April 2024 REPRINT

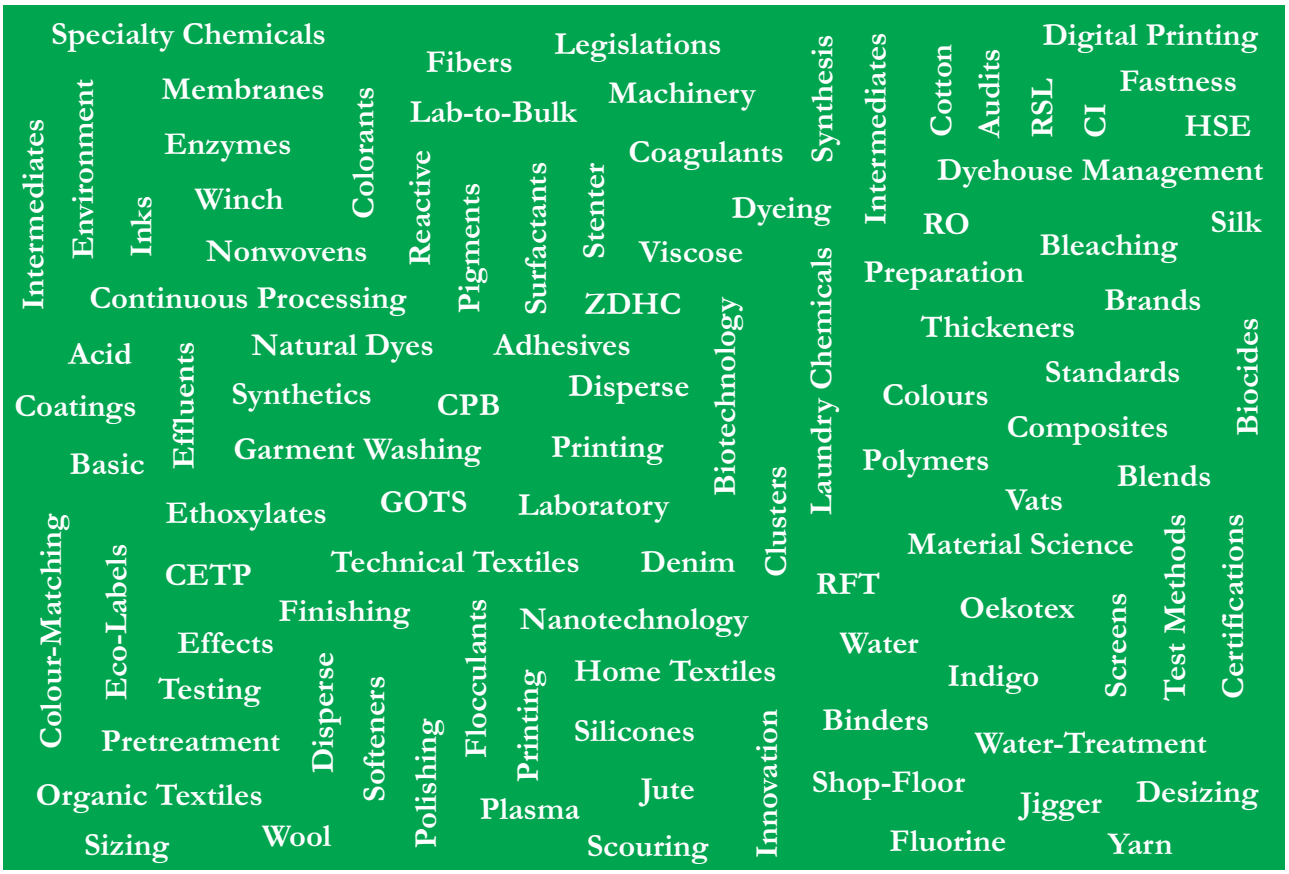
COLOURAGE

The Magazine for Textile and Garment Processing

Title: Marbling: an unconventional way of surface design on textiles

Prateek Sarkar and Sankar Roy Maulik

Department of Silpa-Sadana, Visva-Bharati (A Central University), Sriniketan, West Bengal



Subscription Contact:
COLOURAGE
Colour Publications Pvt Ltd.
126-A, Dhuruwadi, AV Nagwekar Marg
Prabhadevi, Mumbai - 400 025
Tel: +91-22-2430 6319
E-Mail: colorpub@colorpub.in

