. Among these metals, Iron was found as the highest concentration (27.28 ppm) in a measured sample.

Keywords: Ribbed smoked sheet, assessment, heavy metals, Chittagong, rubber, production.

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I. Introduction

Rubber is a part and parcel in our new civilization that is used in various purposes as different forms. A huge amount of Ribbed Smoked Sheets is utilized in the industries [1]. It was introduced in Bangladesh by the British farmer in the early twentieth century, but it was cultivated commercially in 1961 by the authority of Chattogram Hill Tracts. Bangladesh has bright future for the establishment of rubber industries as because of local resources are available that can be used for the production of rubber goods. Fifteen rubber gardens have already situated at the different region such as Chattogram, Sylhet and Modhupur. At present, a total of 25000 hectares of land is utilized for rubber cultivation in Bangladesh. In the Chattogram Hill Tracts, at least 20000 acres of land have been allotted for rubber plantation. The Chattogram Hill Tracts Development Board rubber gardens started rubber production in 1992. The annual demand of natural rubber is 20000 tons where the annual production is about 7500 tons. Footwear, adhesive, engineering goods such as gaskets, rubber seals, rubber curtain etc. are produced from natural rubber. Commercial equipments are protected from aesthetic damages by rubber surfacing process [2]. Medical accessories especially hand gloves are produced from rubber latex. Besides, rubber wood is also applied to prepare particle boards and other furniture [3, 4].

Ribbed Smoked Sheet may be contaminated by heavy metals due to absorption of these metals by rubber plants from the environment resources like soil, air and water etc. [5]. Heavy metals are also scattered surroundings through industrial wastes, power plant and burning refusal [6]. Nickel is found in the environment and also foodstuffs at very poor quantity. It is beneficial to health when uptake as small amount, but over doses of nickel are liable to prostate cancer, lung cancer and nose cancer [6]. Trace metals such as copper and iron is very essential to synthesis of metallo-proteins in human body [7]. But excess amount of these metals is a key component of inflammatory diseases [8]. Cadmium is responsible for kidney diseases and also bone fracture [9]. During human pregnancy, premature birth is occurred due to toxic effect of cadmium [10]. Cobalt and lead may cause lung cancer [6, 11]. Zinc is more beneficial to health in limited doses, but high amount is very harmful to health [12]. Chromium is a metal found in the environment cause of release it from industrial sources especially tanneries [13]. It is liable to cell damage and cancer [14]. Manganese is a common metal which is necessary for human health, but high doses of manganese is shown very toxic effects. It can be damaged different areas of the human brain [15, 16]. The present study has been provided detail description of a process for the production of

Ribbed Smoked Sheet in the Chattogram Hill Tracts Development Board rubber industry. This study has been also determined the concentration of heavy metals in the same products.

II. Materials and Methods

White milky fluid named latex was used as raw material for the production of Ribbed Smoked Sheet. Latex naturally contains rubber particles (30% - 40%), water (55% - 65%) and low quantity of sterol glycosides, proteins, ash, resins and sugars. Ammonia is a chemical used for prevention of the latex coagulation. Other chemicals like formic acid and sulfur were utilized as a coagulant and vulcanizing agent respectively.

Manufacturing process:

Latex collection and preservation: Tapping method was applied to collect the natural rubber latex from rubber tree. In this case, a rubber tapper shaves off a thin layer of bark halfway around the tree trunk and about 0.85cm deep. The dirt was removed from rubber latex by sieving through a (60 - 40) mm mesh. Ammonia was mixed with the clean latex to prevent natural coagulation.

Coagulation: To make a partition, aluminium sheet was inserted vertically in the coagulation tank. Then the milky latex was allowed standing for 6 or 7 hours. The soft thick gelatinous rubber was obtained. Roughly one pound of soft rubber was produced from three pounds of natural latex. The latex is kept for about 12 hours. The natural rubber latex was contacted with 10% of coagulant such as formic acid and allowed to rest for about 8 to 10 hours. The slabs were prepared in this step.

Sheet formation: The slabs were passed through a roller system to remove excess liquid. Then the sheet was formed. The last set of rollers was designed a criss-cross rib on the sheet. The ribbed smoked sheet was washed with water absolutely.

