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THE USE OF COMPOSITE FILLER IN THE PRODUCTION OF POLYGRAPHIC CARDBOARD IN JSC "SLONIM CARDBOARD-PAPER MILL "ALBERTIN"

The results of the researches of the effect of composite filler on the properties of the composite polygraphic cardboard NVP-0.5 obtained in JSC «Slonim cardboard-paper mill «Albertin» on a cardboard machine CM-2 are presented in the article. The proposed composite filler is obtained from available raw materials and makes it possible to replace the imported (kaolin) completely. It is shown that the filler allows to increase whiteness of the polygraphic cardboard NVP-0.5 by 5–8% and that of the ash content in structure by 17.6–18.2%.

Introduction. Mineral fillers play a very important role in the paper industry.

The use of fillers in cardboard (paper) allows [1]:

– to improve the optical properties (brightness and opacity);

– to increase the smoothness of the surface of the web (especially after rolling/calendering);

– to improve the printability/printing properties of cardboard.

Prospective application of fillers is due to their low cost compared with the cellulose fibers, which makes the technology of their use in the composition of printing paper and cardboard production actual.

Traditional fillers are kaolin and chalk [2]. However, they have several disadvantages: low retention in the structure of the web (not more than 50%) and low whiteness (not more than 84%). All of the above deficiencies indicate that the paper and cardboard industry needs a new filler, which can replace the traditional one and at the same time improve the quality of finished products.

One of the ways to eliminate these shortcomings of the traditional fillers, is, in our opinion, to use synthetic fillers obtained from wastes of chemical enterprises.

The laboratory research previously carried out by us in the departments of GCT and TNS and CPW BSTU showed [3] the perspective of synthetic fillers, which include composite, obtained on the basis of phosphogypsum and silica gel. Their application in JSC "Slonim cardboard-paper mill "Albertin" is of practical interest.

The purpose of this research is to study the influence of composite filler on the properties of composite polyfraphic cardboard in JSC "Slonim Cardboard and Paper Mill "Albertine".

Main part. To achieve this goal in a commercial environment of «Slonim Cardboard and Paper Mill «Albertin» waste paper grade MS-6B and MC-13B was used for making lining, middle and lower layers of polygraphic cardboard NVP-0.5 and for the outer layer – sulphate bleached cellulose from hardwood timber. Each type of fibrous raw material was dissolved and crushed separately. Dissolution of waste paper and cellulose materials were carried out in the pulper brand GDV-02 in the presence of circulating water at a concentration of 4% for 30 minutes. Grinding of the dissolved pulp and waste paper were performed at the same concentration on the disk mill brand MD-02 to the grinding (40 ± 2)°SR.

The milled recycled stock was used to make a lining, middle and lower layer of polygraphic cardboard without using chemicals. The coating layer of polygraphic cardboard was obtained from cellulose mixed with rosin emulsion, suspension of a filler and electrolyte solution, the consumption of which is indicated in Table 1.

Table 1

Concentration, exhaust elocity and consumption of chemicals for the manufacture of the coating layer of polygraphic cardboard brand NVP-0,5

Techology	Concentration, g/l			Exhaust velocity, s			Consumption of end product, kg/t		
	suspension of filler	rosin emulsion	electrolyte solution	suspension of filler	rosin emulsion	electrolyte solution	filler	glue	electrolyte
Developed	With the use of a new composite filler (mass fraction of moisture – 48%)								
	128–130	16.7–17.5	77–80	4	24	11	95.6–100.1	5.8–6.2	15.8–16.4
Current	With the use of a traditional filler – kaolin (mass fraction of moisture – 14%)								
	114–116	20.0–21.0	77–80	8	18	14	56.8–60.2	5.7–6.1	15.5–16.3

Rosin emulsion concentration (18 ± 2) g / l was prepared from reinforced adhesive paste brand TM (TU RB 00280198-017-95) according to the current technology and submitted to a composite pool

A composite filler was prepared in a production environment using phosphogypsum, silica gel, sodium silicate, chalk and water. The technological scheme of obtaining a composite filler is shown below. Phospho-gypsum (80.0 kg, 28.0% moisture) and water (2,500.0 kg) were placed in pulper 1 volume of 4.5 m^3, equipped with a stirrer. The resulting mixture was homogenized for 10–15 min, and after that the silica gel (836.0 kg, 59.3% moisture) was added to the mixture. The resulting suspension was stirred for 0.5 h and then liquid glass (4.6 kg, the module SiO_2: Na_2O = 2.9) was added and homogenization was performed. Then chalk was added (36.0 kg) ito the suspension when a stirring device was working. After 30 minutes, the suspension of the composite filler was pumped with pumper 2 to a cleaning cylinder from which it flowed by gravity to pool 5 equipped with a stirring device. After 20 minutes the prepared suspension was pumped by pumper 6 to the composite pool. The suspension of the composite filler had pH 6.0–6.5, contained a solid phase in terms of dry matter in the amount of (120 ± 10) g/l. The size of the filler particles ranged from 2.5 to 5.0 microns.

