#1257 THE INSTITUTE OF PAPER CHEMISTRY
(Investigation of Corrugating Material)
Project Reports

PROJECT REPORT FORM

Copies to: Files
McKee
Van Horn
Conkey

PROJECT NO. 1257
COOPERATOR I.P.C.
REPORT NO. 8
DATE April 8, 1955
NOTE BOOK 1287
PAGE 94 TO 126
SIGNED Julian H. Conkey
Julian H. Conkey

AN EVALUATION OF THE EFFECT OF RESIN TREATED PAPERBOARD ON THE FLAVOR OF VARIOUS FOODS

INTRODUCTION

The objective of this test was to determine if the resins Vinsol 423 and Piccopale 70 would have an adverse effect on the flavor of food packaged in paperboard containers treated with these resins. The foods used in the test were unsalted butter, bacon, steak and ice cream. Evaluation was based on the ratings of a taste panel consisting of six members.

EXPERIMENTAL METHODS

The resins Vinsol 423 and Piccopale 70 were impregnated into corrugating medium to which was applied an untreated kraft liner. A sample of the single face board without resin was included as a control. Each food was placed in contact with the kraft liner, the corrugated side, and first wrapped in parchment and placed in contact with the kraft liner. After varying periods of storage at selected temperatures the foods were tasted and rated by the panel.

Unsalted butter was cut into squares (1 by 1 by 1/4 in.) and sandwiched between the board (2 by 2 in.) samples. The sandwiches were overwrapped with parchment which was held in place by a small

rubber band. Two complete series were set up using unsalted butter as the test medium. One series was stored at 68°F. and tasted at 1, 2, and 3 days. The second series was stored at 0°F. and tasted at 7, 21, and 35 days. The 0°F. temperature and longer storage period is more closely related to actual commercial conditions.

Sirloin steak was cut into rectangular (2-1/2 by 2 by 3/4 in.) and sandwiched between board samples (3 by 2-1/2 in.) in the same manner as the butter. All edge fat was removed from the steak samples in order to give greater uniformity throughout the steak series. The steak was fried in unsalted butter and without other seasoning before tasting. The steak samples were stored at 33°F. and tasted at 2, 5, and 9 days.

The bacon samples (3-1/2 by 1-1/2 by 3/8 in.) were made of two bacon slices cut and stacked to make the sample thick enough to prevent serious drying during storage. The bacon was fried before tasting. The storage temperature was 35°F. and the tasting periods at 7, 21, and 35 days.

The ice cream samples (2-1/2 by 2 by 1/2 in.) were stored at 0°F. and tasted at 7, 21, and 35 days.

Controls made of the various foods wrapped in parchment only were included in each test series. The panel was asked to rate the food and note any off tastes which they could identify. The unsalted butter

was rated as pleasant, neutral, or unpleasant. The more highly flavored foods bacon, steak, and ice cream were rated as very pleasant, pleasant, neutral, unpleasant, or very unpleasant.

The samples were coded so the panel members could not identify the treatments and also the order was randomized for each tasting period. The reference control was, of course, identified to the panel. Later in the test it appeared a bias existed in rating coded samples lower than the control. In order to test this bias a second control was coded and inserted in each test series of the following trials. Each test series was divided and tasted part in the morning and part in the afternoon to avoid taste fatigue.

TABLE I

TASTE RESULTS OF RESIN TREATED PAPERBOARD

Treatment	Contact Side	Average Rating for Entire Test* Butter 68°F.	Butter 0°F.	Steak 33°F.	Ice Cream 0°F.	Bacon 33°F.
None	Liner	1.9	1.6	1.4	2.0	1.5
	Corrugated	1.8	1.2	1.6	1.5	1.3
	Parchment + Liner	1.5	1.2	1.3	1.1	1.4
Vinsol 423	Liner	2.0	1.3	1.9	1.3	1.4
	Corrugated	2.6	1.5	2.2	1.3	1.3
	Parchment + Liner	1.4	1.3	1.8	1.2	1.2
Piccopale 70	Liner	2.6	1.3	1.9	1.5	1.2
	Corrugated	3.0	1.3	1.6	1.4	1.4
	Parchment + Liner	1.7	1.2	1.5	1.0	1.3
Control		1.0	1.0	1.0	1.0	1.0
Coded Control (Bias)		—	1.1	--	1.3	1.5

* Butter Scale
1.0 = Pleasant
2.0 = Neutral
3.0 = Unpleasant

* Steak, Bacon and Ice Cream Scale
1.0 = Very Pleasant
1.5 = Pleasant
2.0 = Neutral
2.5 = Unpleasant
3.0 = Very Unpleasant

EXPERIMENTAL RESULTS AND DISCUSSION

The average results for the six panel members obtained in each test series are presented in Table I.

The unsalted butter series incubated at 68°F. picked up a resinous flavor which could be detected and identified by the panel. The flavor pickup was strongest in the case of the Piccopale 70 resin. The results also show that the use of a parchment overwrap even under these extreme conditions, greatly decreased the flavor deterioration due to resin. When the butter series was stored at 0°F. there was no resin flavor pickup.

