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Dyeing of Cotton Fabric with Ground water & Sea water

Israt Zerin[1]* A.B.M. Foisal[2], Eshita Datta[3] and Mohammad Shohel Rana[4]
[1, 2,4] *Department of Textile Engineering, Southeast University, 251/A & 252, Tejgaon Industrial Area, Dhaka-1208, Bangladesh.*
[3] *Department of Textile Engineering, Bangladesh University of Business and Technology (BUBT), Plot # 77-78 Road # 9, Rupnagar Mirpur-2, Dhaka-1216, Dhaka 1216, Bangladesh*
Corresponding author: Israt Zerin

***ABSTRACT*:** *In this work we look for the possibilities of using sea water for cotton fabric dyeing. It is focused on the shade differences, reflectance%, color strength (K/S value), wash, rubbing and perspiration fastness following cotton fabric is dyed with both ground water and sea water. The fabric samples are 100% cotton single jersey. The quality parameters such as shade differences, reflectance %, color strength, wash, rubbing and perspiration fastness of the both dyed samples have been compared and it has been found that the sea water dyed fabric samples are lighter in shade and the results of quality parameters are satisfactory.*

***Keywords*:** *ground water, sea water, color fastness, color strength, reflectance.*

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I. Introduction

The fresh water scarcity is a growing problem all over the world because only 1% of earth's water is fresh water available for human to drink [1]. The US geological survey found that 96.5% of earth's water is located in seas and oceans and 1.7% of earth's water is located in the ice caps. The remaining percentage is made up of brackish water, slightly salty water found as surface water [2-4].

However, the textile industries are continuously using underground water for dyeing and washing garments and other textile products. They uses large quantity of water in its production processes and highly polluted and toxic waste waters are discharged in to sewers and drains without any kind of treatment [5-6]. Nearly 110 liters of water is needed to dye 1 kg cotton fabric and thus the water consumption of an average sized textile mill having capacity only 8tons/day is about 880000 liters per day [7]. So water scarcity will deepen in the future for meeting demand of industrialization and agriculture purpose. It is urgent to enhance irrigation efficiency and surface water use. It can be investigated the use of sea water for textile dyeing purpose as there is massive land in our coastal area like Chittagong, Mongla, Pirozpur and Khulna.

In this work, it is an attempt to use sea water in dyeing of cotton fabric and compare the difference of shade with dyed samples with ground water. Sea water is collected from cox's bazar sea beach used as raw with pH of 7-8, hardness is about 3.94g/L and TDS is 20920 PPM (2100 g/L). It is investigated the effects of dyeing of cotton fabric with different shade (1.2% & 2.2%) with reactive dyes (brand name Solazol) using ground water and sea water. The effects of color fastness to wash, rubbing and perspiration fastness of dyed fabrics are also studied and reported in this paper.

II. Materials And Methods:

2.1 Laboratory dyeing procedure for cotton fabric

5gm each sample of 100% cotton knit single Jersey bleached fabric is immersed into the dyeing pot of the laboratory dyeing machine. The dyeing pot is previously loaded with color solution according to the recipe, salt, leveling agent (Albatex DBC 1 g/L) and water. The sample is dyed for 20 minutes at 60^0 C then soda ash is added. The dyeing procedure is again continued for 40 minutes at same temperature. The samples are then rinsed wash, neutralized with Acetic acid (0.7 g/L), soaped at 90^0C for 10 minutes consequently washed and dried.

2.2 Comparison on shade variation

The shade difference of the samples has been evaluated by Verivide light box.

2.3 Color characteristics measurement

Reflectance percentage and color strength (K/S) of all dyed samples were measured by using spectrophotometer "Spectro 600" (Spectro 600).

2.4 Color fastness to wash
Washing fastness of dyed samples was tested according to ISO 105:CO3 method at 60°c for 30 minutes.

2.5 Color fastness to rubbing
This test is designed to determine the degree of color which may be transferred from the surface of a colored fabric to a specific test cloth for rubbing (dry and wet), Method: ISO 105 □ □ 12 and M/c Name: Crock master has been used for rubbing test.

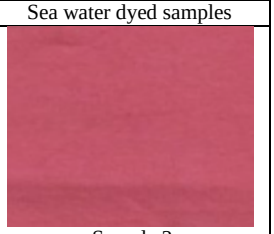
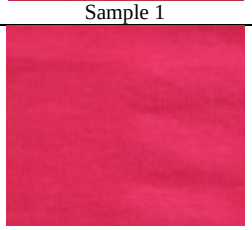
2.6 Color fastness to perspiration
The color fastness to perspiration (acid and alkaline), Method: ISO 105 E04 and M/C Name: Carbolite Incubator, Roaches International limited, Staffordshire, England.

