ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

Volume 8
Issue 2
2023

Google Scholar

Crossref doi

SLIB.UZ
Scientific library of Uzbekistan

ANALYSIS OF THE EFFECT OF ADHESIVE SUBSTANCES ON PAPER STRENGTH

ALIEVA NARGIZA

Researcher of National Institute of Art and Design named after Kamoliddin Behzod
E-mail: nargis_03@mail.ru

Abstract:
The article analyzes high-strength paper samples in the paper production process containing polyester (lavsan) fiber waste, including the introduction of adhesives into the paper cellulose together with synthetic waste fibers, the influence of the selected adhesives on the physical-mechanical and printing properties of the paper.

Keywords: cotton cellulose, polyester (lavsan), modified cationic starch (MCS), carboxyl methyl cellulose glue, acrylic emulsion (AE).

The pulp and paper industry is an industry related to wood processing. Currently, the world paper industry produces more than 800 types of paper and cardboard with different, completely opposite properties, the main raw material for the production of paper and cardboard in the world (more than 90%) is wood cellulose [1-5]. Taking into account the shortage of wood raw materials for Uzbekistan, the wide use of non-wood alternative raw materials of various herbaceous plants, annual plant waste, chemical and textile industries, and household waste for the production of paper products is promising [5-7].

Cotton pulp is the main and expensive raw material for paper production. The technology of paper production from cotton cellulose on an industrial scale does not have economic efficiency, but adding waste from the textile and chemical industry to paper pulp solves the problem of efficient and rational use of raw materials and saves valuable cotton cellulose. In the production of printing paper, the use of valuable cotton cellulose partially from the industrial waste with polyester (lavsan) fiber serves to increase the assortment of paper in the production of paper products at local enterprises, while reducing industrial waste in an ecological way, and at the same time, it makes it possible to determine in what proportions the use of secondary fibers is expedient [8-10]. Obtaining sample papers and evaluating their quality was carried out in the test center of the Global Komsco Daewoo JV paper mill in accordance with the approved technological regulation. Samples containing cotton cellulose fibers and polyester (lavsan) fiber waste were taken in different proportions. Grinding of fibrous materials was carried out in Massroll-22.5 (Moscow). The degree of crushing of cellulose fibers was determined as 50-55º Shopper-Ringler. Samples were made on the sheet molding machine of the company "Rapid" (Germany). In order to obtain paper containing a certain part of cotton cellulose with polyester (lavsan) fiber waste, weighing ≈ 80 gr/m^2, cotton cellulose is crushed to 50-55 °ShR, then cleaned and cut into 2-5mm lengths of polyester (lavsan) fiber to prepare printing paper. mixed with waste. Additional fillers and adhesives were added to the composition of the paper pulp. The consumption of materials based on 1t of paper was as follows: Cotton pulp 0 - 100%; polyester (lavsan) fiber waste 2 - 50%; kaolin (Al_2O_3•$2SiO_3$•$2H_2O$) -145 kg/t; a mixture of tar acids containing rosin glue ($S_{20}N_{30}O_2$) -25.7 kg/t and $Al_2(SO_4)318H_2O$ consisting of aluminum sulfate, and rosin glues were used as adhesives. With the increase in the amount of polyester (lavsan) waste fibers in the cotton

cellulose, the bond strength between the fibers gradually decreased, the amount of intermolecular hydrogen bonds in the paper sheet decreased, and finally, the general properties of the paper deteriorated. [4].

The main goal of this scientific work is to obtain paper samples using modified cationic starch (MCS), carboxyl-methylcellulose and acrylic emulsion adhesives used in the paper production process in order to increase and stabilize the hydrogen bonding forces between the primary and secondary fibers in the paper pulp, and to determine the effect of these adhesives on the paper influence on physico-mechanical and printing properties (Table 1) was studied.

Research work was carried out in three stages. In the first stage, modified cationic starch (MCS) containing 80 percent of cotton cellulose, 20 percent of polyester (lavsan) fiber waste, in the second stage, carboxyl methyl cellulose glue and in the third stage, acrylic emulsion (AE) from 0.5 to 2.5 percent of the paper pulp. paper samples were taken by adding up to percent and the obtained paper samples were taken and compared.