The steak series showed a flavor deterioration; however, the panel's comments showed the flavor changes could not be identified as being due to resin. A comparison between the Vinsol 423 results and the kraft control does indicate this resin may have had an effect. The Piccopale 70 results, however, show a greater flavor deterioration when in contact with the liner than when in contact with the resin impregnated corrugated medium. The parchment wrapped samples showed a better flavor than those in contact with board surfaces although the protective effect was not as great as in the case of the butter. Considering the variation in the test and between like steak samples it is doubtful the resin was a large factor in the flavor deterioration noted.

No significant flavor changes occurred in the bacon or ice cream due to the resin treatments.

Considerable variation was present throughout the test between the panel members. In some instances this variation covered the entire rating scale. Averages of the results of the six tasters, however, showed good agreement between storage periods. The unsalted butter series at 68°F. was the only test showing a significant decrease in flavor quality at succeeding storage intervals. It appears therefore that the storage temperature is the most important factor in respect to resin effects. In commercial practice the wrapping and storage temperatures used for these perishable foods should afford ample protection against any resin odor transfer.

SUMMARY

The effect of Vinsol 423 and Piccopale 70 resin treated paperboard on the flavor of unsalted butter, bacon, ice cream, and sirloin steak was evaluated. The results indicate that with proper packaging and storage these resins will not cause adverse flavor effects.

PROJECT REPORT FORM

(1) Original--Central Files
(2) Copy --Mr. McKee
(3) Copy --Mr. Vaurio
(4) Copy --Dr. Howells
(5) Copy --Mr. Skalmusky

PROJECT NO. Project 1257
COOPERATOR Institute
REPORT NO. 7
DATE March 31, 1953
NOTE BOOK 1042
PAGE 120 TO
SIGNED M. F. Skalmusky
M. F. Skalmusky

IMPREGNATION OF 9-POINT WITH MANNGAL

The fifth material used in this study to improve the strength of 9-point medium at high humidities was Manngal.

Manngal is in powder form, manufactured by the Morningston Nicol Company. The corrugating medium to be impregnated was a semichemical material taken from stock on hand (IPC No. 1138).

The Manngal was made up in a 1% solid content solution with distilled water and heated to 74° C. The material appeared too thick for impregnating so it was diluted with 100% distilled water to give a solid content of 0.5%. The Manngal was made up as follows:

19.8 lb. of distilled H_2O

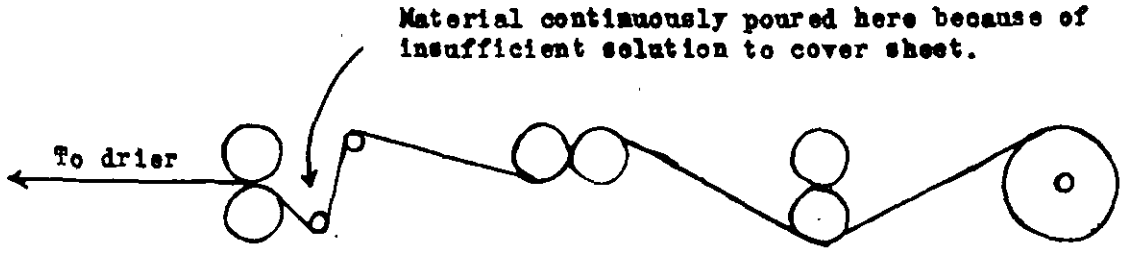
0.2 lb. of Manngal

Heated to 74° C.

20.0 lb. of distilled H_2O added, which brought the temperature down to 44° C. and was used at this temperature.

Sketch 1 shows the sheet travel on the Waldron laminator. The rolls on the impregnating section were not heated and the temperature of the bath was 44° C. The sheet was passed over all the drums of the drier section which were heated to 300° F. The speed of the machine was about 35 f.p.m.

Sketch 1



The Manngal solution pickup was obtained by taking a specimen as it came out of the nips and placing it in a tare weighed turkey bag. The specimen was weighed in the turkey bag and the basis weight calculated. The pickup is given in Table I.

TABLE I

PICKUP

Untreated weight	26.2 lb./1000 sq. ft.
Treated weight	43.5 lb./1000 sq. ft.
Pickup	17.3 lb./1000 sq. ft.

FABRICATION

The material was fabricated into A-flute single-faced board on the Institute's corrugator. The material was bonded to a 42-lb. kraft liner with starch adhesive. Samples were taken from the single-faced board and tested for flat crush, pin adhesion, and Jumbo ring compression at 50 and 85% relative humidity. The operational data are given in Table II.

TABLE II

OPERATIONAL DATA

Temperature, ° F.	
Top corrugating roll	330
Bottom corrugating roll	330
Pressure roll	335
Liner Preheater	345
Medium preheater	400
Roll clearance, inches	
Pressure roll	None
Adhesive roll	0.020
Wiper roll	0.008
Speed, f.p.m.	100
Steam showers, p.s.i.	
Top 2-5	10
Bottom 2-5	10
Before medium preheater	Slight
Adhesive	Starch
pH	12.3
Gel point, ° F.	137
Viscosity (Stein-Hall viscometer)	
H_2O at 73° F., seconds	15.3
Starch at 95° F., seconds	31.0
Starch at 73° F., seconds	43.0

Runability: The material ran very well. The steam shower pressures were varied without any noticeable change in fabrication.

