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[Ikhtiyarova* *et al.*, 7(8): August, 2018]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

NEW MIXED THICKENER ONTHE BASISOF CARBOXYMETHYLSTARCH AND SYNTHETIC POLYMERS FOR REACTIVE DYES OF PRINTING COTTON FABRICS

Gulnora Ikhtiyarova*[1], Alisher Mengliyev[2] , Shakhnoza Mamatova[3]
[*] Department "General chemistry" Tashkent technical state university, Uzbekistan

DOI: 10.5281/zenodo.1403391

ABSTRACT

The suitability of carboxymethylstarch and polyacrylates derivatives as thickeners in reactive printing of cotton fabrics is investigated. We show the influence of different mixed thickeners on the stiffness of cotton fabric printed with monoreactive dye.

With this purpose its structure, a chemical compound thickener and physicomechanical properties printed fabrics are studied. Besides,it number of synthetic polymers:hydrolyzed polyacrylonitrile (HPAN),hydrolyzed acrylic emultion (HAE) and uniflok which were necessary for creation of the necessary composition have been studied and compoundings are developed. The mixed thickener on the basis of carboxymethylstarch and water-soluble polyacrylates possess best coloristic properties.

KEYWORDS: Reactive dye; Printing: Mixed thickeners; Carboxy-methylstarch; Polyacrylamide; Hydrolyzed polyacrylonitile; Rheology.

1. INTRODUCTION

The suitability of carboxymethylstarch and polyacrylates derivatives as thickeners in reactive printing of cotton fabrics is investigated. We show the influence of different mixed thickeners on the stiffness of cotton fabric printed with monoreactive dye.

With this purpose its structure, a chemical compound thickener and physicomechanical properties printed fabrics are studied. Besides, it number of synthetic polymers: hydrolyzed polyacrylonitrile (HPAN),hydrolyzed acrylic emultion (HAE) and uniflokwhich were necessary for creation of the necessary composition have been studied and compoundings are developed. The mixed thickener on the basis of carboxymethylstarch and water-soluble polyacrylates possess best coloristic properties.

2. MATERIALS AND METHODS

2.1Thickening agent and chemicals

- Sodium alginate (HV) from Macrocystispyrifera(Kelp) SIGMA chemical Co., Germany.
- Aqueous binders of acrylic emultion (AE), uniflokand hydrolyzedpolyacrylonitrile (HPAN) based on by Uzbekistan, Navoyi.
- Urea $(NH_2)_2CO$, on by Uzbekistan, Chirchik.
- Mill scoured, bleached and mercerized plain wave cotton fabric (154 g/m^2), supplied by private sector CoUzbekistan.

Reactive dye

The structures of the two dyes are shown in Figures 1 and 2.

ISSN: 2277-9655
Impact Factor: 5.164
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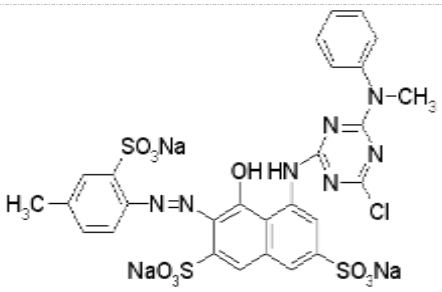

Fig.1. Reactive bright red 6B

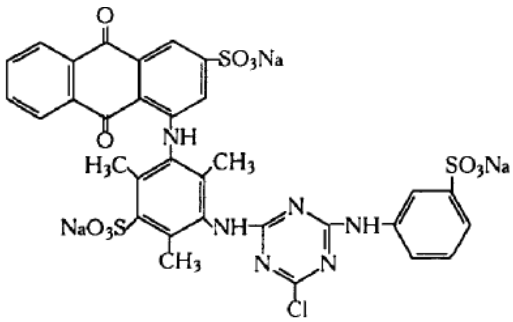

Fig.2 Reactive Orance PX-4B.

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2.2.Synthesis

Synthesis of carboxymethylstarch(CMS)

CMS has been synthesized by reacting rice starch with sodium salt of mono chloroacetic acid(SMCA) in presence of NaOH and ethyl alcohols in asimilar process as done in case of another polysaccharide i.e, tamarind kernel polysaccharide [8] (TKP)(Paletal.,2008). Hydrolysed acrylic emulsion (HAE) has been synthesized by reacting acrylic emulsion with sodium hydrocsid (NaOH) [9].

2.3 Preparation thickening

Following initial trials, stock paste concentrations of 25 g/kg for the alginate, 30 g/kg for the synthetic polymers (HPAN and HAE) and 40 g/kg for the CMS were determined to be suitable. Stock pastes of each thickener were prepared as shown in Table 1. Each was mixed for 5 min with a hand-held electric mixer at maximum speed and allowed to stand 12 h.

