

Benefits of Using Short Cut Polyester Staple Fibres (SC PSF) As 'Reinforcement Additive' to Pulps made from Agro-Residues and Secondary/Recycled Fibre Blends.

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ABSTRACT

In the existing scenario of Paper Industry, the selection of best fibrous raw material which will be available on sustained basis appears to be of prime importance and further, the quality of end product will largely dependent on the type of fibres and their blends in making the stock. The agro-residues and secondary/recycled fibres seem to be the promising raw materials of the future. This invites reinforcement of long length fibres like 6 mm Short Cut Polyester Staple Fibres (SC PSF) in the stock for all those grades of paper wherein the key strength characteristics such as Tear, Bulk, Porosity, Folding Endurance, Stiffness, etc. are very important.

As a reinforcement additive to pulps, it is now well established that the addition of 1.5% to 3% SC PSF significantly improves Tear Factor, where as Burst Factor & Breaking Length are maintained depending upon the pulp beating/refining characteristics. The dramatic increase in this third dimensional strength of paper-strength independent of inter-fibre bonding but a factor dependent only on fibre length makes the end product of unmatched quality. The use of SC PSF also found to offer certain process advantages, which when quantified on long term basis, makes the fibre addition commercially viable, especially for the agro-based mills and those who are using secondary fibres/recycled fibres to make their pulp furnish and is one of the best ways of improving the papermaking process and achieve quality product at the same time.

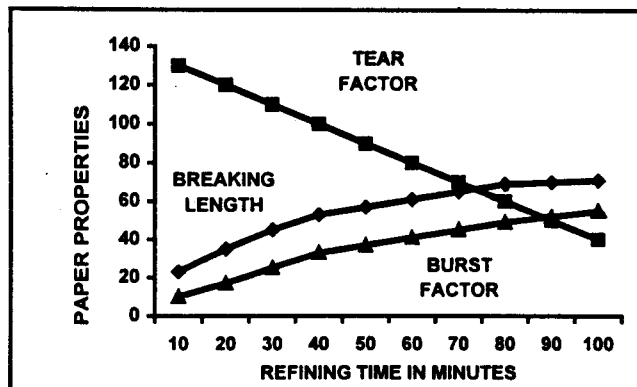
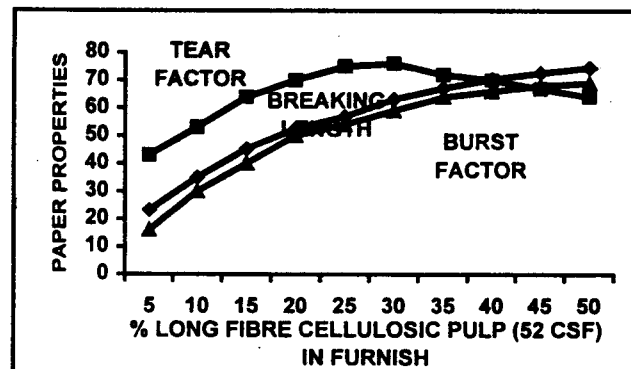
The present paper highlights the Benefits of using SC PSF as 'Reinforcement additive' to pulps made from agro-residues and secondary/recycled fibre blends. The focus is essentially on the various Property improvements & Process advantages that this fibre addition offers in different grades of paper based on the plant trials conducted in some of the leading paper mills in the country. The Techno-commercial benefits have also been highlighted in order to help the papermakers to effectively introduce the SC PSF in their mills.

HISTORICAL BACKGROUND IN INDIAN CONTEXT

Due to the depleting forest resources, there is an acute shortage of the conventional raw materials for Paper pulp in the country. Nearly 60% of the mills are therefore based on agricultural residue as raw materials and/or recycled fibre, where as only 40% are

left with the woody raw materials base. As the agricultural residues have very short fibre length, the

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Fig. - I

Fig. - II


augmentation of strength & other properties are done by addition of purchased softwood/hardwood pulps from International markets. These fibres undergo periodical price fluctuations and availability affecting the mills' economy adversely.

We have also seen that, paper has two dimensional strength for the reason that when the pulp is beaten/refined, the higher fibrillation increases Burst and Breaking Length up to a certain point, but in doing this, Tear (the third force) drops down invariably. This has been shown in Fig.-1. The drastic reduction in Tear Factor propagates tearing of paper

during the formation causing wet-web and / or dry-end breaks on the machine, affecting machine runnability and production loss. There is no other means available to the papermaker to increase Tear Factor, the third dimensional strength of paper, because Tear is independent of inter-fibre bonding and is a factor dependent only on fibre length. By adding Short Cut Polyester fibres (SC PSF), it is now well established that Tear shoots up significantly, where as Burst & Breaking Length are maintained depending upon the pulp beating/refining characteristics. The improvement in Tear is independent of Burst and Breaking Length, which is illustrated in the Fig.-II.

The recommended addition levels of Short Cut PSF to various pulps are given:

Sr. No.	Grade of Paper	Type of Pulp	% SC PSF Addition
1.	Newsprint	● Bamboo/wood/chemical Pulp	2-3
		● Bagasse pulp	2-3
		● Waste paper pulp	1.5-2.0
2.	Writing & Printing	● Bagasse/wood/Eucalyptus	2-3
		● Straw pulp	1.5-3.0
		● Waste paper pulp.	1.5-2
3.	Kraft/Packaging	● Bagasse/waste paper	2-5
		● Waste paper pulp	2-3
4.	Specialty	● Waste paper pulp (Imp./Ind.)	3-25 or more
		● Wood/Chemical pulp (Imp./Ind.)	3-25 or more
5.	Paperboards	● Waste Paper pulp	2-3
		● Waste Paper pulp/Chemical pulp	2-3

FIBRE SPECIFICATIONS AND RELATED TECHNICAL ASPECTS

Short Cut Polyester Staple Fibre is basically a polyester fibre having 6 mm cut length and 1.5 denier (Weight of fibre in gm per 9000 metres of length). Unlike the cellulosic fibres, these fibres are solid rod like structures and have a perfect circular cross section. The melting point of these fibres is 245°C and their moisture regain is only 0.4%. These fibres are having good resistance to acids, alkali, oxidizing agents and conventional organic solvents.