In the first stage, the technological and economic feasibility of using modified cationic starch (MCS) was evaluated and their effect on paper strength parameters was studied. MCS is considered a high-quality component for printed materials, forming a thin film on the surface of the paper, improving the strength and resistance to external effects of the printed material, and is often used as a film-forming agent [5-10]. The effect of MCS on the mechanical properties of paper was studied. The obtained results show that in the process of obtaining MCS printing paper, the strength indicators of the paper increased by 5%. This can be explained by the interaction of the adhesive with cellulose fibers, the formation of hydrogen bonds with the cationic starch fibers due to the presence of anionic groups in fillers due to the mechanism of adhesion of small fibers to each other. It can be explained that the ash level of the experimental papers increased by 3 times, the filler, adhesive and synthetic fibers in the paper mass increased, and the whiteness level of the paper increased, and the whiteness level increased due to the better retention of kaolin and cellulose fine fibers by MCS glue. At the second stage, Na CMC sodium salt carboxymethylcellulose glue was used. Carboxymethylcellulose (CMC) is an acidic ester of cellulose and glycolic acid ON-SN_2-SOON. This ether is obtained in the form of sodium salt and is economically advantageous due to its low cost and easy availability. Na CMC were used as an adhesive in the paper composition in this scientific work. The obtained results helped to increase the strength properties of paper due to its unique physico-chemical properties, which are presented in the literature as a component of Na CMC paper pulp. It was observed that when the amount of NaKMTs in the paper increased by 2.5%, the strength properties increased up to 8%. In taking samples of Na CMC paper, despite the addition of 20% of polyester (lavsan) fiber waste, it was observed that the strength properties increased by 10%. Na CMC are more promising and effective due to their hydrophobicity, while significantly increasing the strength properties of paper.

At the third stage, paper samples were obtained by adding acrylic emulsion polymer adhesive compounds. Acrylic (polymethylacrylate) emulsion is an inconspicuous white liquid with a pH of 6.0-8.5, a relative viscosity of at least 1.75, and a mass fraction of monomer not exceeding 0.35%. 15% improvement in breaking length was observed when comparing paper samples containing acrylic emulsion to paper pulp and paper samples containing MCS and Na CMC glue. The expediency of using a new acrylic emulsion polymer glue instead of the traditionally used MCS and Na CMC glue was based on

the experimental method. Acrylic emulsion not only improves the mechanical performance of the paper, the optical properties of the paper and the whiteness of the paper have been increased by 12%.

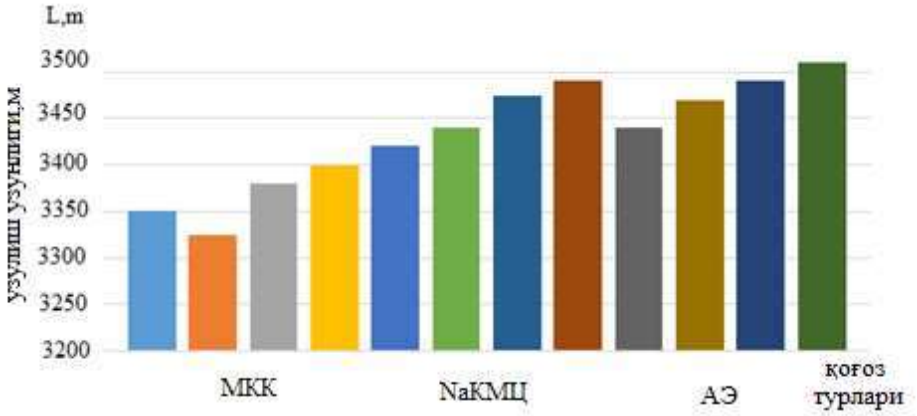

Diagram 1. Effect of adhesives on the breaking length of experimental papers

Table 1

The effect of adhesives on the physical and mechanical properties of experimental papers

