*Available online www.jsaer.com*

***Journal of Scientific and Engineering Research*, 2019, 6(3):76-80**

**Research Article**

**ISSN: 2394-2630**
**CODEN(USA): JSERBR**

# Printing of Polyester Twill Fabric with Thickening Agent Extracted from Tamarind Seed (*Tamarindus Indica*)

**Md. Abu Bakar Siddiquee[1], Md. Zahid Hasan[2*], Md. Manim Hossain[1]**

[1]Department of Textile Engineering, MawlanaBhashani Science and Technology University, Tangail, Bangladesh
[2]Dept. of Knitwear Manufacturing & Technology, BGMEA University of Fashion & Technology, Dhaka, Bangladesh
md.zahid.edu@gmail.com

**Abstract** The demand of printing fabric is increasing day by day. Disperse printing for polyester fabric is common process and as thickening agent guar gum is commonly used. This research attempted to replace the guar gum by tamarind seed gum. To get better result of color fastness, the use of auxiliaries is another objectives of this research. For this, tamarind seed gum was prepared in 700 gram, 800 gram, 900 gram per litrewith10 gram per litre acetic acidand75 gram per litre urea. Flat screen printing technology was used for printing the fabric then determined color fastness to wash, rubbing, perspiration and light. All color fastness properties except light fastness showed very good to excellent result. Color fastness to light showed poor result.

**Keywords** Disperse dye, flat screen printing, Tamarind seed, thickener, color fastness

## Introduction

In printing, thickener is an important component. The thickener maintains proper viscosity of print past and holds the color in place. There are a wide range of thickener materials available including alginates, natural vegetable gums, synthetic polymers or even foam. These components show sensitivity to temperature, pH and salt content. The types of thickening agent are quite diverse. The synthetic thickening agents used generally extremely high molecular weight polymers. The thickening agent is difficult to dispose off as it creates sedimentation in water. As chemicals used in synthetic dyes are toxic and hazardous to human health as well as to the environment, so revive of interest to invent non-toxic eco-friendly materials.

It is possible to prepare Tamarind seed gum by using *Tamarindus indica* linn [1]. It is member of dicotyledonous and subfamily Caesalpinioideae (Legiminosae) [2]. It is generally collected from tamarind seeds which belongs to about 75% polysaccharide as well as contains glucose, xylose and galactose units in a molecular ratio of ~3:2:1 [3,4]. It is not soluble in organic solvents but disperse in hot water with tolerance of broad pH [5]. Thus as a biodegradable thickening agent, it can be used instead of synthetic thickening agent. For preserving leather, as a glues, mordants and stains basically it is used [6].It is used for enhancing color fastness properties of dyed fabric [7]. Sudha et al., used tamarind seed gum as thickening agent for block printing by optimizing the concentration and test the physical and color fastness properties [8]. Enas et al., experimented on extraction of thickening agent from Aloe vera gel and application on polyester fabric printing with disperse dye [9]. Composite gel beads was prepared and characterized from tamarind gum and sodium alginate [10]. Now a days it is also commercializing for instance, in pharmaceutical industry, food industry [11,12]. The main objectives of this study is to apply tamarind seed gum as thickening agent instead of guar gum.

## Materials and Methods

### Fabric Selection

Commercially scoured bleached 100% polyester twill fabric with areal density 220 GSM was selected.

### Tamarind Seed Powder

Tamarind seed was collected from Sirajganj district (Figure 1). After collection it was washed by distilled water then dried in sunlight until dried properly and then grinded. The prepared powder preserved in air tight bottle.

*Figure 1:Tamarind seed and Tamarind seed powder*

### Thickening Agent

It was composed of17 grams of tamarind seed powder (TSP), 200 ml distilled water and sodium azide (5ppm). The mixture was stirred 70 minutes in normal temperature, then heated at 75°C for 25 half an hour.

### Printing Paste Recipe

Following recipe was used in this study.

**Table 1:** Printing paste recipe with tamarind seed gum

| Material | Amount |
|---|---|
| Thickening agent | 700 g/l, 800 g/l , 900 g/l |
| Acetic acid | 10 g/l |
| Urea | 75 g/l |
| Dye | 5 g/l |
| Water | 210 g/l, 110 g/l, 10 g/l |

**Table 2:** Printing paste recipe with guar gum

| Material | Amount |
|---|---|
| Thickening agent | 700 g/l, 800 g/l , 900 g/l |
| Acetic acid | 10 g/l |
| Urea | 75 g/l |
| Dye | 5 g/l |
| Water | 210 g/l, 110 g/l, 10 g/l |

### Printing Process

Flat screen printing was followed. Wet printed samples were dried at 90 ºC for 10 minutes and keep at 190 ºC for 4 minutes for fixation. Then hot and cold wash were performed. After that soaping was done with anionic detergent (5 g/l) then washed and dried by drier.