The reinforcement of SC PSF in paper is relatively simple, as these fibres do not require any kind of processing prior to their addition to the papermaking pulps. The addition should be done on dry basis to the machine chest/blending chest containing pulps. These fibres are not to be refined or beaten as their longer length and toughness compared to cellulosic fibres help improve the physical strength properties of the resulting paper.

PLANT SCALE TRIALS IN VARIOUS GRADES OF PAPER

Plant Scale trials have been conducted by

Reliance Industries Ltd. in around 30 Paper mills, both large & small scale mills, which have obtained good results in the selected grades of paper and are now deciding to conduct extended trials to reconfirm the improvements.

Essentially, the reinforcement of SC PSF is recommended as an additive to pulp and not a raw material substitute. The catalytic dosage range is 1.5% to 3% for most of the normal grades of paper. However, in case of specialty papers, the use of these polyester fibres may shoot up to the level of 25% and/or still higher depending on the end use application of such papers.e.g. Filter papers, electrical insulating grades of paper, etc.

The property improvements in various grades of paper during the plant scale trials are summarized in the following Table-1

The plant scale trials have successfully reconfirmed the property improvements and shown that use of SC PSF on the long term basis would facilitate in improving the machine runnability and save on the variable costs involved. An emphasis on the overall techno-commercial benefits of using the SC PSF is given in the following pages.

TABLE-1

SR No.	Grade of Paper	Basis Weight (gam)	Pulp Furnish	% SC PSF Added on pulp	% Improvement in Tear Factor	% Improvement in Bulk	% Improvement in Double Folds	Remarks
1.	Newsprint	45	Chemical Pulp + Mechano-Chem. Pulp	2.0	15-20	10-15	4-5	Partial replacement of Chemical Pulp.
2.	Writing & Printing Cream Wove S.S. Maplitho	65	Agro-residue pulp + Jute/Cotton Linter	1.5	30-54	4-5	2-5	Partial replacement of Jute/Cotton Linter pulp
3.	Kraft/Packaging Light wt. MG Kraft MG Kraft	44 150	Waste paper pulp Waste paper pulp	1.5 2.0	25-30 35-40	4-6 5-8	2-4 20-25	Improvement in Machine runnability and high tear
4.	Speciality Opaque Laminating Base Release Base Paper MG Poster Paper	41 60 28	Bagasse pulp + Imp. Wood pulp Waste paper Pulp	1.5 2.0	10-15 25-30	2-4 4-5	5-10 2-4	Partial replacement of Imported Chemical Pulp. Improvement in Machine runnability and high tear.

TECHNO-COMMERCIAL BENEFITS TO BE DERIVED FROM SC PSF REINFORCEMENT HIGHER PRODUCTIVITY:

- a) Less wet-web breaks due to better wet strength and high tear resistance leading to reduced machine down time.
- b) Improvement in machine runnability and Higher line speeds possible based on the machine configurations.

BETTER REALISATION

- a) Possible to manufacture lower gsm paper without any adverse effect on quality/productivity, thereby getting better realisation.

LOWER INPUT COSTS

- a) Addition of higher % of fillers possible to reduce the input costs.
- b) Partial replacement of expensive long fibre pulp would allow use of low cost cellulosic fibre, thereby reducing total furnish costs.

UTILITY COST SAVINGS

- a) Increase in sheet dryness after couch & presses reduces the steam consumption in drying of paper. Every 1% increase in sheet dryness after presses leads to approx. 4% reduction in steam consumption.
- b) Less vacuum demand on the flat boxes and couch on the wire part due to faster drainage characteristics of the pulp blend.

SAVINGS IN CONSUMABLES AND SPARES

- a) Better drainage of pulp facilitates reduced vacuum demand in flat boxes and leads to improved wire life.

QUALITY IMPACT:

- a) No mottling effect would be imparted to the coloured posters made using lighter shade dyes even up to 3% SC PSF addition.
- b) In case of high grammage Kraft papers, increase in Stiffness and Double Folds may be observed.
- c) In some special varieties of Writing & Printing papers which are supercalendered/coated, the use of SC PSF do not show any adverse effect.
- d) The printability of papers made using SC PSF is quite normal and due to hydrophobic nature of these fibres, the ink demand gets reduced,

without affecting the print quality.

- e) SC PSF is very much compatible with all kinds of cellulosic fibres as well as wet-end additives like fillers, sizing chemicals, dyes, retention aids, starches & gums etc.

CONCLUSIONS

In the existing scenario of Paper Industry, the selection of best fibrous raw material which will be available on sustained basis appears to be of prime importance and further, the quality of end product will largely depend on the type of fibres and their blends in making the stock. The agro-residues and secondary / recycled fibres seem to be the promising raw materials of the future. This invites reinforcement of long length fibres like 6 mm Short Cut Polyester Staple Fibres (SC PSF) in the stock for all those grades of paper wherein the key strength characteristics such as Tear, Bulk, Porosity, Folding Endurance, Stiffness, etc. are very important.

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Reliance Industries Ltd., has recently started production of this specialty fibre in India's most modern petrochemical Complex at Hazira and supplying it to the Paper Industry.

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