Table 1. Stock paste recipes

Ingredients	Traditional thickener (g)		New thickener (g)	
	A	B	C	D
Manutex RS 230	25	-	-	-
Carboxymethyl starch(CMS)	-	60	40	40
HPAN	-	-	15	-
HAE	-	-	10	10
Uniflok	-	-	-	10

Table 2. Print paste recipes

Ingredients	Amount (g)	
	A (Traditional thickener)	D (Mixed thickener)
Reactive dye	30	30
Thickener	600	700
Urea	150	75
Ludigol	10	10
Sodium bicarbonate	15	10
Distilled water	195	175
Total	1000	1000

2.4 Methods

Rheological measurements: Rheological measurements (flow curves, stress sweep and frequency sweep) were carried out at 25 °C and performed with a rotational controlled stress rheometer Haake RS150 with different measuring devices: cone and plate (C60°/1) and parallel plates with serrated surfaces (PP35 Ti). The latter device was used to investigate flow properties and linear viscoelastic behavior of the polymer-rich phase of the

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G systems, where phase separation was evident, and also of inhomogeneous CG systems to avoid wall slippage effects.

Colour strength measurements: The colour strength of the printed cotton fabric was measured using spectrophotometer model Minolta S 3600d (Japanese).

The reflectance expressed as K/S values was determined applying the Kublka-Munk equation.

$$K/S=(1-R)^2/2R$$

R = reflectance value in the maximum absorption wave length
K = absorption coefficient
S = scattering coefficient.

2.5 Fastness properties
Fastness to washing [10], rubbing [11], and perspiration [12] was assessed according to the standardmethods.

3. RESULTS AND DISCUSSION

3.1. Rheological characterization
Rheologycal factor defining fitness thickener for printing fabric, is dynamic viscosity and dynamic stability of the structure. Dynamic viscosity is shown on fig.3 under different shear rate. As can be seen from fig. 3.and fig. 4. time of the achievement for constant importances of viscosity paste normally decreases with increase the shear rate of the shift and time boiling. Fig.3. shows viscosity vs. mixture ratio at a shear rate of 3 10^4 s^{-1} effect thickening does not exist. The reduction to dynamic viscosity in process boiling possible to explain increase an amount split starched grains. Increase to dynamic stability of the structure when growth of length boiling is the share conditioned by increase water absorbing to factions, which is formed as a result of fissions starched grains and plastifed the thickening.

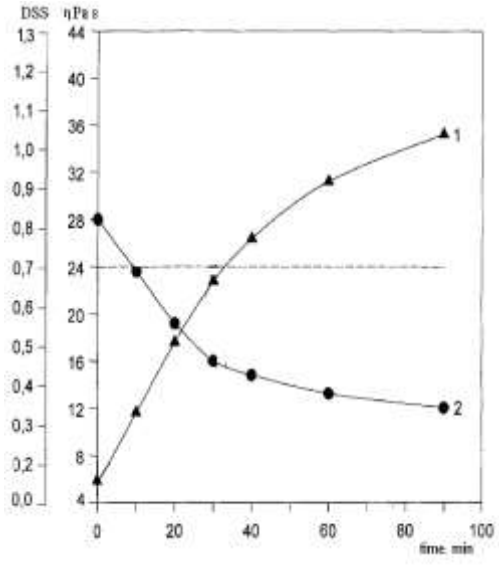

Fig. 3. Influence of time for rheologycal characteristic modified rice starch
1. Dynamic stability of the structure
2. Dynamic viscosity

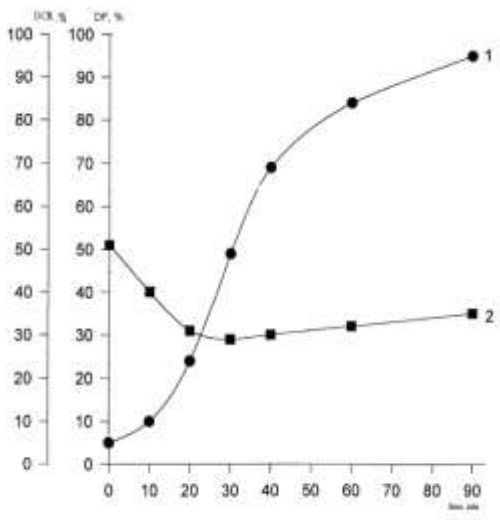

Fig. 4. The Influence of time for characteristic modified rice starch
1 - a degree of the fission (DF, %);
2 - a degree of the collecting of the reactive dye (DCrd,%)