TESTING

After the single-face board was preconditioned for 24 hours at not more than 35% relative humidity and a temperature of 73 ± 2° F., it was either conditioned for 48 hours at 50 ± 3.5% relative humidity and a temperature of 73 ± 2° F. or conditioned for 72 hours at 85 ± 3.5% relative humidity and a temperature of 73 ± 2° F. The samples were tested for flat crush, pin adhesion and Jumbo ring compression. The test results are shown in Table III.

TABLE III

TEST RESULTS

Materials	Flat Crush, p.s.i. 50% R.H.	Flat Crush, p.s.i. 85% R.H.	Pin Adhesion, lb./6 sq. in. 50% R.H.	Pin Adhesion, lb./6 sq. in. 85% R.H.	Jumbo Ring Compression, lb./4 x 20 50% R.H.	Jumbo Ring Compression, lb./4 x 20 85% R.H.
Untreated	25.0	13.9	86	69	417	248
Treated	27.5	15.2	92	75	423	228

DISCUSSION

From the test results shown in Table III, it may be noted that the medium impregnated with Manngal gave slightly higher test results than the untreated medium; however, if there were some way to pick up a higher concentrated solution of the Manngal, the test values may be raised to a worthwhile point.

mfs/ls

PROJECT REPORT FORM

(1) Original—Central Files
(2) Copy —Mr. McKee
(3) Copy —Mr. Vanrio
(4) Copy —Dr. Howells
(5) Copy —Mr. Skalmusky

PROJECT NO. 1257
COOPERATOR Institute
REPORT NO. 6
DATE March 31, 1953
NOTE BOOK 1042
PAGE 120 TO
SIGNED M F Skalmusky
M. F. Skalmusky

IMPREGNATION OF 9-POINT WITH LYCOID

The fourth material used in this study to improve the strength of 9-point medium at high humidities was Lycoid.

Lycoid is in a powdered form, manufactured by the Stein-Hall Company. The 9-point sheet of medium to be impregnated was a semi-chemical material taken from stock on hand (IPC No. 1138).

The Lycoid was first tried by dissolving in distilled water at a 5% solid content and heating to 90° C.; however, the material was too thick for impregnating purposes. The next step was to try 2-1/2% solid contents in the same manner as described above and it still was too thick. In the next step 1% solid content Lycoid was made up and heated to 74° C. The material was still too thick so it was diluted with 100% water to give a solid content of 0.5%. The material was heated only to 74° C. instead of 90° C. because, at this temperature, the material was completed changed from a chalky opaque mass to a more translucent mass.

The Lycoid was made up as follows:

19.8 lb. of distilled H_2O

0.2 lb. of Lycoid

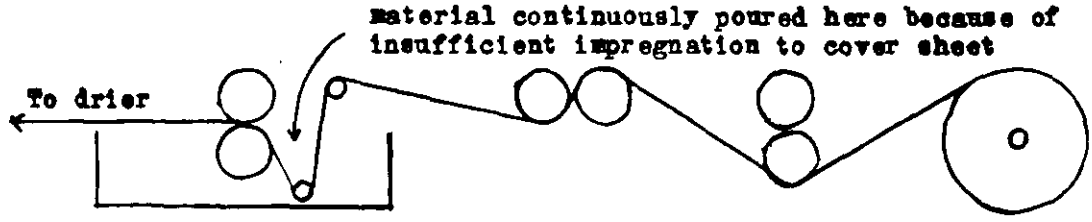
Heated to 74° C.

20.0 lb. of distilled H_2O added.

Cooled to 22° C. and used.

Sketch 1 shows the sheet travel. The rolls on the impregnating section were not heated, and the temperature of the bath was 22° C. The sheet was passed over all the drums of the drier section which was heated to 300° F. The speed of the machine was about 35 f.p.m.

Sketch 1



The Lycoid solution pickup was obtained by taking a specimen as it came out of the nips and placing it in a tare weighed turkey bag. The specimen was weighed in the turkey bag and the basis weight calculated. The pickup is given in Table I.

TABLE I

PICKUP

Untreated weight	26.2 lb./1000 sq. ft.
Lycoid treated weight	40.8 lb./1000 sq. ft.
Pickup of Lycoid solution	14.6 lb./1000 sq. ft.

FABRICATION

The material was fabricated into A-flute single-faced board on the Institute's corrugator. The material was bonded to a 42-lb. kraft liner with starch adhesive. Samples were taken from the single-faced board and tested for flat crush, pin adhesion and Jumbo ring compression at 50 and 85% relative humidity. The operational data are given in Table II.