Editorial Contact:
S. Radhakrishnan
E-Mail: editor.colourage@colorpub.in

Advertising Contact:
Vinaya Sawant
E-Mail: advt.colourage@colorpub.in

Marbling: an unconventional way of surface design on textiles

Prateek Sarkar and Sankar Roy Maulik*
Department of Silpa-Sadana, Visva-Bharati (A Central University), Sriniketan, West Bengal

Abstract

Marbling is an unconventional surface ornamentation technique that produces vibrant and eye-catching designs on fabric. It can create various textures, patterns, and shades for fashionable garments and accessories. This study aims to explore different marbling methods and find a suitable thickening agent, i.e., gum indulka, to make an impact. The best possible result is to develop apparel focusing on Indian, Indo-Western, and Western styles.
Keywords: *Carrageenan, Gum Indulka, Marbling, Methocel, Pigments, Textiles*

Introduction

TEXTILE products are appreciated not only for their functional and communicative value but also for their aesthetic appeal. Designing textiles has a long and illustrious history. The three main areas of textile design, i.e., print, woven and surface ornamentation, can produce cloth for various occasions and markets. Textile design has grown in various sectors, including fashion, interior design, and fine arts. Various surface ornamentation techniques, viz., painting, stencilling, stitching, embellishing, resist, appliqué and patchwork, quilting, etc., either individually or in combinations, can produce diversified value-added textiles for niche markets and will attract the consumers to purchase that particular product.

In contrast, the marbling technique of surface ornamentation is entirely unconventional. The naturally flowing colours produce eye-catching and vibrant effects on the fabric. This novel method of printing is relatively quick and efficient, allowing for the printing of longer lengths of fabric in a single stretch. It is one of the cheapest methods of surface ornamentation since the preparatory cost, i.e., block and screen-making, and printing can be avoided. The risk of mixing pigments and colours can be reduced using hydrophobic substances like turpentine oil, kerosene, etc. The marbling bath can be effectively reused several times to get the marbled effect.

Marbling is a centuries-old technique that involves paint, adhesives or any dispersant and water to create unique patterns on fabric, paper or any object. The marbling process relies on the chemical character, particle size, viscosity, and surface tension of pigments/colours. This traditional art form has been cherished in Asia and Europe for centuries and used for decorative purposes and as a background texture for official documents. This technique was originally developed in the 15th century to decorate papers. Presently marbling is used in fabric decoration also. In the marbling process, carrageenan and sodium alginate are commonly used as thickeners. Researchers compared these two as thickening agents and observed that carrageenan had a better pattern-transferring ability than sodium alginate (Akduman & Sari, 2023). The researcher also explores using reactive and vat dyes in screen printing to transfer the marbling effect to fabric for garments and accessories (Dzramedo & Ahiabor, 2020). Marbling can be used to create abstract prints and versatile patterns. Fabric marbling using dyes and shaving foam, focusing on colour fastness, durability, and lightness, has been reported in the literature (Priya et al., 2021). Designers are now interested in marbling and trying to apply them to high fashion

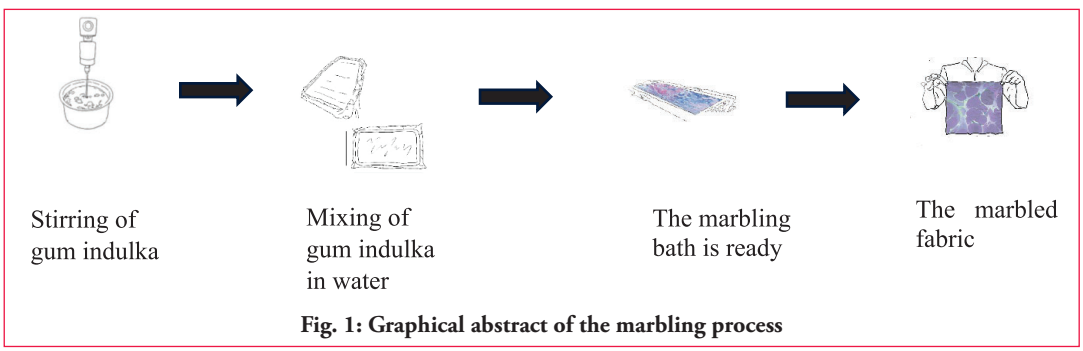


Fig. 1: Graphical abstract of the marbling process

*Corresponding author :
editor.colourage@colorpub.in

and high-value accessories (Hendrawan & Putri, 2016). Designers create various textures on the fabric surface to showcase their design concepts. It is indispensable in fashion and textile design. Surface texture in fashion design creates its identity through the manipulation of materials (Gong & Shin, 2013). Some researchers combine marbling and block batik motifs, to create a new design in the batik production process. Marbling patterns were created on a silicate surface that replaced water (Hafiza et al., 2021). Researchers developed a new design approach for complex marbling patterns that encourages creativity while expediting design generation, meets textile industry repeat criteria, and outputs vector images (Shufang et al., 2014).