Smoke drying: In this process, the wood was burnt in a windows as well as doors opened room at about (38 – 50) °C temperature. The ribbed sheets were hung in the room for seventy two hours. The room was closed when the actual temperature reached at 50°C. The sheets were treated by the smoke and heat [17] (Figure-1). The smoke acts as a preservative and also prevents the mould on the rubber sheet [18, 19].



A



B

C



D



E



Figure-1: (A) Latex collection (B) Coagulation Tank (C) Coagulation (D) Rollers (E) Raw rubber Sheet (F) Smoke drying (G) Dried Ribbed Smoked Sheet

Measurement of heavy metals:

The concentration of heavy metals has been detected by using Flame Atomic Absorption Spectrometer (Thermo Scientific, Model: icE 3300, 3000 Series, USA).

Sample preparation: Weighed about 20g of sample in an evaporating dish and transferred to muffle furnace. The sample was ignited at 750°C for about 3 – 4 hours and then cooled to room temperature. About 5ml of water and also 5 ml of conc. HNO₃ were added to the samples. The samples were heated until the digestion was completed absolutely. At the final stage, the samples were filtered into 100 ml volumetric flask and added the water up to the mark.

III. Result and Discussion

Microorganisms are responsible to produce Volatile Fatty Acid (VFA) in natural rubber latex. This fatty acid can be neutralized by potassium hydroxide. The final rubber products may be badly affected in presence of VFA which is considered as volatile fatty acid number. The acceptable limit of VFA is 0.05 – 0.06 for natural raw rubber latex and is 0.02 – 0.03 for rubber finished products respectively. It is essential to mention that the presence of low value of VFA indicates the high quality of rubber latex [20]. However, ammonia may be also liable to improve the quality of the latex. Expected quantity of ammonia in the rubber products must be 0.55 - 0.60%. Ribbed Smoked Sheet (RSS) is classified into several varieties. There are five major grades like RSS₁, RSS₂, RSS₃, RSS₄ and RSS₅. The quality of these sheets depends on different factors viz. elasticity, color, purity, tensile strength etc.

The concentration of heavy metals has been measured in RSS. A total of nine metals such as Cr, Mn, Fe, Co, Ni, Cu, Zn, Pb and Cd have been measured in three samples of RSS. The current study disclosed that six metals were present in different concentrations. The concentration of Cr, Co and Ni were found in Below Detection Limit (BDL) for all samples. Sample B was contained 1.73 ppm of Cd where Sample A and C was shown BDL. Mn was found in Sample A, B & C as 3.50 ppm, 3.11 ppm and 4.24 ppm respectively. The highest concentration of Fe was obtained from Sample C as 27.28 ppm and 19.06 ppm of Fe was found in Sample A as the lowest one. Cu was identified in 3.65 ppm for Sample A, 4.40 ppm for Sample B and 1.98 ppm for Sample C. Sample A & B were shown the concentration of Pb as 1.09 ppm and 4.13 ppm respectively. On the other hand Pb was found as BDL for Sample C. It was observed that among the metals the highest concentration (27.28 ppm) have been measured for Fe in Sample C [Table – 1].

Table-1: Concentration of Heavy metals in Ribbed Smoked Rubber Sheet

Sample Category	Sample – A	Sample – B	Sample – C
Metals Concentration (ppm)	Cr	BDL	BDL
	Mn	3.50	3.11
	Fe	19.06	23.72
	Co	BDL	BDL
	Ni	BDL	BDL
	Cu	3.65	4.40
	Zn	1.78	5.22
	Pb	1.09	4.13
	Cd	BDL	1.73

*BDL: Below Detection Limit

IV. Conclusion

There is more difference between natural rubber latex and synthetic latex as because of very healthier characteristics and more durability was found in natural rubber latex. Ribbed smoked sheet is a natural rubber that is utilized in industrial sectors depending on its properties such as purity, tear strength etc. It is very necessary to increase the ribbed smoked sheet market including global automotive market enhancement. USA, European Union, Japan, China etc. are the greatest consumers of natural rubber sheets and rubber products. However, smoke plays an important role to increase tensile strength of rubber. But is smoke generated from firewood can cause the production of low quality rubber sheet. For these reasons, an alternative source of fuel such as solar energy, biofuels etc. can be used in the drying stage of ribbed sheets. The future of ribbed smoked sheet market will be bright if the industries will produce very high quality rubber products.

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