TABLE II

OPERATIONAL DATA

Temperature, ° F.	
Top corrugating roll	330
Bottom corrugating roll	330
Pressure roll	335
Liner preheater	345
Medium preheater	400
Roll Clearance, inches	
Pressure roll	None
Adhesive roll	0.020
Wiper roll	0.08
Speed, f.p.m.	100
Steam Showers, p.s.i.	
Top 2-5	10
Bottom 2-5	10
Before medium preheater	slight
Adhesive	Starch
pH	12.3
Gel point, ° F.	137
Viscosity (Stein-Hall viscometer)	
H_2O at 73° F., seconds	15.3
Starch at 95° F., seconds	31.0
Starch at 73° F., seconds	43.0

Runability: Ran very well. The steam shower pressures were varied without any noticeable change in fabrication.

TESTING

After the single-faced board was preconditioned for 24 hours at not more than 35% relative humidity and a temperature of 73 ± 2° F., it was either conditioned for 48 hours at 50 ± 3.5% relative humidity and a temperature of 73 ± 2° F. or conditioned for 72 hours at 85% ± 3.5% relative humidity and a temperature of 73 ± 2° F. The samples were

tested for flat crush, pin adhesion and Jumbo ring compression. The test results are shown in Table III.

TABLE III

TEST RESULTS

Material	Flat Crush, p.s.i. 50% R.H.	Flat Crush, p.s.i. 85% R.H.	Pin Adhesion, lb./6 sq. in. 50% R.H.	Pin Adhesion, lb./6 sq. in. 85% R.H.	Jumbo Ring Compression, lb./4 x 20 50% R.H.	Jumbo Ring Compression, lb./4 x 20 85% R.H.
Untreated	25.0	13.9	86	69	417	248
Treated	28.9	16.0	96	74	464	245

DISCUSSION

From the test results shown in Table III, it may be noted that the medium impregnated with Lycoid gave slightly higher test values than the untreated medium; however, if there were some way to pick up a higher concentrated solution of the Lycoid, the test values may be raised to a worthwhile point.

PROJECT REPORT FORM

(1) Original--Central Files
(2) Copy --Mr. McKee
(3) Copy --Mr. Vaurio
(4) Copy --Dr. Howells
(5) Copy --Mr. Skalmusky

PROJECT NO. 1257
COOPERATOR Institute
REPORT NO. 5
DATE March 27, 1953
NOTE BOOK 1042
PAGE 116 TO 119
SIGNED M. F. Skalmusky
M. F. Skalmusky

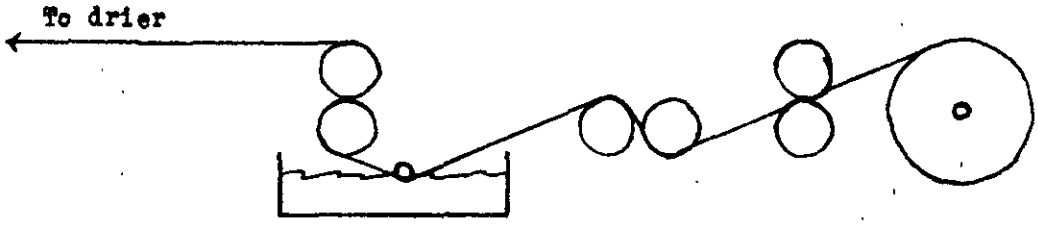
IMPREGNATION OF 9-POINT WITH ZINC CHLORIDE

The third material used in this study to improve the strength of 9-point medium at high humidities was zinc chloride.

The zinc chloride was diluted in distilled water to get a 30% solid content. The 9-point sheet to be impregnated was a semichemical material taken from stock on hand (IPC No. 1095).

The sheet was impregnated with a 30% solid contents of zinc chloride and a two-side impregnation. Sketch 1 shows the sheet travel. The rolls on the impregnator section were not heated and the temperature of the bath was 73° F. The sheet was passed over all the drums of the drier section which were heated to 300° F.

Sketch 1



The zinc chloride solution pickup was obtained by taking a specimen as it came out of the nips and placing it in a tare weighed turkey bag. The specimen was weighed in the turkey bag and the basis weight calculated. The pickup is given in Table I.

TABLE I

PICKUP

Untreated weight	26.2 lb./1000 sq. ft.
Treated weight	33.2 lb./1000 sq. ft.
Pickup	7.0 lb./1000 sq. ft.

The impregnated material was fabricated into A-flute single-faced board on the Institute's corrugator. The material was bonded to a 42-lb. kraft liner with starch adhesive. The single-face board was tested for flat crush, pin adhesion and Jumbo ring compression at 50 and 85% relative humidity and a temperature of 73° F. The operational data are given in Table II.

TABLE II

OPERATIONAL DATA

Temperature, ° F.	
Top corrugating roll	330
Bottom corrugating roll	330
Pressure roll	335
Liner preheater	345
Medium preheater	400
Roll Clearance, inches	
Pressure roll	None
Adhesive roll	0.020
Wiper roll	0.008
Steam showers, p.s.i.	
Top 2-5	15
Bottom 2-5	15
Before medium preheater	Moderate

(Continued on next page.)

TABLE II (Cont.)