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On fig.3 is presented dependency degree collectings of the reactive dye staff and degree of the fission from time boiling for thickener modified starch with sodium salt of monochloroacetic acid (SMCA) in presence of NaOH. Chemical modified starched thickener, in spite of more low degree of the fission starched granules, possesses the satis factory rheologycal feature. As it is seen from fig. 4, in the beginning with increase of time boiling occurs the reduction to abilities of the starch to link the dye staff that, probably, is conditioned by continuation of the process of the oxidation and transition carbonyl groups in carboxide on surfaces grains and in surface layer. The sharp growing degree fissions starchgrains begins after 30 minutes boiling. After achievement degree fissions of the starch 60-70 % velocity of this process it falls that is connected with spottiness of the starch and presence it is difficult split to factions. At achievement degree fissions of the starch, exceeding 60-70%, ability of the starch to interact with reactive dye newly begins to increase. This possible explain that that share of the particles increases with increase the fission starch grains, capable to interact with reactive dye staff.

Printed fabrics with new thickener based on CMS and HPAN, uniflok, HAE has a good printed-technical characteristic (tabl.3).

Table 3. Stability of the colourations printed cotton fabric on base traditional and mixed thickener

Type of thickener	Concentration of thickener, g/kg	Colour Yield K/S	Rubbing fastness			Persent fixation, %
			Dry	Washing fastness	Wet	
Manutex RS	25	22	5/5	5/4/5	5/5/5	82
CMS	60	17	5/4	5/4/4	5/4/4	74
CMS-HAE	40:20	18	5/4	5/4/5	5/4/5	78
CMS-HAE-uniflok	40:20:10	19	5/4	5/4/5	5/4/5	80
CMS-HPAN	40:20	19,5	5/4	5/4/5	5/4/5	79
CMS- HAE-HPAN	40:10:15	21	5/5	5/4/5	5/5/5	81

Table 4. Quality factors of printing cotton

Thickener, urea	Reactive OrancePX-4B						
	F,%	ΔE	ΔS	ΔT	Dry	Washing fastness	Wet
Mixed thickener CMS- HAE-HPAN 100 kg urea	80,0	4,62	2,67	3,39	5/5	5/5/4	5/5/4
Mixed thickener CMS- HAE-HPAN 50 kg urea	81,0	3,22	2,79	2,36	5/5	5/4/5	5/4/5
Manutex RS 230 100 kg urea	82,0	Standard			5/5	5/4/5	5/4/5
Thickener, urea	Reactive bright red 6B						
	F,%	ΔE	ΔS	ΔT	Dry	Washing fastness	Wet
Mixed thickener CMS-HAE-HPAN100 kg urea	85,7	5,93	0,91	5,28	5/4	5/4/5	5/5/4
Mixed thickener CMS- HAE-HPAN 50 kg urea	82,8	3,87	1,07	2,34	5/4	4/4/5	5/4/5
Manutex RS 230 100 kg urea	84,5	Standard			5/5	5/4/5	5/4/5

F% - Persent fixation, %; ΔE- colour tone, ΔS- saturate, ΔT- Bending length,sm;

As can be seen from tabl. 4, persent fixation when printing mixed thickener corresponds to the persent fixation when printed thickening Manutex RS 230. The colour difference for under investigation dye staffs as a whole is significant, herewith exists increase to saturation in contrast with standard Manutex RS 230.

4. CONCLUSION

The results show that the polyacrylates HPAN, PAA and HAE increased slightly the pseudoplasticbehaviour and thixotropy of carboxymethylstarch thickener the pastes but imported no significant decrease in color strength and persent fixation. The highest K/S is obtained and the fastness properties range between good and excellent for samples printed using carboxymethylstarch and polyacrylates based on HPAN, HAE and PAA, this is true irrespective of the type of printed fabric.

The fastness properties of goods printed with this system were satisfactory and the hand of printed goods was soft. As can be seen from table on intensities of the colour and toughness of the colourations printed drawing she exceeds traditional thickening from airwaves of the carboxymethylstarch, as well as cost proposed compositions in 2-3 times below cost manutex RS 230 thickening used for printing cotton fabric.

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CITE AN ARTICLE

Ikhtiyarova, G., Mengliyev, A., & Mamatov, S. (2018). NEW MIXED THICKENER ONTHE BASISOF CARBOXYMETHYLSTARCH AND SYNTHETIC POLYMERS FOR REACTIVE DYES OF PRINTING COTTON FABRICS. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, 7*(8), 580-584.