The prepared electrolyte solution with a concentration of (78 ± 2) g/l (TU 400258949.003-2005) was placed into a socket of a mixing pump before feeding the pulp to a cardboard machine (CDM), CM-2.

The prepared wet elementary layers (lining, middle, lower and top) formed polygraphic cardboard brand NVP-0.5 on cardboard machine CM-2.Wet cardboard web was subjected to pressing, drying and calendering on cardboard machine CM-2. The quality indicators of polygraphic cardboard brand NVP-0.5 containing a new composite filler was compared to the quality of printing cardboard produced according to the current technology and containing kaolin (Table 2).

The results of industrial tests showed that one of the advantage of a new composite filler is the quality improvement of a finished product

Table 2 shows that the quality of polygraphic cardboard brand NVP-0, 5 according to the developed technology by some measures exceeds the quality of polygraphic cardboard according to the current technology.

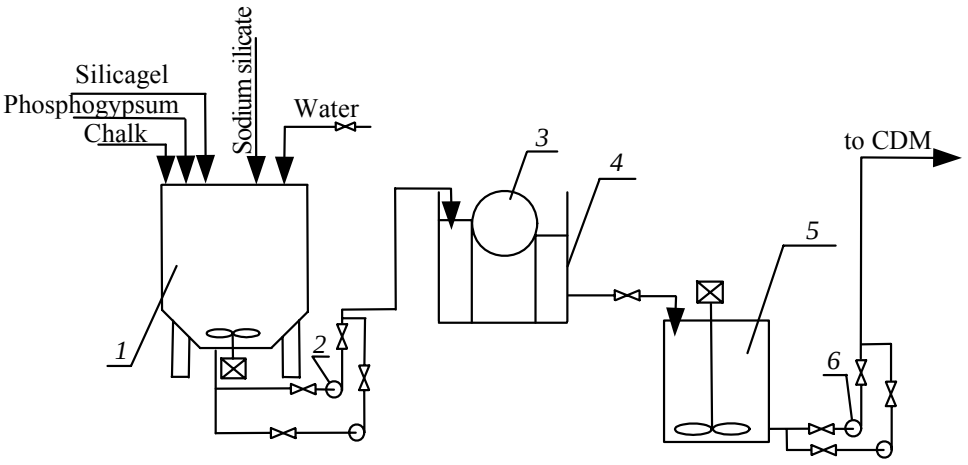
This is proved by the fact that the absorption at unilateral wetting decreases from 29–35 to 35–45 g/m^2, which is of great practical importance.

In addition, polygraphic cardboard brand NVP-5, containing a new composite filler in a coating layer is 5–8% whiter than that containing a traditional filler (kaolin) in its structure.

It should be noted that the ash content of an experimental batch of polygraphic cardboard brand NVP-0,5 is characterized by high values (17.0–18.3%) compared with the ash content of that containing kaolin (14.1–14.9%). This is probably due to the fact that the composite filler, being finely dispersed possess high adhesion properties and due to the uniform distribution of particles on the surface of fibers increases the degree of keeping it in the structure of the coating layer.

Other indicators of quality (breaking strength in multiple bends, the resistance to bending and delamination, resistance of the surface to tweezing) for an experimental batch of polygraphic cardboard corresponded to regulated values according to TU RB 00280146.30-98.

The performed technical and economic calculations have shown that the replacement of a commonly used filler kaolin by the new composite filler can reduce the cost of finished products by 69–72 thousand BLR.



Technological scheme of obtaining a composite filler:
1 – pulper; *2*, *6* – pumps; *3* – cleaning cylinder; *4* – tub; *5* – pool

Table 2

Indicators of quality of polygraphic cardboard brand NVP-0, 5, obtained with the use of the current and developed techologies

Parameter	Value of the indicator		
	Developed technology	Current technology	TU RB 00280146.30-98
Absorption at unilateral wetting of the top side, g/m^2	29.0–35.0	35.0–45.0	50.0–60.0
Fracture toughness at multiple bends, n. d. f.	44.0	27.0–29.0	15.0
Bending resistance, mN	173.0	172.0–187.0	165.0
Delamination/exfoliation, H	115.0	125.0–128.0	115.0
smoothness, c	5.0–6.0	2.0–4.0	–
Ash content in the coating layer, %	17.0–18.3	14.1–14.9	12.0
Ash content in cardboard, %	6.6	6.6	–
Resistance of the surface to tweezing, m/s	2.5	2.5	1.6
Whiteness (of a coating layer), %	80.0–84.0	76.0–77.0	75.0

Conclusion. As a result of pilot tests at JSC "Slonim Cardboard and Paper Mill "Albertine" 52 tons of polygraphic cardboard brand NVP-0.5 containing a new home-produced composite filler in its structure were produced. The advantages of the developed technology for producing composite filling is that the raw materials were the wastes of JSC "Gomel Chemical Plant" – silica gel and phosphogypsum. The use of a new home-made composite filler in a production environment did not cause technical difficulties. The actual economic benefit of the technology of a composite filler was 3.6 million BLR.

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