OPERATIONAL DATA

Adhesive	Starch
pH	12.3
Gel point, ° F.	138
Viscosity (Stein-Hall viscometer)	
H_2O at 73° F. seconds	15.3
Starch at 95° F., seconds	27
Starch at 73° F., seconds	36
Speed, f.p.m.	100

Runability: It was hard to get the sheet started because it tended to stick to the corrugating rolls and follow back in the nips. The sheet turned black on the preheater until the machine got rolling. There was also a poor adhesive bond. After the sheet was running, the steam shower pressures were varied without any noticeable difference in the runability.

TESTING

After the single-face board was preconditioned for 24 hours at not more than 35% relative humidity and a temperature of 73 ± 2° F., it was either conditioned for 48 hours at 50 ± 3.5% relative humidity and a temperature of 73 ± 2° F. or conditioned for 72 hours at 85 ± 3.5% relative humidity and a temperature of 73 ± 2° F. The sample was tested for flat crush, pin adhesion and Jumbo ring compression. The test results are shown in Table III.

DISCUSSION OF RESULTS

The test results given in Table III indicate that the material impregnated with zinc chloride gave lower test data than the untreated material.

TABLE III

TEST RESULTS

Material	Flat Crush, p.s.i.		Pin Adhesion, lb./6 sq. in.		Jumbo Ring Compression, lb.	
	50% R.H.	85% R.H.	50% R.H.	85% R.H.	50% R.H.	85% R.H.
Untreated	30.1	16.7	103	83	493	308
Treated	26.8	10.0	52	34	432	196

mfs/ls

PROJECT REPORT FORM

(1) Original--Central Files
(2) Copy --Mr. McKee
(3) Copy --Mr. Vanrio
(4) Copy --Dr. Howells
(5) Copy --Mr. Skalmusky

PROJECT NO. 1257
COOPERATOR Institute
REPORT NO. 4
DATE March 27, 1953
NOTE BOOK 1042
PAGE 104 TO 113
SIGNED M. F. Skalmusky
M. F. Skalmusky

IMPREGNATION OF 9-POINT WITH SODIUM METHYL SILICONATE

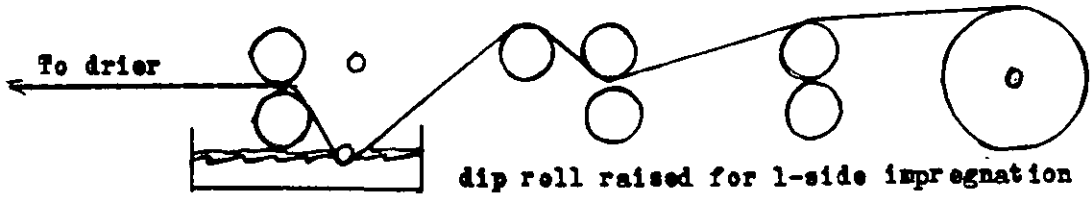
The second resin used in this study to improve the strength of 9-point medium at high humidities was sodium methyl siliconate.

This material was received in liquid form with 30% solids. The 9-point sheet to be impregnated was a semichemical material taken from stock on hand (IPC No. 1095).

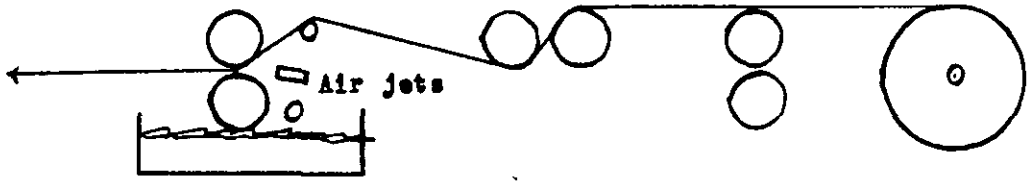
The first trial in impregnation with sodium methyl siliconate was tried with 30% solid and a two-side impregnation. Sketch 1 shows the sheet travel. No heat was used in the impregnating section. The temperature of the material in the bath was 73° F. and the temperature of the drier rolls was 300° F. With the above procedure used, the sheet came off the driers too brittle. The dip roll was raised so that the sheet was impregnated from one side and the sheet was still too brittle.

The second trial with sodium methyl siliconate was made with the material diluted with 100% distilled H_2O, which made it 15% solids. This sheet was impregnated on one side and the sheet travel can be seen in Sketch 2. It may be noticed that air jets were installed. This was done to prevent the impregnating material from overlapping the edges and producing a build-up on the edges of the sheet which caused difficulties in winding the sheet in a roll.

Sketch 1



Sketch 2



The pickup of the sodium methyl siliconate was obtained by taking a specimen as it came out of the nips of the pressure roll and placing it in a tare weighed turkey bag and calculating the basis weight. The pickup data are given in Table I.

TABLE I

PICKUP

Untreated material	26.7 lb./1000 sq. ft.
Treated material	28.8 lb./1000 sq. ft.

The impregnated material was fabricated into A-flute single-face board on the Institute's corrugator. The impregnated material was bonded to a 42-lb. kraft liner with starch adhesive. The material was

fabricated with the treated side next and also away from the single-face liner. The untreated material was also fabricated under the same conditions as the treated material for a basis point. The single-face board was tested for flat crush, pin adhesion and Jumbo ring compression at 50% and 85% relative humidity. The operational data are given in Table II.

