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Recent Use of Natural Thickeners in the Printing Process

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AS A MAJOR component of textile printing pastes, thickener was used. They have a high molecular weight, a high viscosity, a strong handling, long hydration time compatible with other components of printing pulp and they are colorless. You impart plasticity and adhesiveness to the printed paste such that patterns without bleeding are introduced. Printing pastes primarily have the purpose to hold, attach and move the teat onto the targeted cloth. Various well-known natural and synthetic thickeners were present. Natural thickeners are preferred to synthetic thickeners as they are comparatively cheap, easily available, and non-irritant in nature. Natural products are also generally non-polluting renewable sources for sustainable supply. Synthetic thickeners have certain disadvantages such as high cost, toxicity, and result in environmental pollution.

Keywords: Natural thickeners, Printing, Tamarind Kernel Thickener, Aloe Vera gel. Gum Karaya**,** Alginates.

Introduction

High molecular weight compounds of thickener, which give viscous pastes into the water, are used for textile printing. They provide the printer paste with adhesiveness and plasticity so that it can be applied without spreading onto the surface of the cloth and can retain the pattern outlines under high pressure. Their primary purpose is to retain or attach the colored particles onto the fabric in the desired position before the dye is transferred to the fabric and fixed. [1]

There are three requirements for determining a good thickener: the properties of the wet dye paste, the dry printed film, and the actions before or after fastening and finished printing. [2]

The criteria for the color paste are very different.

a) Precipitation due to thickener contact with other contaminants in printed pastes should not only be thickened.

b) The print paste thickener should also be given particular rheological characteristics during the printing process under differing shear stresses. The uniformity of the printing process is the liability.

c) The thickener can also avoid fibers, which will produce an aqueous paste, from being capiliarised.

d) The thickener does not counterfeit colors, i.e. ensure real colors and optimal performance.

e) A thickener paste should have strong storage consistency to allow the colors to be reused and maintain all of these properties for a long time.

Some features of the dried print film are required:

a) A stable film, not sticking, with good mechanical and elastic properties and good adhesion, should be generated by the thickener. This avoids separating and fracturing in the course of drying and vaporization.

f) The drying process requires chemical consistency, as alkaline, salt, and other amounts are improved enormously by taxing the thickener.

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g) The thickener should allow a uniform swell of the print film for smooth fastening in the subsequent steaming process. This rule can be extended so that during the steaming phase, the colors are not allowed to run.

h) The dyestuff should not be held but should have some water permeability to ensure that the dyestuff migrates through the fiber.

i) The thickener can offer good color, brightness, and uniformity.

j) The cloth should be delicate and not be negatively affected during the washing process.

The thickener should be inexpensive and readily available in addition to these technological aspects. [3]

Classification of thickener

The thickening agents available today (Scheme 1) can be broadly divided into two categories depending on their origin. [1]