Thickener for marbling

Carrageenan and methylcellulose, known as methocel, are commonly used to create a marble effect on fabric, both serving the same purpose of adhering colours to the surface of the solution prepared with water and thickeners. Methocel is a synthetic thickener used in book arts as a sizing agent and to decrease the drying period of PVA glues. It is cost-effective and more durable compared to natural thickening agents. Methocel also creates a viscous surface for marbling on fabric. Carrageenan is a naturally occurring linear sulphated polysaccharide produced from red edible seaweed. Because of its gelling, thickening, and stabilising properties, it is widely used in the food industry. Because of their high affinity for food proteins, they are primarily employed in dairy and meat products. Both carrageenan and methocel have certain drawbacks. They are very expensive and after marbling it leaves a smell on the fabric, which enhances after a few usages, if not washed properly. Carrageenan also causes inflammation in some cases who have sensitive skin (https://www.marbledbeauty.co.uk).

Gum Indulka is the derivative of guar gum thickener suitable for screen printing. They have no reducing effect on dyestuffs and are unaffected by the hard water used to make the thickening paste. There are three series of gum indulka, including the U series, AG series, and PA series (Shenai, 1976). Gum Indulka from the AG series, which is sold in the market as a powder that is lemon yellow, is used in the present work.

Objectives of the study

The introductory part and review of the literature suggest that the marbling process is appreciated by different luxurious brands in their collection. The objective of the present study includes the experimentation with various methods to achieve pleasing marbling effects on various textile substrates and identifying the most preferred method in terms of quality. In the present study gum indulka was used as a thickener to avoid certain drawbacks of carrageenan and methocel commonly used in marbling.

Experimental

Materials

Fabric

Table 1 shows the varieties of fabric with different areal densities, that have been used for the present study.

Table 1: Different fabrics used for marbling

Type of fabric	Material	Areal Density (g/m^2)
Woven	Cotton (Markin)	180
Woven	Viscose	130
Woven	Polyester/Cotton	110
Woven	Polyester	180
Woven	Cotton (Canvas)	400
Knitted	Polyester/Viscose	180
Knitted	Slub Viscose/	
Polyester	100	

Chemicals

Binder SLN, Turpentine oil, Kerosene oil, Emulsifier N, Gum Indulka and Diammonium phosphate, Sodium Carbonate, Turkey Red Oil, and Detergent of commercial grade were used in the study as and when required.

Dyes and pigments

Different pigment emulsions viz. Texcron Blue BN, Texcron Golden Yellow KRM, Texcron Brill Red FJC, Texcron Green G, Texcron Brown BR, Texcron Black NGB, Texcron Orange, different acrylic colours and reactive dyes were used for getting a marbling effect on various fabrics.

Methodology

Preparation of fabric

All fabrics used in the study were RFD, i.e., ready for dyeing. Hence, mild scouring was done before marbling to improve the absorbency of the fabric. The process was performed using sodium carbonate (3%), T.R. Oil (0.5%), and detergent (0.5%) at 80°C for 30 min - 60 min, depending on the type of fabric. The scoured fabric was washed thoroughly with cold water and finally dried in the air.

Exploration of marble effects on fabric

With Water

In this method, three litres of water were taken and the pattern was created either with pigment colour mixed with turpentine oil, only pigment colour, commercial acrylic colour or acrylic

colour mixed with turpentine by dropper, before dipping the cotton (markin) fabric to transfer the pattern.

With Water and Turpentine oil

During this process, three litres of water were mixed with turpentine oil, and the pattern was developed with reactive dyes and reactive dyes mixed with turpentine oil by sprinkling, before dipping the fabric to transfer the pattern to the fabric.

With Kerosene emulsion

Table 2 depicts the recipe used to prepare kerosene oil – water-based emulsion thickener to be used for marbling.

Table 2: Recipe of kerosene emulsion

Ingredients used	Quantity (g)
Kerosene Oil	78
Binder SLN	10
Emulsifier N	2
Diammonium Phosphate	2
Water	Balance
Total	100

The marbling process with kerosene oil-water-based emulsion thickener was performed in three different methods.