TABLE II

OPERATIONAL DATA

Temperature, ° F.	
Top corrugating roll	330
Bottom corrugating roll	330
Pressure roll	335
Liner preheater	345
Medium preheater	550+
Roll clearance, inches	
Pressure roll	None
Adhesive roll	0.020
Wiper roll	0.008
Steam showers, p.s.i.	
Top 2-5	10
Bottom 2 -5	10
Before medium preheater	Moderate
Adhesive	Starch
pH	12.3
Gel point, ° F.	139
Viscosity (Stein-Hall viscometer)	
H_2O at 73° F., seconds	15.3
Starch at 95° F., seconds	27
Starch at 73° F. seconds	39
Speed, f.p.m.	100

Runability: The material ran well. The steam shower pressure was varied without any noticeable difference in the runability. The single-face board with the treated side next to the single-face liner did not have a very good adhesive bond. It seemed that the adhesive did not penetrate into the medium; however, this may be overcome by using silicate of soda on the double-facer. Therefore, only the material with the untreated side next to the single-face liner was tested.

After fabrication, the single-face board was preconditioned for 24 hours at not more than 35% relative humidity and a temperature of 73 ± 2° F. and then either conditioned for 48 hours at 50% ± 2.5% relative humidity at 73 ± 2° F. or for 72 hours at 85 ± 2.5% relative humidity and 73 ± 2° F. prior to testing in the conditioned atmosphere.

TABLE II

Material	Flat Crush, p.s.i. 50% R.H.	85% R.H.	Pin Adhesion, lb./6 sq. in. 50% R.H.	85% R.H.	Jumbo Ring Compression, lb./4 x 20 50% R.H.	85% R.H.
Untreated	30.1	16.7	103	83	493	308
Treated	32.3	15.9	98	80	530	266

DISCUSSION OF RESULTS

The treated material gave slightly higher flat crush and ring compression results at 50% relative humidity; however, at 85% relative humidity, the results of the treated material were lower which indicates that the sodium methyl siliconate did not improve the strength at higher humidities. Therefore, additional trails may not be worthwhile because there is no tendency in the direction for which the purpose of this study was initiated, unless there is some way to modify the sodium methyl siliconate.

mfs/ls

PROJECT REPORT FORM

(1) Original--Central Files
(2) Copy --Mr. McKee
(3) Copy --Dr. Howells
(4) Copy --Mr. Vaurio

PROJECT NO. 1257
COOPERATOR Institute
REPORT NO. 3
DATE February 27, 1953
NOTE BOOK 1042
PAGE 110 TO 115
SIGNED M. F. Skalmusky
M. F. Skalmusky

BEATER ADDITIONS OF RESIN TO IMPROVE THE STIFFNESS OF CORRUGATING MEDIUMS AT HIGH HUMIDITIES

This program was initiated by the Institute to investigate resins and methods of incorporating resins by beater additions, and thereby improve 9-point medium stiffness at high humidities. This work was carried out by the Plastics Group. The second phase of this study was to fabricate and evaluate the sheets after they were made. This work was done by fabricating the sheets into A-flute, single-face board on the corrugator and testing the sheets for flat crush at 50 and 85% relative humidities.

The handsheets were fabricated by bonding the sheets on the edge to a 3.5-pt. kraft screening carrier sheet and fabricating them to a 42-lb. kraft liner with starch adhesive. After the sheets were formed, the carrier sheet was removed. The operational data are given in Table I.

TABLE I

OPERATIONAL DATA

Temperature, ° F.	
Top corrugating roll	330
Bottom corrugator roll	330
Pressure roll	335
Liner preheater	345
Medium preheater	400

(Continued on next page.)

TABLE I (Continued)

OPERATIONAL DATA

Roll clearance, inches	
Pressure roll	None
Adhesive roll	0.020
Wiper roll	0.008
Steam shower, p.s.i.	
Top - 2-5	10
Bottom - 2-5	10
Before medium preheater	Slight
Adhesive	Starch
pH	12.3
Gel point, ° F.	139
Viscosity, seconds (Stein-Hall viscometer)	
H_2O at 73° F.	15
Starch at 95° F.	29
Starch at 73° F.	46
Speed, f.p.m.	100

Runability: All sheets ran well except one sheet of 1042-99-1 cracked.

After the sheets were fabricated, they were preconditioned for 24 hours in an atmosphere not higher than 35% relative humidity and a temperature of 73 ± 2° F. and then either conditioned for 48 hours in an atmosphere of 50% relative humidity or for 72 hours at 85% relative humidity in temperatures of 73 ± 2° F.

TESTING

After the sheets were fabricated, five of the seven fabricated sheets were cut for testing. Out of each sheet, two 5 square inch flat crush specimens were cut--one for 50% and the other for 85% relative humidity--therefore, each sample had five test specimens for testing in 85% relative humidity.

The specimens were tested on an H. and D. flat crush tester with 1/2 flintcoat paper on the platens. The test results are given in Table II.

TABLE II

FLAT CRUSH, p.s.i.

