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بالرسالة صفحات لم ترد بالأصل

SYNTHESIS, CHARACTERIZATION, EVALUATION OF NEW THICKENER AND ITS APPLICATION IN PRINTING

A THESIS
PRESENTED TO
FACULTY OF SCIENCE
CAIRO UNIVERSITY

BY
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(M.Sc.)

FOR
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Aim of the Present Work

This work deals with synthesis, characterization and evaluation of new thickener and its application in textile printing. This work is discussed and estimatied through the following topics:

1- Preparation of a new thickener based on carbohydrate material.

2- Evaluation of the physical and rheological properties of that product

3- Application of the produced thickener in printing of textile fabric using different pigments and dyes.

4- Evaluation of the produced thickener in relation to the commercial ones.

5- Examining the performance of the new thickener when used in printing of textile fabrics in relation to

a- Colour strength

b- Fastness properties to light, washing, rubbing (wet-dry) and perspiration (Alkali -Acidic).

c- Appearance, Texture (harsh feeling).

APPROVAL SHEET FOR SUBMISSION

Title of thesis: "Synthesis, characterization, evaluation of new thickener and its application in printing".

Name of Candidate: Ehab Shawki Ahmed Salem.

This thesis has been approved for submission by the supervisors:

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2- Prof. Dr. Ferial Mohmoud Tera.

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Summary

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The work included in this thesis presents four main topics:

1- Synthesis and characterization of starch graft poly vinyl acetate copolymer using different radicals initiation systems

This was studied at different conditions that affect greatly the graft yield percent of the reacting products including initiation systems type and concentration, liquor ratio, reaction time and temperature as well as monomer concentration. The results of this study lead to the following conclusion:

(i) By using four types of radical ionization systems namely: hydrogen peroxide (5-60m mol/l), ceric ammonium sulphate (2-20m mol/l) as well as ammonium persulphate/sodium thiosulphate (APS/STS) and ammonium persulphate/acetone sodium bisulphite adduct (APS/ ASBS) (5/10-60/120m mol/l) the maximum graft yield percent of 11.433,10.717 as well 7.781 and 8.624 are obtained for 30m mol/l H_2O_2,10mmol/l ceric ammonium sulphate as well as 40/80m mol/l APS/STS and APS/ASBS, respectively.

(ii) Highest graft yield percent is obtained by using 1/3.5 liquor ratio at temperature 80 ^{0}C as well as duration time 60 mins.

(iii) Increasing the monomer concentration in the studied range (10-60%, based on weight of starch) was accompanied by remarkable increase of the graft yield percent.

(iv) Characterization of the starch-g- polyvinyl acetate copolymers having different graft yield percents using FTIR clarifies the presence of identified band in the range of 1750 which was assigned to C=O of the acetate ester group.

(v) The rheological measurements clarified many interesting points, thus:

(a) The viscosity of all examined samples are of non-Newtonian pseudo – plastic behaviour in which a reversible decrease in viscosity with increasing the shear rate and the shear thinning value (n) varied between (0.3144 to 0.509).

(b) The viscosity decrease by increasing the initiator concentration and this decrement affect greatly by the type of initiator used and follows the order: H_2O_2 >Ce>APS/ASBS>APS/STS.

(c) The creep analysis shows that the sample of less acetyl content would be of the less syneresis.

(d) The oscillation analysis indicates that the elastic component (G`) for all examined samples is greater than the viscous component (G``) at all time scale, reflecting the good stability to storage, good spreading behaviour when applied, and little or no tailing effect for the examined samples.

2- Preparation and characterization of Carbamoylethyl guar

Carbamoylethyl guar was prepared by the reaction of guar gum with acrylamide in the presence of potassium hydroxide. Different factors including acrylamide and potassium hydroxide concentrations as well as reaction time and temperature were found to affect greatly the

extent of the carbamoylethylation reaction. The results showed the following:

(i) At definite condition of potassium hydroxide increasing acrylamide concentration was accompanied by remarkable increase in each of nitrogen, carboxyl and total ether contents.

(ii) Keeping the acrylamide concentration constant and increasing potassium hydroxide concentration in the studied range (0.025-0.1mol) a positive action on increasing the carboxyl content takes place. Meanwhile, an increment in the nitrogen contents were observed when potassium hydroxide concentrations increased up to 0.05, 0.075 and 0.075mol fo- 0.05, 0.075 and 0.1 acrylamide concentrations, respectively. Meanwhile, the total ether contents were increased by increasing potassium hydroxide concentration up to 0.075mol for each of 0.05 and 0.75mol acrylamide, and in the range studied for 0.1mol-acrylamide concentration.

(iii) The nitrogen and total ether contents of the obtained CEG increased significantly by increasing the duration of reaction up to 45 minutes at 60 °C while such increment was observed up to 30 minutes only when the temperature was raised to 70 ° and 80 °C.

(iv) The carboxyl content increased by increasing reaction time and temperature reflecting the effect of alkaline medium to accelerate the rate of saponfication reaction on increasing the temperature and/or the time.

(v) The rheological measurements for native guar and CEG solution samples represent that:

(a) The viscosity of all examined samples are of non-Newtonian pseudo - plastic behaviour in which a reversible decrease in viscosity with increasing the shear rate and the shear thinning value (n) varied between (0.4268 to 0.7474).

(b) The viscosity of the native guar is higher than the examined modified guar samples and by decreasing the total contents of the CEG samples the viscosities are decreased with improvement of its flow properties.

(c) The creep analysis shows that the sample of less total ether contents would be of the less syneresis.

(d) The oscillation analysis indicates that the elastic component (G`) of the native guar and modified samples with higher total ether contents are greater than the viscous component (G``) at all time scale, reflecting its good properties with respect to the stability to phase separation, good spreading behaviour when applied, and little or no tailing effect..

(e) The storage stability study for different time intervals for native guar as well as carbamoylethyl guar having two different total ether contents show that the viscosity for native guar decreases sharply after two days. While, nearly no or little decrement in the viscosity was observed for the two modified guar samples after storage for 5 days

3. Utilization of starch –g- polyvinyl acetate copolymer for textile printing

(i) Four samples of starch graft polyvinyl acetate having different acetyl contents were evaluated as thickening agents in pigment printing of cotton, wool, nylon, polyester and cotton/ polyester fabrics. It was found that the colour strength values for pigment printed cotton, wool and nylon fabrics were increased by increasing the acetyl content from 2,31 to 8.02% then they decreased at 11.22%. Meanwhile, the colour strength was increased with the increase of the acetyl content in the studied range (2.31 to 11.22%) for polyester and cotton/polyester pigment prints.

(ii) Excellent washing and perspiration fastness values of the ranges (4/5-5) for all printed pigment samples were noticed, also satisfied rubbing fastness values (3-4) was recorded. The handle feeling of the prints was soft for cotton and wool pigment printed samples while harsh feeling was assessed for polyester printed samples, while harsh to soft feeling for nylon and cotton polyester blend fabrics were observed.

(iii) Reactive dye printing of wool and cotton using starch -g- polyvinyl acetate copolymer samples having different acetyl content percent as a thickening agent alone or in admixture with commercial sodium alginate thickening agent using different composition ratios clarified many points: