

Development of Specialty Papers is an Art: Playing Cards Base Paper from *Eucalyptus Tereticornis*, *Leucaena Leucocephala* and *Bambusa Aurandacea* — Part XV

Dharm Dutt, C H Tyagi, J S Upadhyaya and Shalini Singh

ABSTRACT

The study aims at developing playing cards from locally available hardwoods like, *Eucalyptus tereticornis*, *Leucaena leucocephala* and grass like *Bambusa aurandacea* of Assam origin. These cellulosic raw materials are mostly utilized, in India, in different proportions. This specialty paper requires better look, long lasting, non-effective in water and protection from dust, which may be developed separately by off machine operation. The most important properties of base paper for playing cards are structural properties like caliper, sizing, peeling resistance, optical properties like brightness and opacity and mechanical properties like tear and bursting strength. The results of laboratory made playing cards base paper are promising and fulfill the purpose of end users.

Key Words: Indigenous raw materials, Playing cards, Shuffling and gliding properties, Stiffness

INTRODUCTION

Indian paper makers are facing a serious lack of better quality of fibrous raw materials. This inadequate supply of better fibrous material has forced the paper makers to spend heavily on imported wood fiber. The Indian pulp and paper industries could not match their final products in globally competitive market, both cost as well as quality-wise. With other associated multifarious problems also like, high manufacturing cost, minimum profit level due to less selling price of end products in such a competitive atmosphere with heavy expenditure to conserve environment. Therefore, paper technocrats have to develop some specialty grades of paper of high market demand instead of traditional papers. Unfortunately, paper makers keep their manufacturing standards secret and there is no information available about the development of specialty papers. Keeping this goal in view, efforts were made to develop playing cards base paper from locally available hardwoods like, *Eucalyptus tereticornis*, *Leucaena leucocephala* and grass like *Bambusa aurandacea* of Assam origin.

A term cards usually applied to the sizes cut from various kinds of boards. Prefixing another word, such as business, postal, visiting, wedding and playing cards etc indicates their use. However, in modern society, the most appealing and alternative cards are manufactured from coated poly vinyl chloride paper. In order to make them

attractive and long life it is necessary to impart better look, long lasting, and water resistance and dust protective properties. A paper sheet of uniform formation and evenly finished of caliper varies between 0.254 to 0.305 mm is taken and print design is marked on one side of the sheet. Each sheet is printed with numbers and attractive designs. After printing PVC coating is done. Before coating PVC coating compound is prepared in a reservoir and uniform solution fed to the hopper of a roll coater. Paper sheet is passed through the coating machine twice for coating of both the faces of sheet. After coating printed sheets are to be cut in equal sizes of playing cards. The corner of the playing card is also rounded off in the same operation of cutting.

A stiff resilient coated paper is usually laminated in two or more plies in order to make it more opaque. Other important properties are high gloss, smoothness, stiffness and uniform caliper. Black centered paper usually provides opacity, good shuffling property, stiffness and effortless gliding properties. The most important requirements for playing cards base paper to be achieved during stock preparation and machine operation are as under:

- Formation of paper is much important, as it influences many other important properties like compressibility, porosity, opacity and surface smoothness. Paper should have uniform formation and pulp should be free from shives, specks and dirt. No

pinholes, blemishes, calendar cuts and slime spots are required. No cracking or folding is required

- Moderate level of mechanical strength properties like, burst and tearing strength are required. Flexural stiffness is the most important because the playing cards should be able to resist deformation during under stress. This property is greatly influenced by tensile stiffness modulus of pulp; paper thickness and surface treatment of paper and it is less influenced by fiber bonding and fiber orientation.
- In order to rearrange a pack of playing cards by gliding them over each other quickly cards must have good shuffling and effortless gliding properties. That could be achieved by laminating the base paper in two or more plies.
- A high degree of smoothness is required to develop high degree of slippage. It can be achieved by blending short and finer fibers and addition of filler pigment, which fill in the voids between fibers in the sheet surface. It can also be developed by controlling manufacturing parameters like degree of pressing, calendaring and type of dryer surfaces. Finally, it is developed in converting operations like coating and saturating.
- Gloss of playing cards can be achieved by selecting certain

Department of Paper Technology, Indian Institute of Technology Roorkee, Saharanpur Campus, Saharanpur 247 001

Table 1 Wet end additives for the development of base paper for playing cards

Sl No	Particulars	Quantity	Purpose of addition
1	Amphoteric starch	2 kg/T	Added to improve dry strength, drainage, retention, and sizing of paper
2	Wax emulsion	7 kg/T	It provides very effective resistance to penetration by liquid
3	Fortified rosin	20 kg/T	To enable paper to resist penetration by liquid
4	Poly aluminum chloride	80 kg/T	As a pH controlling agent, mordant and, anchoring agent for rosin
5	Micronized soapstone powder (brightness 90 per cent ISO)	120 kg/T	Added to fill in the voids and crevices between the fibers, thus producing a denser, softer, brighter, smoother and more opaque sheet
6	Defoamer	1 kg/T	Added to control foaming, blemishes and pin holes in the paper
7	Whitening agent	1.5 kg/T	Added to improve the brightness of paper and reduce yellowness of paper

Table 2 Comparison of laboratory made base paper for playing cards with specifications prescribed by converters and mill made paper