III. Results And Discussion

3.1 Comparison on shade%

Table 1 show the dyeing recipe and the shade of each samples dyed with ground water and sea water. The evaluation has been done under D65 light source in the light box. Reactive dyes of cold brand, salt and soda used amount has been mentioned on the table. The amount of salt and soda are calculated according to shade % those are practically used for the laboratory dyedsamples.

Table I. Dyeing recipe & comparative shade between the samples

Recipe	Ground water dyed samples	Sea water dyed samples
Sola red- 1% Sola yellow- 0.2% Salt- 40 g/L Soda- 8 g/L Leveling agent- 1 g/L	 Sample 1	 :Sample 2
Sola red- 2% Sola yellow- 0.2% Salt- 50 g/L Soda- 10 g/L Leveling agent- 1 g/L	 Sample 3	 Sample 4

3.2 Reflectance Percentage of Dyed Samples

Obtained reflectance percentage is plotted on graph for sample 1, 2, 3, 4 (see Figure 1). Reflectance percentage of Sample 2, and Sample 4 medium shade and dark shade dyed with sea water shows (83.32 % and 82.59%) higher value than Sample 1 and Sample 3 (82.47% and 82.59%) dyed with ground water.

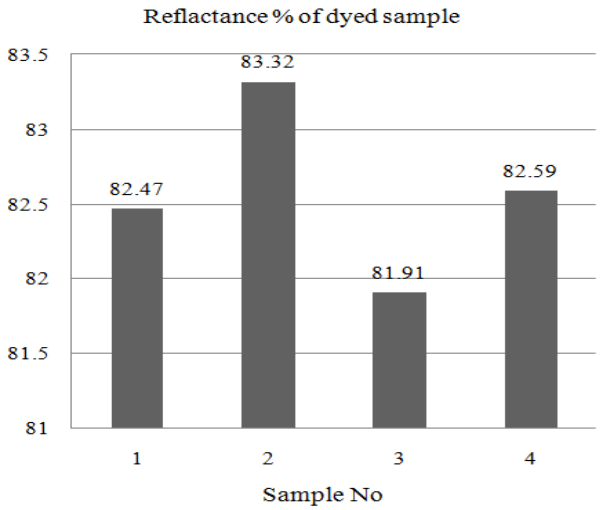


Figure 1: Graphical representation of Reflectance %

3.3 K/S value of Dyed Samples

Obtained K/S value is plotted on graph for sample 1, 2, 3 and 4 (see Figure 2). Sample 2 and Sample 4 for medium shade and dark shade dyed with sea water shows lower k/s value (0.017 and 0.018) than Sample 1 and Sample 3(0.019 and 0.020) dyed with ground water.

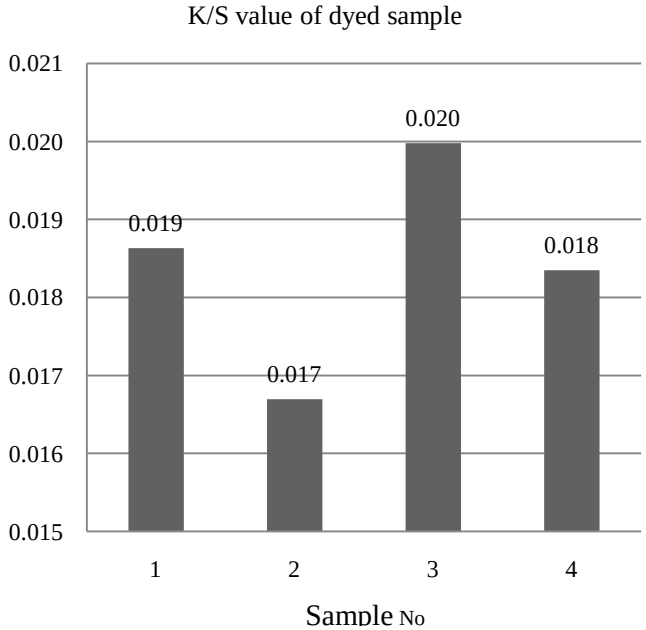


Figure 2: Graphical representation of K/S value

3.4 Spectrophotometric evaluation :

The Light sources D65 and D55 are used for the spectrophotometric evaluation. The lightness (DL), Saturation (DC) and Tone (DH), CIE lab value for references (Da and Db), Total color deviations (DE) are evaluated between the ground water dyed cotton samples and sea water dyed samples.

Table II. Spectrophotometric Evaluation of Dyed Samples

Standard	Sample	Illum./obs	Lightness (DL)	Saturation (Dc)	Tone (DH)	CIE Lab value for ref.Da	CIE Lab value for ref.Db	Total color deviation DE
Sample 1	Sample 2	D65 10 Deg	22.19	-24.95	-4.07	-24.82	-4.79	14.03
		D55 10 Deg	21.19	-25.48	-4.28	-25.48	-5.77	13.89
Sample 3	Sample 4	D65 10 Deg	14.06	-11.52	-6.95	-11.56	-6.88	19.46
		D55 10 Deg	13.73	-11.75	-7.19	-11.75	-7.5	19.56

From the Table 2, the spectrophotometric values under different light sources of CMC (Color matching committee) it is seen that DE value is out of range i.e. more than 1. DE values recognize the color difference between dyed fabric samples. It is observed by this experiment for same recipe dye absorption is less for sea water dyed samples and a great shade difference observed.