### Color Fastness to Wash

For test, followed method ISO 105 C06. Fabrics were cut to 12 cm by 4 cm and attached with SDC multi-fiber fabric (Acetate, Cotton, Nylon, Polyester, Acrylic, Wool) by sewing. With 4g/l ECE reference detergent and sodium perboratetrahydrate washing solution was prepared and run at 60°C for 30 minutes in gyro washing machine (James Heal, James H. Heal & Co. Ltd., UK) then washed at room temperature. Evaluation was performed by color change and color staining scale.

**Color Fastness to Rubbing**

For test, followed method ISO 105 X 12. For dry and wet rubbing specimens were cut to 14 cm by 5 cm. Crock meter (SDL International Ltd, UK) with cotton rubbing cloth was used. Evaluation was done by color change and color staining scale.

**Color Fastness to Perspiration**

For test, followed method ISO 105 E04. Fabrics were cut to 10 cm by 4 cm and attached with SDC multi-fiber fabric (Acetate, Cotton, Nylon, Polyester, Acrylic, Wool). Acid and alkaline solution were prepared after that the composite test specimens were wetted in the solution at room temperature for 30 minutes. After pouring the excess solution the specimen kept within two glass plates under pressure 12.5 KPa for 4 hours at 40°C by perspirometer (SDL International Ltd, UK).

**Color Fastness to Light**

ISO 105 BO2 test method was followed. Specimens were exposed to artificial light source under specified condition together with dyed blue standard having known fading characteristics. The fastness was evaluated by comparison of color change of specimen with standards.

**Results and Discussion**

**Color Fastness to Wash**

The grade of color fastness to wash of the twill fabric samples with different amount of thickening agent were evaluated and presented in the table 3.

**Table 3:** Observed result for color fastness to washing test

| Thickener source | Amount of thickener (g/l) | Color staining | | | | | | Color change |
|---|---|---|---|---|---|---|---|---|
| | | Acetate | Cotton | Nylon | Polyester | Acrylic | Wool | |
| Tamarind | 700 | 5 | 4-5 | 4 | 4 | 5 | 5 | 4 |
| | 800 | 5 | 5 | 4-5 | 4-5 | 5 | 5 | 5 |
| | 900 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Guar gum | 700 | 5 | 4-5 | 4 | 4 | 5 | 5 | 4 |
| | 800 | 5 | 5 | 4-5 | 4-5 | 5 | 5 | 5 |
| | 900 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

Here, Grade 5 = Excellent, Grade 4 = Good, Grade 3 = Fair, Grade 2 = Poor, Grade 1 = Very poor,

The overall results of color fastness to washing of all samples were very good to excellent.

**Color Fastness to Rubbing**

The grade of color fastness to rubbing of all printed twill fabric samples with different thickening agent were evaluated and presented in the table 4.

**Table 4:** Observed result for color fastness to rubbing test

| Thickener source | Amount of thickener (g/l) | Grade | |
|---|---|---|---|
| | | Dry rubbing | Wet rubbing |
| Tamarind | 700 | 4-5 | 3-4 |
| | 800 | 5 | 4 |
| | 900 | 5 | 4-5 |
| Guar gum | 700 | 4-5 | 3-4 |
| | 800 | 5 | 4 |
| | 900 | 5 | 4-5 |

Here, Grade 5 = Excellent, Grade 4 = Good, Grade 3 = Fair, Grade 2 = Poor, Grade 1 = Very poor,

Fair to excellent result were experienced for color fastness to rubbing test.

**Color Fastness to Perspiration**

The grade of color fastness to perspiration of all printed twill fabric samples with different thickening agent were evaluated and presented in the table 5 and 6.

