FORMULATION OF PRINT PASTE USING NATURAL AND INDIGENOUS THICKENER- MAIZE (ZEA MAYS L.) STARCH GUM

M. SHAHIDULLAH, H.U. AHMED, M. M. UDDIN, A. HALIM AND M. M. ANWER

Bangladesh Jute Research Institute, Manikmia Aveniue, Dhaka-1207, Bangladesh

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ABSTRACT

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The experiment was conducted in the Laboratory of Fibre Chemistry, Physics and Testing Department of Bangladesh Jute Research Institute Head Quarter, Dhaka during 2005-06 to investigate the possibility of maize starch gum to be used as natural and indigenous thickener. Maize starch gum a natural, cheap and indigenous starchy material was used as thickener in preparing textile printing paste. The prepared jute and cotton fabrics were printed with a definite amount of dye along with different percentages of maize starch, sodium alginate and their mixture and other necessary auxiliaries. The print quality was assessed in terms of sharpness ranking, washing fastness and rubbing fastness. Experimental observations showed that maize starch gum can be successfully used in textile printing of jute and cotton fabrics as indigenous and natural thickener which is friendly to environment.

Key words: Maize starch gum, alginate, screen printing, reactive dye, sharpness ranking, washing and rubbing fastness

INTRODUCTION

The origins of presently used natural and synthetic thickening agents are known. Natural polymer is soluble or dispersible in water solvent to produce viscose pastes. Sources of polysaccharides and plant seeds, e.g. guar gum, sea weed, e.g. alginate, plant gum exudates, e.g. gum arabic, jhingun gum and gum tragacanth etc. (Miles, 1981; Shahidullah, 2004-05; Whitler, 1973; Hambay, 1949) is used as textile printing.

Sodium alginate, as a salt of alginic acid (carbohydrate component of brown sea weeds), possesses a unique position among all thickeners producing soft and brilliant prints specially when reactive dyes are used (Shenai, 1985). Sodium alginates are readily soluble and the extent of interaction with the reactive dyes is negligible. With excessive use of reactive dyes in textile printing, sodium alginate has now become scarce and expensive. The brown sea-weed is not also available in abundance, because in the chief producing countries around the North Sea, the oil boom has made the labour cost very high. Sodium alginate is not readily available in our country (Gularjani, 1979). High price, scarceness of natural thickeners and the increase demand of thickeners stimulate the search of locally available materials suitable to use as an alternative to the traditional thickeners (Miah et al., 1993). The main objective of this study was to investigate the possibility of maize starch gum to be used as natural and indigenous thickener.

MATERIALS AND METHODS

In this experiments bleached jute fabrics (15X13 - 150" - 9 oz/36") and white cotton fabrics (long cloth) were used and the experiment was conducted in the Laboratory of Fibre Chemistry, Physics and Testing Department of Bangladesh Jute Research Institute Head Quarter, Dhaka during 2005-06. Procion orange MX-2R an ICI product (ICI Reactive orange 4), sodium alginate, maize starch gum, urea, resist salt (lodigol) and soda ash were used as dyes and chemicals.

The white cotton fabrics (long cloth) were first desized by conventional method. Then the bleached jute and desized white cotton fabrics were padded in a solution of soda ash (2%) on a padding mangle to 100% pickup and 70% pickup respectively and then dried on air. The fabrics were then calendared and made ready for printing.

Maize starch gum is a thickener obtained from the maize powder collected from local market. Natural and indigenous thickener maize starch powder was mixed with required amount of water and stirred with heating until a homogeneous mass was produced.

Several recipes of print pastes were made using alginate and maize powder in combination or single as thickener at different proportions. The pastes were prepared by adding the components gradually with constant stirring until a homogenous print paste was produced.

The prepared jute and cotton fabrics were printed by hand screen. The passage of squeeze was made twice for jute and once for cotton fabric. The squeeze angle and squeeze pressure were maintained same in all cases.

Fixation was carried out through curing for 2-3 minutes at 130°C. A thorough cold water rinse was given to the printed fabrics. The printed fabrics were then washed with 5g/*l* soap solution at 60-70°C for 20 minutes so that the hydrolyzed dyes were removed from inside the fabrics and cold rinse completed the washing. The fabrics were dried in air and then calendared.

RESULTS AND DISCUSSION

The composition of the different print pastes used in the experiment were mentioned in Table 1 and the print quality was assessed in terms of (i) sharpness ranking (ii) washing fastness of ISO test no. 3 and (iii) rubbing fastness were mentioned in Table .

Sharpness of the prints were assessed by visual observation of spreading of color and expressed by a grey scale 1-5 in decreasing order for spreading of color which had the following meanings:
5= Excellent, 4 = good, 3 = fair, 2 = poor and 1 = very poor.

Washing fastness test of ISO test no. 3 was carried out for each print (washed in 5 parts soap, 2 parts soda ash per 1000 parts at 60°C for 30 minutes) using grey scale (Clark, 1974; Trotman, 1968).