Code No.	Materials	50% R.H.	85% R.H.
1042-88-1	Control-pH-7.5	30.4 (0-5-5)	18.1 (0-5-5)
1042-88-2	Synco 721-20%	35.1 (0-5-5)	23.2 (0-5-5)
1042-90-1	Synco 721-50%	46.9+(0-5-5)	35.8 (0-5-5)
1042-91	Control-pH-4.5	26.2 (0-5-5)	16.8 (0-5-5)
1042-94	Lustrex X620-Parez	23.8 (0-5-5)	15.0 (0-5-5)
1042-95	Parez	22.7 (0-5-5)	17.1 (0-5-5)
1042-96	Lustrex X620-50%	28.4 (0-5-5)	19.5 (0-5-5)
1042-99	Vinsol 20%	28.0 (0-5-5)	21.6 (0-5-5)
1042-105	Vinsol 50%	40.7 (2-5-5)	38.3 (1-5-5)

DISCUSSION OF RESULTS

From the test results in Table II, it may be seen that the materials for Code Numbers 1042-88-2, 90-1, and 105 indicated that they improved the stiffness at 85% relative humidity as well as at 50% relative humidity.

mfs/ls

PROJECT REPORT FORM

Copy to: McKee
Howells
Vaurio
Files

PROJECT NO. ✓1257 X
COOPERATOR Institute
REPORT NO. 2
DATE 2-4-53
NOTE BOOK 1042
PAGE 94 TO 105
SIGNED William C. Krueger
William C. Krueger
Donald Manion
Donald Manion

STIFFENING OF CORRUGATED MEDIUM

INTRODUCTION

This report covers some of the work done on the evaluation of various beater additives to improve the stiffness of corrugating medium. The majority of the work described in this report was carried out using the Bardac Process as covered by American Cyanamid.

MATERIALS AND METHODS

The following procedures were used in the preparation of the sheets for evaluation by the Container Section. The numerical designations on the sheets refer to the notebook and page number.

No. 1042-94

115 grams (O.D. wt.) of semi-commercial Asplund pulp was diluted with 4083 grams of tap water. The sulfate ion concentration of the slurry was adjusted to approximately 75 p.p.m. by the addition of 0.212 grams alum. The stock was then mixed in the spiral mixer for 10 minutes. Information from the City Water Department indicated that the sulfate ion concentration in city water ranged between 30 and 35 p.p.m.

1.725 grams Parez acid colloid (1.5% of fiber) was added and the pH of the slurry was adjusted to 4.6 by adding HCl. Mixing was then continued for 45 minutes.

57.5 grams of Lustrex X-620 (Monsanto--plasticized polystyrene) was added and the slurry mixed for 15 minutes. At this point the resin emulsion appeared to be incompletely precipitated as the slurry appeared milky.

The slurry was then diluted to 0.5% consistency. The freeness at this point was 420 cc. (Canadian Standard). Sheets were then formed on the 8.5-inch sheet mold. The deckle box pH was adjusted to 4.5 with sulfuric acid. The drainage time was 15 to 16 seconds. The sheets were wet pressed at 180 p.s.i. and dried.

1042-95

115 grams of pulp was diluted with 4083 grams of water and mixed for 10 minutes in the spiral mixer. The sulfate ion concentration was adjusted to 75 p.p.m. with alum. Mixing was continued for 5 minutes followed by the addition of 5.75 grams Parez resin 607 acid colloid. The pH was adjusted to 4.5 and the slurry was mixed for 45 minutes. The stock was then diluted with 18,167 grams water and the sheets were formed. Prior to forming the deckle box pH was adjusted to 4.5 by the addition of HCl. The sheets were then pressed and dried. The freeness was 400 cc. and the drainage time was 15 seconds.

1042-96 (Revised Bardac Process)

In a letter dated December 12, 1952 from American Cyanamid to Howells they described a revised Bardac Process using Paper Product 2250. These sheets were made using this revised process.

115 grams of pulp was diluted with 4083 grams of water and mixed in the spiral mixer for 10 minutes. The sulfate ion concentration of the slurry was adjusted to 75 p.p.m. by the addition of alum. The slurry was then mixed for 5 minutes and 5% (fiber basis) Parez Acid Colloid was added. The pH was adjusted to 4.5 with HCl and mixing continued for 45 minutes. To this slurry was then added a mixture made up as follows:

50% (on fiber basis) of Lustrex X-620 solids. 115 grams emulsion was thoroughly mixed with 5% (5.75 grams) of Paper Product 2250 and 2.5% Paper makers alum.

The slurry with the emulsion was mixed for 10 minutes and diluted to 0.5% consistency. The sulfate ion concentration was again adjusted to 75 p.p.m. as it would be in the deckle box by the addition of aluminum sulfate. The sheets were formed after adjusting the deckle box pH to 4.5. The sheets were pressed and dried. The freeness was 350 cc. and the drainage time was 14 to 15 seconds.

