Evaluation of the Mordent Property of Coconut Husk Retted Water at Different Ages

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Introduction

Today, the Brown Coir has become the leading agent in coconut husk fiber industry. It is used in the production of ropes, mats, door mats, brushes, sacks, caulking for boats as well as stuffing fiber for mattresses. The main step of Coconut brown coir fiber production industry is coconut husk retting process for the extraction of coir fiber in coir industry (Bhat & Nambudiri, 1971). For that the husk is steeped in water for 4-5 months in Sri Lanka (Menon & Pandalai, 1958). As a result of retting, large quantities of organic substances including pectin, pentosan, fat, tannins, and also toxic phenols are liberated into water. This coconut retted water is a waste product and a huge environmental problem. This research was focused in utilizing coconut retted water as a mordent in fabric dyeing industry.

A mordent is a substance used to set dyes on fabrics or tissue sections by forming a coordination complex with the dye which then attaches to the fabric or tissue. The function of the mordant is to fix the dye on to the material or fiber. The dyeing industry these days pose severe environmental problems due to accumulation of the synthetic dyes and mordents. Majority of these synthetic dyes and mordents are not bio-degradable and consequently most of them are being banned. At this juncture, the use of natural coloring material as mordents and dyes play a very important role and now-a-days the industry is trying out on natural forms to avoid, environmental hazards.

Methodology

Uniform pieces of cotton fabric weighing 0.25 g were boiled in hot water bath at 100 ˚C to remove unnecessary particles in cotton fabric. Each piece was then boiled with coconut retted water at different ages (1 month, 2 months, 3 months and 4 months) separately in a water bath for another 20 minutes. A 0.25 mg/ml concentrated $FeSO_4$ was used as the control. Then, all cotton fabric pieces were allowed to dry. The dye preparations were made as 30 ppm solutions. The cotton fabric pieces which were treated with coconut retted water at different ages were impregnated with dye preparations in a boiling tube and heated in a water bath at 60°C for 10 to 20 minutes. Then, they were boiled over a Bunsen flame for 5 minutes for complete adhesion of the dye on to the fabric. These pieces were then allowed to dry to complete the process. Nine trials were carried out with each sample of coconut retted water with sky blue color. The process was repeated with $FeSO_4$ impregnated cotton fabric pieces and with cotton fabric pieces without any mordent as positive controls and negative controls respectively. Nine trials were conducted for both positive and negative controls. After completing the dyeing process, all cotton fabric pieces were subjected to visual comparison with a standard color chart by 30 individuals.

To evaluate the effect of coconut retted water as a mordent, colored cotton fabrics were washed a mild acid solution, a mild base solution and a detergent solution. Amount of washed out dye was measured by measuring the absorbance of solutions at 340 nm.

$$Amount\ of\ washed\ out\ dye \propto Absorbance\ of\ washout\ soution$$

and,

$$Effectiveness\ of\ coconut\ retted\ water\ as\ a\ mordant \propto \frac{1}{Absorbance}$$

Data were collected in triplicates for each and every set of treatments and analyzed statistically.

Results and Discussion

According to figure 1, the lowest absorbance after washing with HCl and NaOH were shown by the fabrics treated with four month old retted water sample. So, it can be concluded that the four month old retted water sample has the best mordent ability in acidic and basic conditions. However, best mordent property against detergent was shown by one month old coconut retted water sample. All other treatments were shown moderate and not significantly different mordent properties

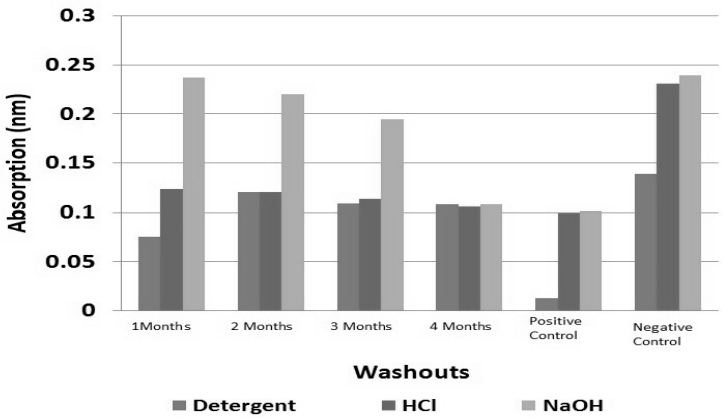

Figure 1: Bar chart of Absorption and treatments.

Table 1. Grouping information using Tukey method.

Treatments	Mean values	Group
No mordent	0.20367	A
2 month	0.15467	A B
1 month	0.14589	A B
3 month	0.13989	A B C
4 month	0.10778	B C
$FeSO_4$	0.07189	C

The p value is lower than 0.05 therefore there is a significant effect on absorption among treatment. According to ANOVA analysis there is a significant difference of no mordent treatment among others. And also there is no significant difference between absorption of one month and two months samples. Three months, four months and $FeSO_4$ treatments are significantly different from each other. Although one month and two months sample are not significantly different they are significantly different from each other treatments. In addition to that t has been given the highest mean absorption. And the lowest mean was recorded from the $FeSO_4$ mediated washout (See table 1).

Table 2. Grouping information using Tukey method.

Washing type	Mean values	Grouping
NaOH	0.18394	A
HCl	0.13306	B
Detergent	0.09489	B

The p value is lower than 0.05 (0.000), therefore there is a significant difference in amount of dye washed out with different washing agents (See table 2).

Conclusion

According to this study, four month old retted water has best mordent ability because of the increase of tannin concentration of the retted water.

According to mean value HCl and detergent are not significantly different, but they are significantly different from NaOH. In addition to that NaOH has shown the highest mean absorption and the lowest was recorded from the detergent washout. Therefore, it can be concluded that basic conditions such as NaOH solution cause greatly towards the loss of color from fabrics and powerful mordents should be used to prevent that loss.

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