Natural Thickeners

Plant Exudates

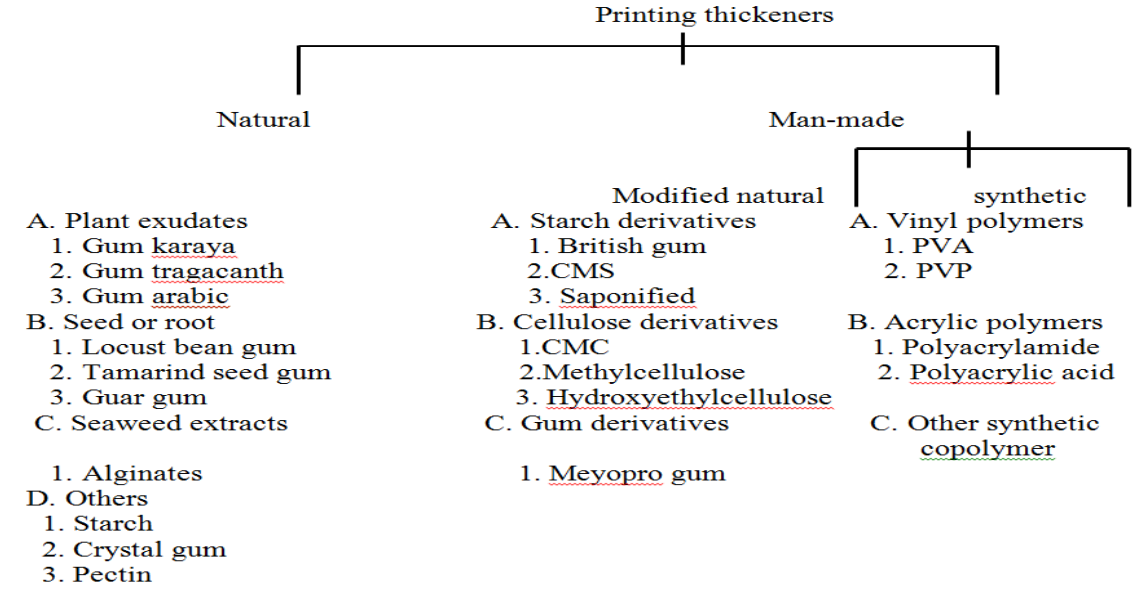
Gum Karaya

Gum karaya is called Sterculia urens tree dry exudation. It is a polysaccharide that's acetylated and is relatively acidic in nature and insoluble. It ranks second only to commercially important gum arabic among the exudation gums. [4]

Quantitative determinations revealed the following hydrolytic components; D- galacturonic acid (43 parts), D- galactose (14 parts), L-rhamnose (15 parts). Hydrolytic studies showed the presence of D- galactose (5 parts), L- rhamnose (5 parts), D- galactose(1 part), and D- galacturonic acid (8 parts); traces of D- xylose and 6- deoxy- D-fructose were also indicated. [1]

Gum karaya is modified in the textile industry to use for printing operations for which it had been deemed insufficient before a process had been created to improve its solubility. The result is a water suspension under pressure from gum karaya[3]. With pressure 121 the rate of dissolution varies. Solutions that produce 15-18 percent of solids are sold as cloth gum solutions in industrial use. An alternative solution approach includes sodium peroxide, persulfate, or per silicate therapy. An appropriate paste should contain 40-5% sodium peroxide (0.5-0.6% by weight of gum) and 40-50% gum karaya, which also blanches gum. When electrolytes are applied, the viscosity of the pulp reduces, though it remains stable for several days. [5] Additional preservatives such as formaldehyde, benzoic acid, salicylic acid, and chlorinated phenols can lead to further improvement instability. A slight supplement of mild alkali increases adhesiveness more.

Modified gum karaya can be used for direct color printing on cotton materials. It is used mostly for the printing of large blots. It makes flawless prints and after fastening the ink, the exhausted film can be quickly separated from the fabric. [1] The chosen gum in this particular field is sharpness, consistency, and equality, rather than color. [6]



Scheme 1. Classification of thickener.

From Seed or Root
tamarind kernel

Tamarind seed gum is galactoxyloglucan, a carbohydrate polymer rich in xyloglucan (65-72%) and containing glucose, xylose, and galactose units in a molecular ratio of ~ 3: 2: 1. [7, 8]

It is a plant that grows abundantly in more than 50 countries of the world. The main areas of production are in Asian countries such as India, Bangladesh, Sri Lanka, Thailand, and Indonesia. The tamarind tree bears the pods (fruits) that contain

About 10-12 brown seeds surrounded by abundant acid pulp[9]. The fruits of tamarind contain about 30% of the pulp, 40% of the seeds, and 30% of the hull.

The seed of the tamarind is from the bifurcated seeds with a reddish color that tends to be brown-purple. [10]

The tamarind seed consists of the coat or testa seed (20-30%) and the kernel or endosperm (70-75%). Endosperm tamarind is obtained from the seeds from a process of roasting, peeling, and grinding[11].

Take a quantity of tamarind kernel powder (depending on concentration) in 100 ml of water with slow stirring for 30 minutes. Subsequently, the prepared thickener was stirred for 30 minutes again, using a high-speed motor to achieve a uniform formula[12]. After preparing a thick paste of different concentrations, it was printed on polyester cloth with and without carrier using tamarind kernel thickener and dispersed dyes.

The good characterized of thickener is low cost, non-toxic, biodegradable, soluble, suitable for printing polyester with dispersive dyes[12].

A thickener was used in ideal conditions at a concentration of 25% of thickener, and the degree of evaporation at 130 degrees, for 30 minutes, the lines were shown more and more clearly, as they were characterized by sharp borders while preserving the whiteness of the floor[12].