1042-99 20% Vinsol

115 grams (O.D.) stock was diluted with 4083 and mixed for 10 minutes. The sulfate ion concentration was then adjusted to 75 p.p.m. by the addition of aluminum sulfate and mixing was continued for 5 minutes. To this slurry was then added 1.72 grams Parez resin acid colloid. The pH was adjusted to 4.6 with HCl and mixing was continued for 45 minutes. A mixture was prepared by mixing 2.5% Paper Product 2250 (based on the fiber) with the Vinsol emulsion (20% on the fiber). Paper makers alum (2% on fiber) was added and the mixture was diluted to 25% solids and added to the slurry. The emulsion appeared to precipitate with the addition of the alum but redispersed on dilution.

The sulfate ion concentration was adjusted to 75 p.p.m. by the addition of sulfate after the addition of the emulsion to the slurry. After a short mixing period the stock was diluted to 0.5% consistency and the sheets were formed with the deckle box pH being adjusted to 4.5 with HCl. The freeness was 350 cc. and the drainage time was 14 to 16 seconds. The sheets were pressed and dried.

The whitewater appeared to be slightly cloudy indicating a little loss of the emulsion. The sheets were two-sided.

1042-105

These sheets were made up the same as 1042-99 except that 50% Vinsol was used instead of 20%. The whitewater was a little milky and the blotters appeared to pick up some of the emulsion. The freeness was 400 cc. and the drainage time was 15 to 17 seconds.

FUTURE WORK

Some of the emulsions to be tried in the future include Bitusize, Lustrex X-600 (unplasticized polystyrene) and various other materials as they are received.

wck/rm

PROJECT REPORT FORM

Copies to: Files
Howells
McKee (2)
Vaurio
Manion

PROJECT NO. 1257
COOPERATOR Institute
REPORT NO. One
DATE January 15, 1953
NOTE BOOK
PAGE TO
SIGNED Donald Manion
Donald Manion

BEATER ADDITION OF RESINS TO IMPROVE STIFFNESS OF CORRUGATING MEDIUM (Synco 721)

This program was initiated by the Institute to investigate resins and methods of incorporating resins, by the beater addition process, in corrugating medium and thereby improve its stiffness. The program was divided into two phases. The first, carried out by the Plastics Group, involved the preparation of handsheets in which various resins have been incorporated. The second phase is the subsequent evaluation of these handsheets. This part of the program will be handled by the Container Group.

As was agreed prior to starting this work we aimed for a control sheet having a basis weight of 26 to 28 lb./1000 sq. ft.,* and a caliper of 9 to 10 mls.

Semichemical Asplund pulp obtained from the Green Bay Paper and Pulp Company was used as the base stock throughout this investigation. The pulp, as received, was already at a Canadian Standard Freeness of 400 cc., so our original specification of 500 to 600 c. C.S. was discarded. Upon receipt of the pulp formaldehyde was added as a preservative. The consistency was determined and found to be 15.36%.

P

* The basis weight of the sheets containing resin was allowed to vary as the resin retention varied.

Preparation of Stock for Handsheets

Four sets of handsheets (15 sheets per set) were prepared by the following standardized procedure.

1) 115 g. (o.d. weight) of the above pulp was placed in a special spiral mixer and was mixed 10 minutes at approximately 2.5% consistency.

2) In those sets to which Synco 721 resin was added, the addition was made at this point and mixing was continued for 10 minutes.

3) The resin was precipitated with the addition of Precipitant II* to a pH of 4.0 to 4.5, and mixed for an additional 5 minutes.

4) The stock was then transferred to a 15 gallon stainless steel tank and diluted to 0.5% consistency.

5) Freeness samples were taken and handsheets were formed on an 8 by 8 inch sheet mold at a consistency of 0.076%.

6) In three sets of sheets, the pH in the deckle box was adjusted to 4.5 with H_2SO_4. The pH of the fourth set was left unadjusted.

7) The handsheets were couched onto damp blotters, wet pressed at 180 p.s.i. for 3 min. on the Elmes press, turned on the blotters and dried on a chrome-plated drum drier at 230°F. for 10 minutes.

These sheets were then coded and sent to the Container Group for evaluation.

The following table gives the specific data for each set of sheets.

* Papermaker's Alum--------100 g.
Sulphuric Acid (95%)----- 40 g.
Distilled water to make 1000 ml.

TABLE I

FORMING CONDITIONS FOR HANDSHEETS

	Furnish: Pulp (o.d. wt. g.)	Furnish: Resin Solids (g.)	Precipitant II (cc.)	pH after Precipitation	pH in Deckle Box	Drainage Time, (sec.)	Freeness (cc. C.S.)	Appearance of White Water	Basis Wt. (Air dry) lb./1000 sq. ft. 1-sheet 8 by 8 in.
Controls 1042-88-1	115	0	0		7.7	14-16	400	clear	27.0
Controls 1042-91	115	0	0		4.5	14-16	395	clear	27.0
20% Synco 721 1042-88-2	115	23.0	30 *1	4.4	4.5	15-18	390	clear	28.8
50% Synco 721 1042-90-1	115	57.5	75 cc.	4.0	4.5	14-16	420	Slightly milky	31.8

*1 An additional 20 cc. was added to the stock to lower pH in deckle box. This was not effective and H_2SO_4 was then added to the deckle box.