Indicators / options	Adhesive substances											
	MCS				Na CMC				AE			
	1	2	3	4	5	6	7	8	9	10	11	12
The amount of adhesive in the paper mass, %	0,5	1,5	2,0	2,5	0,5	1,5	2,0	2,5	0,5	1,5	2,0	2,5
Cotton cellulose, %	100	80	80	80	100	80	80	80	100	80	80	80
Polyester (lavsan) fiber waste, %	-	20	20	20	-	20	20	20	-	20	20	20
Break length, m	3380	3375	3386	3395	3394	3398	3405	3408	3398	3404	3408	3412
Degree of whiteness, %	86	87	86	88	87	91	90	91	85	87	90	89
Breaking stress, N	31,0	31,5	32,8	33,0	32,6	32,8	33,4	34,2	32,6	33,3	34,7	34,9
Bending, i.b.s.	44	54	65	86	46	52	81	96	45	60	78	97
Ash, g	1,2	5,5	4,6	4,9	1,0	2,6	3,1	3,5	1,7	2,6	3,7	4,9

The obtained results revealed that the quality indicators of the paper samples were improved by 15%. It was found that the properties of polymer glue samples containing synthetic compounds correspond to the established standards and are as follows: polymer adhesives have the necessary adhesion to ensure a strong connection with the paper mass, give elasticity to paper samples, increase the breaking length.

Thus, it was determined that it is appropriate to use MCS, Na CMC and acrylic emulsion as adhesives in improving the strength indicators of paper samples. At the same time, the expediency of using a synthetic binder containing MCS, Na CMC and acrylic emulsion in increasing the quality of paper and cardboard samples (breaking length by 15%, optical indicators by 12%) was analyzed based on experiments. In this scientific work, paper samples with high strength are obtained during the process of paper production,

In conclusion it can be said that the method of obtaining paper, consisting of (80%) cotton cellulose and (20%) polyester (lavsan) fiber waste and chemically active (2-2.5%) adhesives, is proposed, in which cellulose-chemical dispersions of active adhesives create a high-strength bond between cotton cellulose and waste fibers, and the possibility of obtaining high-quality, high-quality paper with high strength clarified.

Reference:

1. Bulanov I. A. Printing and technical properties of paper from various components of raw materials. / Bulanov I. A., Azizova Kh. D., Klimova E. D. // Vestnik MGUP. -M., 2010 - No. 6. PP 59-61.

2. Eshbaeva U.J. Ofset paper with the introduction of synthetic polymers and its printing and technical properties: Doctor. Dissertation work − Tashkent: TIILI. −2017. −p.234.

3. Holmberg, K. Surfactants and polymers in aqueous solution. 2nd ed. / K. Holmberg, B. Jonsson, B. Kronberg, B. Lindman - Chichester: John Willey & Sons, 2003. - 545 p.

4. Ivanov, S.N. paper technology. −M.: Goslesbumizdat. −2006. −P.696.

5. Eshbaeva U.J., Jalilov A.A., Rafikov A.S. Paper from textile waste. Monograph.LAP LAMBERT Academic Publishing. Düsseldorf. Germany. −2018. −pp.130.

6. Eshbaeva U.J., Jalilov A.A., Rafikov A.S. Paper with the introduction of synthetic polymers. Monograph. −T.: Kamalak. −2018. −pp.208.

7. Eshbaeva U.J., Jalilov A.A., Development of Technology for Producing Multilayer Paper and Cardboard Containing Synthetic Fibers // “NVEO – Natural Volatiles & Essential Oils”. -2021, Vol. 5, -P. 10637-10644.

8. Eshbaeva U.J., A.S. Rafikov. Analysis of papers with various synthetic binders. // Polygraphy. −Moscow. 2012. − № 8. P.52-53.

Eshbaeva U.J., Rafikov A.S. Influence on paper quality of synthetic polymers // Composite materials. - Tashkent, 2015. - No. 4. -p.25−26.

CONTENTS

PRIMARY PROCESSING OF COTTON, TEXTILE AND LIGHT INDUSTRY

GROWING, STORAGE, PROCESSING AND AGRICULTURAL PRODUCTS AND FOOD TECHNOLOGIES