**Table 5:** Observed result for color fastness to perspiration test (acidic medium)

| Thickener source | Amount of thickener (g/l) | Color staining | | | | | | Color change |
|---|---|---|---|---|---|---|---|---|
| | | Acetate | Cotton | Nylon | Polyester | Acrylic | Wool | |
| Tamarind | 700 | 4 | 4-5 | 4 | 4 | 5 | 4 | 4 |
| | 800 | 5 | 5 | 4-5 | 4-5 | 5 | 5 | 5 |
| | 900 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Guar gum | 700 | 5 | 4-5 | 4 | 4 | 5 | 4 | 4 |
| | 800 | 5 | 5 | 4-5 | 4-5 | 5 | 5 | 5 |
| | 900 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

**Table 6:** Observed result for color fastness to perspiration test (alkaline medium)

| Thickener source | Amount of thickener (g/l) | Color staining | | | | | | Color change |
|---|---|---|---|---|---|---|---|---|
| | | Acetate | Cotton | Nylon | Polyester | Acrylic | Wool | |
| Tamarind | 700 | 4 | 4-5 | 4 | 4 | 5 | 4 | 4 |
| | 800 | 5 | 5 | 4-5 | 4-5 | 5 | 5 | 5 |
| | 900 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Guar gum | 700 | 5 | 4-5 | 4 | 4 | 5 | 4 | 5 |
| | 800 | 5 | 5 | 4-5 | 4-5 | 5 | 5 | 5 |
| | 900 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

The overall result was very good to excellent.

**Color Fastness to Light**

The overall results of color fastness to light of all samples were poor.

**Table 6:** Observed result for color fastness to light

| Thickener source | Amount of thickener (g/l) | Grade |
|---|---|---|
| Tamarind | 700 | 2 |
| | 800 | 2-3 |
| | 900 | 3 |
| Guar gum | 700 | 2-3 |
| | 800 | 2-3 |
| | 900 | 3 |

**Conclusion**

This study showed that tamarind seed gum can be used as thickening agent for disperse printing. By using this we can reduce the cost without compromising the quality of the printed fabric and without destroying the environment. Moreover the waste material can be saved.

Tamarind tree is available most of the place in Bangladesh. So it is very easy to collect tamarind seed and can be apply as thickening agent with a very cheap rate.

Further work can be done by using other parts of the tree or any other tree by changing dye, fabric type, fiber type etc.

**References**

[1]. Goyal, P., Kumar, V., & Sharma, P. (2008). Cyanoethylation of tamarind kernel powder. *Starch-Stärke*, *60*(1), 41-47.

[2]. El-Siddig, K., Gunasena, H. P. M., Prasad, B. A., Pushpakumara, D. K. N. G., Ramana, K. V. R., Vijayanand, P., &Wllliams, J. T. (2006). Fruits for the future 1-Tamarind, *Tamarindus indica*; Southampton Centre for Underutilised Crops.

[3]. Freitas, R. A., Martin, S., Santos, G. L., Valenga, F., Buckeridge, M. S., Reicher, F., & Sierakowski, M. R. (2005). Physico-chemical properties of seed xyloglucans from different sources. *Carbohydrate Polymers*, *60*(4), 507-514.

[4]. Wang, Q., Ellis, P. R., Ross-Murphy, S. B., & Burchard, W. (1997). Solution characteristics of the xyloglucan extracted from Detariumsenegalense Gmelin. *Carbohydrate polymers*, *33*(2-3), 115-124.

[5]. Baveja, S. K., Rao, K. V., & Arora, J. (1988). Examination of natural gums and mucilages as sustaining materials in tablet dosage forms. *Indian Journal of Pharmaceutical Sciences*, *50*(2).

[6]. Kanth, S. V., Venba, R., Madhan, B., Chandrababu, N. K., &Sadulla, S. (2009). Cleaner tanning practices for tannery pollution abatement: role of enzymes in eco-friendly vegetable tanning. *Journal of Cleaner Production*, *17*(5), 507-515.

[7]. Gulrajani, M. L. (1999). Natural dyes-Part I: Present status of natural dyes. *Colourage*, *46*, 19-28.

[8]. Babel, S., Upadhaya, H., & Gupta, R. (2015). Optimization of Thickening Agent Based on Tamarind Seed Gum for Printing of Cotton and Its Impact on Physical Parameters. *International Journal of Fiber and Textile Research*, 5-8.

[9]. El-Zairy, E. M. (2011). New thickening agent based on Aloe vera gel for disperse printing of polyester. *Autex Research Journal*, *11*(2), 66-70.

[10]. Zhang, J., Xu, S., Zhang, S., & Du, Z. (2008). Preparation and characterization of tamarind gum/sodium alginate composite gel beads. *Iranian Polymer Journal*, *17*(12), 899-906.

[11]. Sumathi, S., & Ray, A. R. (2002). Release behaviour of drugs from tamarind seed polysaccharide tablets. *J Pharm PharmSci*, *5*(1), 12-8.

[12]. Williams, P. A. (2000). Gum arabic In Handbook of Hydrocolloids; Phillips, GO; Williams, PA, Eds.