Rubbing fastness of the prints was measured by abrasion of dry and wet cotton fabrics on printed fabrics by Crock Meter and the amount of colour taken by above cotton fabrics was determined with the assessment of rubbing fastness by the grey scale (Standard Methods, 1978).

Table 1. Composition of different print paste

Paste no.	Thickening agent (%)		Procion orange MX- 2R dye in (%)	Auxiliaries (%)			Water
	Sodium alginate	Maize starch		Water holding agent urea	Spread resisting agent Lodigol	Fixing agent sodium bicarbonate	
1	2	-	2	10	1	2	83
2	3	-	2	10	1	2	82
3	4	-	2	10	1	2	81
4	3	-	2	-	1	2	92
5	4	-	2	10	1	-	83
6		8	2	10	1	2	77
7		10	2	10	1	2	75
8		10	2	-	1	2	85
9		10	2	10	1	-	77
10		12	2	10	1	2	73
11		12	2	-	1	2	83
12		12	2	10	1	-	75
13	2	5	2	10	1	2	79
14	2	5	2	-	1	2	88
15	2	5	2	10	1	-	80

Table 2. Sharpness ranking, washing and rubbing fastness properties of the printed jute fabrics

Paste no.	Jute fabrics			
	Sharpness ranking	Washing fastness	Rubbing fastness	
			Dry staining	Wet staining
1	2	2-3	4	3
2	4	4	4	3
3	5	4-5	5	3-4
4	2	3	3	3
5	1	3	3-4	3-4
6	2	3-4	3	4
7	3-4	3-4	4-5	3
8	2	3-4	3-4	3
9	1	3-4	3	2-3
10	4	4	4	3-4
11	2	3	4	3-4
12	1-2	3	3-4	3
13	3-4	3-4	4	3
14	2	3-4	3	2-3
15	2	3	4	3

N.B: 5 = Excellent, 4 = Good, 3 = Fair, 2 = Poor, 1 = Very Poor.

Table 3. Sharpness ranking, washing and rubbing fastness properties of the printed cotton fabrics

Paste no.	Cotton fabrics			
	Sharpness ranking	Washing fastness	Rubbing fastness	
			Dry staining	Wet staining
1	2-3	3-4	5	3-4
2	5	4-5	5	4
3	5	4-5	5	4
4	2	4	4	3-4
5	1-2	4	4	3-4
6	2-3	3-4	4	3-4
7	4-5	4-5	4-5	4
8	2	4	4	3
9	1-2	4	4	3-4
10	5	4-5	5	4-5
11	2	4	4	3-4
12	2	4	3-4	3
13	4-5	4-5	5	4
14	2	3-4	4	3-4
15	1-2	3-4	4	3-4

It was observed from the Table 2 and Table 3 that when 3 and 4 percentages of alginate (paste no. 2, 3), maize starch gum (paste no. 7&10) and the combination of alginate and maize starch gum (paste no.13) were incorporated with urea, lodigol and sodium bicarbonate the prints showed good-excellent sharpness properties, whereas 2 percentage of alginate (paste no.1), 8 percentage maize starch gum (paste no.6) produced the poor-fair sharpness of prints for both jute and cotton fabrics.

The 3 percentage of sodium alginate gum (paste no.4) and 10 and 12 percentage of maize starch gum (paste no. 8 and 11) and the combination of alginate and maize starch (paste no. 14) without water holding agent urea gave poor sharpness.

It was also observed that the 4 percentage sodium alginate gum (paste no. 5), 10 and 12 percentage of maize starch gum (paste no.9 and 12) and the combination of sodium alginate and maize starch gum (paste no.15) without fixing agent sodium bicarbonate showed poor to very poor sharpness.

Therefore required sharpness was not found without water holding agent urea and fixing agent sodium bicarbonate. The reason for obtaining excellent sharpness in the prints was that the urea molecules hold some of the water very strongly which helped in dissolution of dyes and sodium bicarbonate also helped in the fixation of dyes in the materials.

The washing fastness properties of both the jute and cotton printed fabrics were fair to excellent. The rubbing fastness of the printed fabrics was fair to excellent. But dry staining is better than those of wet staining. There was no difference between the jute and cotton prints were observed in the sharpness, washing fastness and rubbing fastness for a particular paste used. So, it can be concluded that maize starch gum or mixture of maize starch gum and alginate gum can be successfully used in the printing of jute and cotton fabrics as indigenous and natural thickener which is environment friendly.

CONCLUTION

Bangladesh has special interest for getting maize starch as locally available materials in our country. It is an indigenous natural and available starch can be used easily as a substitute of synthetic thickener. The prepared jute and cotton fabrics were printed with a definite amount of dye along with different percentages of maize starch, sodium alginate and their mixture and other necessary auxiliaries. The sharpness ranking, washing and rubbing fastness properties of the samples were observed. The paste no. 2, 3, 7, 10 and 13 showed good to excellent sharpness ranking and washing and rubbing fastness properties gave well to excellent. So, it can be concluded that maize starch gum or mixture of maize starch gum and alginate can be successfully used in the textile printing of jute and cotton fabrics as indigenous and natural thickener.

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