In the first method, three litres of water were taken and the pattern was developed by pigment colour mixed with kerosene emulsion by using a dropper, before dipping the fabric to transfer the pattern.

In another process, three litres of water mixed with kerosene emulsion was taken, and patterns were developed by pigment colour, followed by dipping the fabric to transfer the pattern.

In the third method, three litres of water were taken, and patterns were developed by pigment colour mixed with kerosene emulsion and turpentine oil, before dipping the fabric to transfer the pattern.

With Gum indulka and Reactive dye

Gum indulka (50 g) was mixed with three litres of water with the help of a high-speed stirrer and patterns were created with reactive dye mixed with turpentine oil and sodium carbonate by using a dropper, followed by dipping the fabric to transfer the pattern to the fabric.

With Gum indulka and Pigment colour

In this process, gum indulka (50 g) was mixed with three litres of water with the help of a high-speed stirrer and patterns were developed with pigment colour mixed with Binder SLN (98 g), diammonium phosphate (2 g), and turpentine oil by using a dropper, followed by dipping the fabric to transfer the pattern.

Results and discussion

Effect of different reagents on marbling

With Water

The use of water as a base for marbling was unsuccessful. There was no indication of the marble effect in some of the studies, and colour mixing was observed in some cases. Commercial acrylic paint produced a marbled effect to some extent with poor brightness, and the fading of colours was noticed while washing. Figure 2 shows samples developed with water as a base.

Fig. 2: Marbling effect with water

With Water and Turpentine Oil

In this process, water mixed with turpentine oil was taken as the base where the patterns had developed with high brightness but did not give a marble effect. Another situation in which water was used as a base revealed no indication of a marbling effect because turpentine oil and reactive dye did not adequately mix. Furthermore, both cases had poor washing performance. Figure 3 depicts the marbling effect with water and turpentine oil as the base.

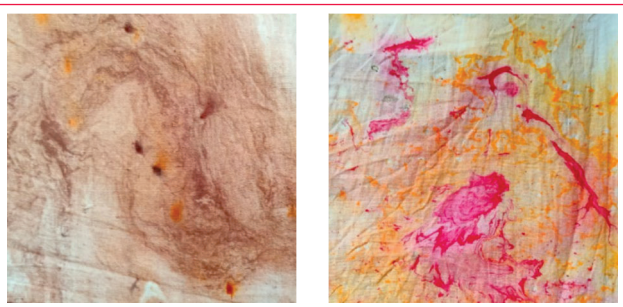


Fig. 3: Marbling effect with water and turpentine oil

With Kerosene emulsion

In this process, a mixing of colours was noticed, but the

Fig. 4: Marbling effect with kerosene emulsion

colours were washed out after washing. Moreover, the fragrance of the kerosene remained on the cloth after washing. Also, the brightness of the marble effect was very low. Figure 4 shows some samples developed by using kerosene emulsion.

With Gum indulka and Reactive dye

In this process, the marbling effect was very good, however, after washing, the colour started to wash out. Additionally, the colour brightness diminished. Steaming may give better results, but it also contributes to additional cost and energy, hence it was not preferred during the study. Figure 5 illustrates the marbling effect with gum indulka and reactive dye combination.

Fig. 5: Marbling effect with gum indulka and reactive dye

With Gum indulka and Pigment emulsion

The process of using gum indulka and pigment emulsion creates non-reproducible, exquisite prints that resemble complex patterns found on marble. The prints were quite attractive and had a great visual appeal. The brightness of the colour was very good and colourfastness to rubbing tested through Crockmeter as per ISO 105-X12:2001 was 3-4 for all fabric samples. There was no mixing of colours during the process. The most crucial point is the viscosity of the solution for creating distinct and appealing patterns. Figure 6 shows different samples developed on various fabrics, and good marbling effects were noticed in all cases. Hence, the gum indulka and pigment emulsion combination was adopted to create marbled fabrics for producing apparel.