When comparing printed samples with concentrations lower than (5-15%) of thickener, the color value (K/S) of the samples was increased with increasing evaporation time and temperature[10].

This indicates better dye fixation at higher temperatures Concentration, evaporation time, and temperature give excellent washing and rubbing stability[7].

The printing process was carried out in two cases, either with the presence of the carriers or without the carriers, and the carriage used is (vinyl phenol) [11].

After printing on polyester with or without a repeater, samples were dried at 60 ° C for 15 minutes. Then the stabilization process is done by evaporation. Samples are treated at 60-70°C for 15 minutes in a solution of (2 g/L of sodium hydroxide) and sodium hydroxide (2 g/L) [12]. Samples are then rinsed in cold water for 10 minutes, using soap with an anionic detergent (2 g/L) at 50°C for 15 minutes. Samples are rinsed well and finally dried at 85°C for 5 min.

And after the printing process with different concentrations, with or without carriers Installed at 130°C for 30 minutes[11]. Samples are assessed visually for ground whiteness, color uniformity, streak sharpness, and fabric grip on a 5-point rating scale (1 poor, 2 average, 3- good, 4 - very good, 5 - excellent) [12].

The results provided show that samples gave better results when using repeater printing samples compared to samples printed without the use of repeater[12]. This demonstrates the function of the carrier in lightening the pores of the fabric, which facilitates the diffusion of the dye particles into the fibers.

After completion, the filer is easily removable from the surface of the fabric. Samples printed with tamarind kernel paste showed excellent washing stability and rubber (both dry and wet) [11].

Seaweed Extracts
Alginates

The term “algin” usually refers to the water-soluble derivatives of seaweed alginic acid. Algin is one of the kelps components (chiefly the giant brown seaweed Macrocystis purifera, also other seaweeds of the laminaria, saragassum, and Fucus species).

Alginic acid, and its alginate salt, are a linear molecule made up of a 6 - 1, 4 - glycoside attachment of D-mannuronic acid elements as pyranose rings. Besides the ratio of L-guluronic acid to D-mannuronic acid ranges among various preparations from around 0.4 and 3.1, with a plurality of molecular weights between 20 000 and 220 000. In comparison, epimeric L-guluronic acid is inked into carbon atoms[1].

Alginic acid is water-insoluble, but sodium, potassium, and magnesium are soluble, along with some amines. Trivalent and bi-metal salts in water are usually insoluble but swell in water[2]. Soluble alginates have viscous, low adhesive strength solutions that make them ideal for textile printing[1].

Alginates can be used in the printing of cotton and viscose direct dyestuff; scatter dyes in acetate, nylon, and other industrial materials; Vat, solubilization of vat, solubilization of azo, and dye on plant or plastic fibers. It is applied to print acid wool dyes. Because of the presence of bi- and trivalent metal salts in the paste, It cannot use to print basic or chrome colors. For the printer of hard goods, such as nylon taffetas, low viscosity alginates are used, whereas high viscosity forms may be efficiently employed on knitted or spun materials. It is often used either individually or in combination with emulsions for the printing of terylene/cotton blends.

Aloe Vera gel

Aloe Vera gel is extracted from the plant as being environmentally friendly. Aloe Vera leaves contain polysaccharides that are found in abundance in nature and are readily available from sources such as algae (such as genes), plants (such as pectin, guar gum, and mannan), microbes (such as dextran, xanthan gum), and animals (such as chitosan, chondroitin) [13]. Aloe Vera leaf can be divided into two main parts, which are green outer shell, including vascular bundles, and colorless inner parenchyma containing aloe Vera gel[14]. The gel has been used for some biological activities such as promoting wound healing, anti-fungal activity, anti-allergic or anti-diabetic effects, as well as anti-inflammatory, anti-cancer, immunomodulatory, and infectious properties[15].

The central parenchyma tissue of aloe vera contains yellowish secretions containing 1, 8 dihydroxy anthraquinone derivatives and their glycosides[16]. The tissue or pulp of Aloe Parenchyma contains proteins, fats, amino acids, vitamins, enzymes, inorganic compounds, and small organic compounds in addition to a variety of carbohydrates[16]. It is mainly used in dyeing and printing polyester and blended fabrics and can be used with all techniques. The prints have excellent properties, excellent moisture fastness, and excellent color strength[14].