Sl No	Particulars	Specifications prescribed by converters	Mill A	Laboratory results
1	Substance, g/m ²	140±5 per cent	155	145
2	Bulk, cm ³ /g	1.30±0.10 per cent	1.38	1.35
3	Ash, per cent	6-8	6.5	7.2
4	Burst factor	18 (min)	22	24
	Wax pick	8 A (min)	11A	13A
5	Breaking length, m			
	MD	3500	4210	—
	CD	2500	2625	—
	Avg	3000	3417.5	3845
6	Folding endurance			
	MD	—	—	—
	CD	10 (min)	8	—
	Avg	—	—	14
7	Tear factor			
	MD	55 minimum	55	—
	CD	—	62	—
	Avg	—	58.5	60
8	Brightness, per cent ⁰ PV	82 (min)	82	84
9	Cobb 60, g/m ²			
	TS	—	26	—
	WS	26 (max)	28	—
	Avg	—	27	25

additives, which improves the optical smoothness of the surface of a coated sheet and improve its ability to reflect incident light.

Experimental Methodology

Pulp beating, blending and stock preparation-Bleached pulps of *E. tereticornis*, *L. leucocephala* and *B. aurandacea* were beaten in WEVERK

make laboratory valley beater to various beating levels and blended in the ratio of 15:80:05. Various wet end additives like, fortified rosin, poly aluminum chloride, amphoteric starch, micronized soap stone powder of brightness 90 per cent, wax emulsion and Cartaflex were added into the pulp furnish. The results are reported in Table 1.

Sheet Making-Laboratory hand-sheets

of basis weight 140 g/m² were prepared on British sheet forming machine. These hand-sheets were air-dried, conditioned and tested as per BIS specification. The final results were compared with specifications prescribed by converters. The results are reported in Table 2.

RESULTS AND DISCUSSIONS

Bleached pulp of brightness 85.6⁰PV of

E. tereticornis, *L. leucocephala* and *B. aurandacea* in the ratio of 15:85:05 were beaten at 30°SR are found suitable for the development of playing card base paper.

Table 1 shows the optimum dose of wet end additives for the development of base paper for playing cards. The beaten stock was treated with 20 kg/T of fortified rosin to get a Cobb value of 25. A desired pH level of 4.8 was maintained by adding 80 kg/t of Poly aluminum chloride (solid basis), which was also found to be the optimum dose for the precipitation of fortified rosin size on to the cellulosic fibers. It is important to note that the hardness of ground water is 238 ppm. 2 kg/T of amphoteric starch and 7 kg/T of wax emulsion respectively are found suitable to develop dry strength and to entrap fines and fillers and effective resistance to liquid penetration. 120 kg/T of micronized soapstone was found to give desirable ash level in paper without affecting mechanical strength properties adversely. One kg/T ton of cartaflex- antifoaming agent was found suitable to control foaming, blemishes and pinholes. A dose of 1.5 kg/T of whitening agent is added to vanish yellowness and to improve brightness of pulp.

Table 2 shows the comparison of various properties of laboratory made base paper for playing cards with specifications prescribed by the converters. Considering the experience of converters to handle the problems during utilization of playing card paper properties like, cobb₆₀, breaking length, ash, wax pick, folding endurance, burst factor, brightness and opacity have been developed as per customer requirements. A bulk of 1.30±0.10 cm³/g is prescribed to explain the nature

of the paper structure and adherence of PVC during coating. The bulk of laboratory made paper and mill made paper strictly resemble with the prescribed specification. However, the substance of mill made paper deviate the specification on higher side. Substance, bulk and ash content of laboratory made paper resembles with the prescribed specifications. Minimum specified burst factor for playing card base paper is 18. The burst factor of mill made and laboratory made papers are 22 and 24 respectively. Playing cards paper, after printing and cutting are subjected to gliding them over each other quickly and cards must have good shuffling effortless gliding properties. Therefore, folding endurance, breaking length, and tear factor are the most important properties. A minimum value for folding endurance in CD should be 10. The folding endurance of mill-made paper and laboratory made papers are 8 and 14 respectively. In order to avoid the playing cards from converters has specified a tear factor of 55 minimum in the machine direction. The tear factor of mill made and laboratory made hand-sheets is on higher side than the specified value. If the value of Tear, folding endurance and breaking length deviates from the prescribed values towards lower side, the base paper will be unable to impart good shuffling and effortless gliding properties. The higher values for the same can be achieved by adding long fiber furnish. However, shuffling and effortless gliding properties will be improved but cost of the base paper will increase accordingly. Cobb₆₀ value of 60g/m² is optimum for PVC coating. The higher Cobb and bulk may cause deep impregnation of PVC on base paper and vice versa. It may result surface strength of coated paper.

CONCLUSIONS

- (i) 2 kg/T of amphoteric starch, 20 kg/T of fortified rosin, 7 kg/T of wax emulsion, 80 kg/T of poly aluminum chloride, 120 kg/T of micronized soapstone, 10 kg/T of cartaflex- an antifoaming agent and 1.5 kg/T of whitening agent may be taken an optimum dose for the development of base paper for playing cards.
- (ii) A folding endurance of 10 minimums in CD, tear factor of 55 minimum in MD, and average breaking length of 3000 m are required for good shuffling and effortless gliding properties. The folding endurance, tear factor, and breaking length of laboratory made paper are 14, 60, and 3845 m respectively. All other properties of base paper required to handle the problems during conversion of playing card like, cobb₆₀, ash, wax pick, and burst factor resembles with specification.

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