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SUMMARY

FOR the purpose of coating hessian for rendering it water proof and seepage proof for making cement bag and bag for packing any other hygrospic and powdery material, a composition of lac/CNSL modified with urea and formalin has been tried which is heat as well as water resistant. A new technique for coating the hessian has been developed. After trying several compositions incorporation of 10 g urea and 30 g formalin to 100 g urea and 30 g formalin to 100 g lac and equal prolac and equal proportion CNSL oil results in a composition from which films of heat and water resistance can be prepared.

USE of lac with CNSL oil for coating hessian to make the latter moisture proof has been tried by earlier workers[1]. Although the coating after application initially gave good performance, gradually it became hard and brittle. Another objection in accepting the coating was its pungent odour due to the presence of cashewnut shell oil. The users of bags raised are objection on the thickness of the coating and sticking of the coatings in the bags when they are kept in piles. The present work was undertaken to remove the above noted defects.

It has already been reported[2] that shellac being heated with cashewnut shell oil and subsequently treated with formalin and urea in the presence of butyl alcohol can produce varnishes of considerable water resistance, flexibility, adhesion, resistance to alkali and solvents. To produce a thin film on hessian, a diluted solution of the above composition was tried by brushing or roller coating. The solution was adsorbed by the hessian and a continuous film could not be produced. A thicker solution produced a thick film which required too long a time to dry.

The same composition was tried as an adhesive to laminate polyethylene sheet on hessian. It was observed that the polyethylene sheet could be peeled off without much effort from the hessian leaving a continuous thin film stuck to the hessian. This provides a clue to develop a process of coating hessian with a thin layer by transfering the film from polyethylene. This process has been worked out in details and the properties of the film have been studied. The film thus produced does not soften by heat upto 150°C and can stand continuous heating at 100°C for more than twelve hours without deterioration of the properties. Use of butyl alcohol in the composition increases the cost of production. This could be reduced by using ethyl alcohol (denatured spirit) and minimising the time of heating of the composition. Continuous film of thickness 0.07 mil could be produced.

However, it has been found that film of 0.15 mil thickness was suitable for coating hessian to make it moisture proof and seepage proof. Suggested use of hessian coated as above is for packing cement, pigments, fillers, and all other powdery materials, fertilisers etc. Particularly for cement which is filled directly from the dryers at a temperature of 120°C and requires about 12 hours for cooling. Same composition can be used for coating cloth also. Film thus produced had no small and on storing at normal conditions, the film remains flexible. There is no tackiness of the film.

Experimental

Method of preparation: 100 parts of shellac of any grade including lac extracted from kiri by alkali process and containing impurities upto 1.5 percent, and 100 parts of cashew nut shell oil are heated at 140-150°C for an hour. Regulated stirring arrangement must be made to avoid super heating of the composition at the bottom of the cooking vessel and also overflowing due to frothing at the beginning of the reaction. After completion of the heating period, the composition is allowed to cool to 50°-60°C and dissolved in 200 parts of denatured spirit (sp.gr. 0.88 at 20°C) 30 parts of formalin and 10 parts of urea on the weight of shellac are added and mixed thoroughly, if required by slight worming. Thus, prepared composition on cooling is ready for use.

Method of application: A thin coating of the composition is applied on one side of the polyethylene sheet by any coating machine at room temperature. The coated polyethylene sheet is pressed on hessian or cloth of any specification keeping the lac composition in between the polyethylene and other surface to form a uniform lamination taking care for expelling all air bubbles. The sheets are dried either by festooning for twenty-four hours or passing through an oven for 15 mins at 58°-60°C. Instead of festooning, if the sheets are kept in roles loosely wound at room temperature, about a week is required for drying. After drying, the polyethylene sheet is peeled off and a glossy uniform film obtained on hessian or cloth, which is baked at

100°C for 20 minutes to attain heat resisting properties. Thickness of film can be adjusted by adjusting the thickness of coating on polyethylene.

Water resistance and heat resistance tests were done for films of different compositions of different thickness hessian after drying the film in air and also baking at 100°C for different period.

Water resistance test: Ten coated strips (5" x 1") of each sample were dipped in a beaker containing distilled water at room temperature (25-30°C). At the end of 2,4,6,24 hours, two strips were taken out wiped and visually examined for blushness.

Heat resistance test: Two tests have been done. One for tack developed by heat, and the other for sticking of particles when filled in the bag while hot. In the first test, effect of heat to soften the film was noted. Two pieces of samples were placed with coated side, face to face under a weight of 1 kg over an area of 19.7 sq.in. in an oven maintained at a temperature of 100° ± 2°C. After heating for one hour, the samples were taken out and their stickiness noted by pulling the sheets apart. To ascertain the suitability of the coated hessian for packing cement at higher temperature (120°)C, sand particles of mesh number between 60 to 100 were heated at 150°C and put on the sheet of coated hessian. Hot sand was allowed to cool on the hessian to room temperature. Sand was poured out and the surface was examined for any effect.