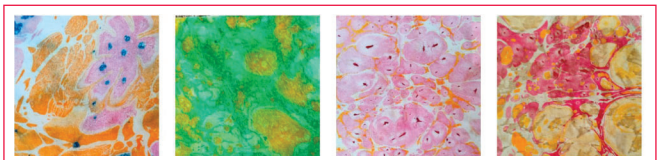


Fig. 6: Marbling effect with gum indulka and pigment emulsion

Product development

Figure 7 shows the different stages of producing a fabric with a marbled effect. A bath of 140 inches by 50 inches, in which 3 m fabric can be marbled at a time, had been made. The shape of the bath was made with bricks, in which polythene sheets were used to give it a rectangular shape where the water for marbling would

7a: Rectangular shaped bath to store water

7b: Addition of pigment emulsion

7c: Dipping the fabric in the bath

7d: Drying the fabric in the sunlight

Fig. 7: Different stages of marbling with gum indulka and pigment emulsion

be stored (Figure 7a). Gum indulka of 500 g was mixed with 50 litres of water in a high-speed stirrer. Approximately 400 litres of water were taken in the bath, and the gum indulka solution made earlier was mixed and kept in the bath for 1 hour or until all bubbles dissipated. Once the bubbles had dissipated, pigments mixed with binder and diammonium phosphate were added to make the patterns on the bath with the help of droppers (Figure 7b). After that, the fabric was dipped in the bath (Figure 7c) and taken out. It was dried and washed again to remove the gum indulka adhere to the fabric and then dried again (Figure 7d). Now, the fabric is ready to make garments (Figure 8).

Fig. 8: Apparel from fabric developed through marbling

Advantages of marbling

Water is expensive enough to treat and dispose of. Water conservation and reuse are rapidly becoming a necessity for the textile industry. In this marbling, approximately 10-12 times, the fabrics can be marbled in the same bath, and after the process, this bath can be used further for printing dark shades.

Conclusion

Surface texture is indispensable in fashion and textile design for innovative creations. Along with technological advances in the fashion industry, surface texture has derived many new and attractive features that provide more opportunities for designers to show various design concepts. Rather than the surface quality of fabrics, surface texture in fashion design creates its identity through the manipulation of materials i.e., an application that tends to be primarily for visual effects without being restricted to decorative purposes. A suitable substitute for mass-producing fabrics with great aesthetic value is marbling. It is effective in lowering both human work and energy usage and is one of the quickest methods for printing.

Gum Indulka used as a thickener efficiently created a good marbling effect. Colours stay in stable condition on the top of the bath, creating a smooth flow of pigments. Also, the Indulka used for marbling can be reused for the printing of dark shades of colour. It can be used for marbling on cotton fabric as an alternative to carrageenan or methocel.

Future aspects

Marbling with natural dye and with only water, i.e., without adding any thickener in the bath, may be explored further to reduce the production cost and preparation time of the bath. Yarn marbling and marbling at the fibre stage can also be a possible area of research in future. One can play with marbled fabric cut into pieces for weaving different patterns, and it can also be used as extra weft.

References

- Akduman, C., & Sari, H.K. (2023). The Turkish art of marbling (Ebru) on textile fabrics: investigation of thickening agent, mordant and fixation temperature. Sakarya University Journal of Science, 27(5), 930-942, DOI: 10.16984/saufenbilder.1283596
- Dzramedo, B.E., & Ahiabor, R. (2020). Representation of screen marbling techniques with reactive and vat dyes combination on textiles and fashion design products for the Ghanaian market. Arts and Design Studies, 80, 41-48.
- Gong, L., & Shin, J. (2013). The innovative application of surface texture in fashion and textile design. Fashion and Textile Research Journal, 15(3), 336–346. https://doi.org/10.5805/SFTI.2013.15.3.336
- Hafiza, G.N., Ibrahim, M., & Zain, W.S.W. (2021). The application of batik block motifs and marbling techniques as pattern designs in contemporary batik. AIP Conference Proceedings 2347, 020122. https://doi.org/10.1063/5.0052330
- Hendrawan, A., & Putri, K.R.S. (2016). The potential value of marbling technique on the creative industry. Bandung Creative Movement, Multidisciplinary Design, 3(1), 446-451.
- https://www.marbledbeauty.co.uk (Retrieved on 9th May, 2023)
- Priya, R., Das, S., Nevetha, R. P., & Balaji, S. Ram. (2021). Studies on fabric marbling technique for design and development of carried accessories. Man-Made Textiles in India, 49 (8), 270.
- Shenai, V.A., (1976). Technology of Textile Processing, Technology of Printing. Sevak Publications, 133-134.
- Shufang, Lu., Mok, P.Y., Jin, X. (2014). From design methodology to evolutionary design: An interactive creation of marble-like textile patterns. Journal of Engineering Applications of Artificial Intelligence. 32, 124-135. https://doi.org/10.1016/j.engappai.2014.02.015.

■