The printing process was carried out under different conditions of thickener concentration as well as the concentrations of additives in the printing paste (urea and citric acid) [17].

Among these experiments, the optimal conditions were to print polyester fibers with dispersed dyes using Aloe Vera gel as a thickener as follows: 30 g / kg dispersed dye, 50 g / kg urea, 15 g / kg citric acid, 500 g / kg fumigated Aloe Vera and the dilution process is completed. At 50% at 100 ° C for 3 min followed by a 6 min fixation process at 180°C [14, 18]. Aloe Vera gel thickener print also blind fibers as polyester/cotton, polyester/viscose, and polyester / linen70/30 with appropriate dye [14, 15].

The thickener is extracted from a conventional method by pulp extraction, followed by blending with a high-speed hand mixer to crush the pulp so that the gel can be extracted from it. Finally, the pulp was crushed by a sieve. And aloe vera thickener is used at a concentration of 500 g / kg because it has been proven to be the best concentration of the thickener in the printing process[14, 19].

Aloe vera gel mixture with alginate sodium

The cotton fabric was printed with pigeon dyes using thickener aloe Vera With alginate sodium. The results show that the properties of the printed fabric (sharpness of prints, color accuracy, general stability properties, smoothness, and water vapor transmission) depend on the percentage of thickener aloe Vera gel[20].

Printed under optimum conditions for print paste containing 80% aloe Vera / 20% sodium alginate (700 g/kg), dye (50 g/kg), binder (145 g/kg), stabilizer (10 g/kg), and ammonium sulfate (5 g/kg), followed by drying at 85°C for 5 minutes and roasting at 150°C for 3 minutes. The printed sample showed good friction stability[20, 21].

* When using the aloe Vera thickener, the properties of the printed samples were weak, so they were mixed with a ratio of sodium alginate thickener to improve properties and stability[22].

* The percentage of aloe Vera present in a thickener is affected by the intensity of the design and the penetration strength of the color from (100%) AV until mixed in proportions with sodium alginate at a ratio of (50/50%)[20, 21].

* It was noticed that aloe Vera was used as a thickener, and the color penetration was improved with the addition of sodium alginate, which directly increased the viscosity of the printing paste[23].

In percentage SA thickener (i.e. beyond 10%) due to its high viscosity, which seems to limit the release and transport of dye particles from the thickener paste, resulting in staining the shape and reducing color leakage around the shape, and giving sharp lines to the design. Also, the presence of the best concentration of sodium alginate is 20 g. The samples were fixed for washing and rubbing[20, 24].

Summary

Printing is a form of dyeing in which colors are applied to specified regions instead of the entire fabric. To restrict the coloring matter to the design area, the dyes and other auxiliaries are pasted with a natural or synthetic thickening agent. Finding alternatives to the used thickeners has gained importance lately due to the several limitations associated with toxicity, availability, and cost of the currently used thickeners.

Natural thickeners are preferred to synthetic thickeners as they are comparatively cheap, easily available, and non-irritant in nature. Natural products are also generally non-polluting renewable sources for sustainable supply. Synthetic thickeners have certain disadvantages such as high cost, toxicity, and result in environmental pollution.

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الاستخدام الحديث للمثخنات الطبيعية في عملية الطباعة

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تم استخدام مثخنات تتميز بوزن جزيئي مرتفع ولزوجة عالية ومعالجة قوية ووقت ترطيب طويل متوافق مع المكونات الأخرى لباب الطباعة وهي عديمة اللون. تنقل الزوجة والالتصاق إلى المعجون المطبوع بحيث يتم إدخال أنماط بدون نزيف. الغرض الأساسي من معاجين الطباعة هو إمساك الصبغة وإرفاقها وتحريكها على القماش المستهدف. كانت هناك العديد من المكثفات الطبيعية والاصطناعية المعروفة. تُفضل المثخنات الطبيعية على المثخنات الاصطناعية لأنها رخيصة نسبيًا ومتاحة بسهولة وغير مهيجة بطبيعتها. المنتجات الطبيعية هي أيضًا مصادر متجددة غير ملوثة للإمداد المستدام. المثخنات الاصطناعية لها عيوب معينة مثل التكلفة العالية والسمية وتؤدي إلى تلوث البيئة.