From the results as given in Table I, it will be observed that film with shellac and CNSL only does not show any resistance to heat and tackiness persists even after seven days of air drying. The compositions were modified with different proportions of urea and formaldehyde and the minimum quantities required have been found to be urea-10 g and formaldehyde-30 g in order to improve the heat resistance by placing sand heated upto 150°C on it.

The composition which could stand the heat from hot sand was tested for stickiness. From Table II, it will be observed that the sample without baking had stickiness which was removed by baking at 100°C for

TABLE — 1

HEAT RESISTANCE TEST

Composition: Shellac = 100 g, CNSL = 100 g, spirit = 200 ml and varying amount of urea and formaldehyde. Sand heated to 150°C was spread over the coated hessian.

Sl. No.	*Compositions*	*Coated hessian dried for* 3 days	4 days	5 days	6 days	7 days
1.	Urea = 0 Form = 0	S	S	S	S	S
2.	Urea = 10 g Form = 30 g	NS	NS	NS	NS	NS
3.	Urea = 6 g Form = 25 g	S	S	S	LS	LS
4.	Urea = 4 g Form = 20 g	S	S	S	LS	LS
5.	Urea = 2 g Form = 15 g	S	S	S	LS	LS
6.	Urea = 8 g Form = 20 g	S	S	S	LS	LS
7.	Urea = 15 g Form = 40 g	NS	NS	NS	NS	NS
8.	Urea = 20 g Form = 50 g	NS	NS	NS	NS	NS
9.	Urea = 10 g Form = 0	S	LS	LS	LS	LS
10.	Urea = 0 Form = 30 g	S	S	S	S	S

S = Sticking
LS = Less sticking
NS = Not sticking

TABLE — 2

HEAT RESISTANCE TEST

All compositions contain shellac = 100 g, CNSL = 100 g, Spirit = 200 ml. Two pieces of the same coated hessian were taken and kept inside the oven for one hour facing the coated surface to each other and 1 kg weight was placed over it over an area of 19.7 Sq cm.

Sl. No.	*Compositions*	*Coated surface after drying 24 hrs baked at 100°C for* 5 mts	10 mts	20 mts
1.	Urea = 0 Form = 0	Film Melts		
2.	Urea = 10 g Form = 30 g	S	LS	NS
3.	Urea = 6 g Form = 25 g	S	S	S
4.	Urea = 4 g Form = 20 g	S	S	S
5.	Urea = 2 g Form = 15 g	S	S	S
6.	Urea = 8 g Form = 20 g	S	LS	LS
7.	Urea = 15 g Form = 40 g	S	LS	NS
8.	Urea = 20 g Form = 50 g	S	LS	NS
9.	Urea = 10 g Form = 0	S	LS	LS
10.	Urea = 0 Form = 30 g	S	S	S

S = Sticking
LS = Less sticking
NS = Not sticking

TABLE — 3

Film properties of lac/CNSL combinations over hessian — water Immersion test.
All compositions contain lac = 100 g, CNSL = 100 g, spirit = 200 ml with varying amounts of urea and formalin.

Sl. No.	*Compositions backed at 100°C*	*20 minutes*							*30 minutes*							*40 minutes*						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1.	Urea = 10 g Form = 30 g	NB	NB	NB	NB	FB	B	—	NB	NB	NB	NB	FB	FB	—	NB	NB	NB	NB	NB	NB	NB
2.	Urea = 6 g Form = 25 g	NB	NB	FB	FB	B	—	—	NB	NB	NB	NB	FB	B	—	NB	NB	NB	NB	NB	NB	NB
3.	Urea = 4 g Form = 20 g	NB	NB	FB	FB	B	—	—	NB	NB	NB	NB	FB	B	—	NB	NB	NB	NB	NB	NB	NB
4.	Urea = 2 g Form = 15 g	NB	NB	FB	FB	B	—	—	NB	NB	NB	NB	FB	B	—	NB	NB	NB	NB	NB	NB	NB
5.	Urea = 8 g Form = 20 g	NB	NB	FB	FB	B	—	—	NB	NB	NB	NB	FB	B	—	NB	NB	NB	NB	NB	NB	NB
6.	Urea = 15 g Form = 40 g	NB	NB	NB	NB	FB	B	—	NB	NB	NB	NB	NB	FB	B	NB	NB	NB	NB	NB	NB	NB
7.	Urea = 20 g Form = 50 g	NB	NB	NB	NB	FB	B	—	NB	NB	NB	NB	NB	FB	FB	NB	NB	NB	NB	NB	NB	NB

NB = No blush FB = Faint blush B = Deep blush

20 minutes. Other compositions with lesser quantity of urea and formaldehyde failed the test.

Lastly, water resistance of the composition was tested for different samples. From Table III, it will be observed that the sample after baking at least for 20 mts did not blush after immersion in water for four days. If the baking period is increaced to 30 and 40 mts., the sample could stand water immersion for five and seven days respectively without blushing.

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