3.5 Color fastness to wash

Table 3 shows that the change in color due to wash on reactive dyed ground and sea water samples. The wash fastness rating in terms of ground water and sea water dyed samples 1and sample 2 is ‘ 5’ .The samples for 3 and 4 the ratings are ‘4/5’. It indicates that the results are almost same and there is no significant difference for the samples.

TableIII. Color fastness to wash

Samples	WTP water dyed samples	Samples	Sea water dyed samples
Sample-1	5	Sample-2	5
Sample-3	4/5	Sample-4	4/5

3.6 Color fastness to rubbing

Table 4 shows the results of rubbing fastness of the samples no 1, 2, 3 and 4. In case of sample no. 1 for the dry and wet rubbing fastness rating is 4 and 3. For sample 2 dry and wet rubbing fastness rating is 5 and 3/4. For sample 3 dry and wet rubbing fastness rating is 4/5 and 3 for ground water dyed samples. On the other hand sea water dyed sample 4 rating is 5 and 4 respectively. The rubbing fastness result may reveal that sea water dyed samples have significant result compared to ground water dyed samples.

Table IV. Results of Rubbing Fastness

Samples	Ground water dyed samples		Samples	Sea water dyed samples	
	Dry	Wet		Dry	Wet
Sample-1	4	3	Sample-2	5	3/4
Sample-3	4/5	3	Sample-4	5	4

3.7 Color fastness to perspiration

Table 5 shows that the acidic and alkaline solutions for perspiration test have the better results on both types of samples. According to the Grey scale the value 4 stands for the good results, 3/4 stands for moderate results and 4/5 stands for the very good fastness to perspiration.

Table V. Results of Perspiration Test

Samples	WTP water dyed samples		Samples		Sea water dyed samples
Sample-1	Acid	4/5	Sample-2	Acid	4/5
	Alkali	4/5		Alkali	4/5
Sample-3	Acid	3/4	Sample-4	Acid	3/4
	Alkali	3/4		Alkali	3/4

IV. Conclusion

This work investigates the influence of ground water and sea water on cotton fabric dyeing with different shade percentages. The results showed that sea water dyed cotton fabric with reactive dyes for 1.2% and 2.2% shades are lighter than ground water dyed fabric samples. It is visualized that the wash fastness is very good for both fabric samples. In dry rubbing fastness, the result is also very good for both water dyed fabric samples. The wet rubbing fastness was good. The reflectance% and K/S values of ground water and sea water dyed fabric samples are comparable. Research is required to assess the feasibility and cost effectiveness of sea water.

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References

[1] B. L. Pangarkar, P. V. Thorat, S. B Parjane, and R. M. Abhang,"Performance evaluation of vacuum membrane distillation for desalination by using a flat sheet membrane," Desalination and Water Treatment, vol. 21, no. 1-3, pp. 328–334, 2010.

[2] L. F. Greenlee, D. F Lawler, B. D. Freeman, B. Marrot, P. Moulin, "Reverse osmosis desalination: water sources, technology, and today's challenges," Water Research, vol. 43, no. 9, pp. 2317–2348, 2009.

[3] B. L. Pangarkar, M. G. Sane, M. Guddad, Reverse Osmosis and Membrane Distillation for Desalination of Groundwater: A Review, ISRN

[4] Materials Science Volume 2011, Article ID 523124, 9 pages doi:10.5402/2011/523124

[5] A. B. M. Foisal, S. D. Saha, A.K.M. Shafayet Khan, Md. Abdullah al Noman (2016)**,** Reuse Of Dye House Waste Water By Reverse Osmosis Process, Journal of Science & Engineering (SEUJSE) ISSN 1999-1630, volume 10, No. 2, p-70-74

[6] A. Shaid, S. M. D. Osman, AMD Hannan, M. A. R. Bhuiyan (2013) Direct Reusing of Textile Wastewater in Scouring-Bleaching of Cotton Goods Devoid of Any Treatment, International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN : 2278-800X, Volume 5, Issue 8 (January 2013), 45-54.

[7] P.G. Abir, A.B.M. Foisal (2015) Comparative Study On Etp Discharged Water And Wtp Treated Ground Water Dyed Cotton Fabric Samples, 5(1) edn., Institutional Engineering and Technology (IET): green global foundation.

[8] M.A.A. Khan, A.K. Guah (2012) Characterization and optimization of coagulation of textile effluent collected from gazipur, International Conference on Advances in Civil Engineering 2012 (ICACE 2012), 12–14 December 2012, CUET, and Chittagong, Bangladesh.

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