

Short Cut Polyester Staple Fibres for Papermaking

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ABSTRACT

Reliance Industries Limited have developed in their Reliance Technology Centre, Short Cut Polyester Staple Fibres (SC PSF) as a promising reinforcing additive to pulps for improved quality of paper. Essentially SC PSF is a speciality polyester fibre having fine diameter and 6 mm cut length.

The agro-residues like bagasse, rice straw, wheat straw, etc., and waste paper constitute about two thirds of the total raw materials for papermaking in India. The quality of paper produced from agro-residues and waste paper is inferior to paper produced from standard wood pulps due to the short fibre lengths. In order to improve paper properties such as tear strength, bulk, porosity, etc. There is a need for reinforcement additive, such as SC PSF.

It has been observed that addition of 2-5% 'Recron' SC PSF to cellulosic pulps leads to a significant improvement in paper properties. The tear improvement in paper is substantial and it ranges from 10% to 65% depending on the type of pulp.

The ease of addition of 'Recron' SC PSF to the stock in machine/blending chest and its compatibility with all the stock preparation additives makes it more flexible to use along with different stocks for specific end products. Added advantages of 'Recron' SC, PSF include faster drainage, less wet-web breaks, faster drying of paper, greater thickness (low density) papermaking and improved runnability.

The present paper reviews the results of laboratory scale demonstrations and plant scale trials with the use of SC PSF in various paper mills. The plant trials were carried out with an objective of assessing both the product & process benefits of using 'Recron' SC PSF on a commercial production machines installed in the paper industry today.

Reliance Industries limited have established the production facilities for 'Recron' SC PSF in its most modern petrochemical complex at Hazira and is now offering the product to the Pulp & Paper Industry.

RATIONALE

The Pulp & Paper Industry is one of the core industries linked to basic human needs. The major long term concern for the growth of this industry is the sustained availability of good quality fibrous raw material sources. The present condition of the forest resources in our country is leading to acute short

supply of the conventional pulping raw materials such as bamboo and woods. This scarcity of traditional raw

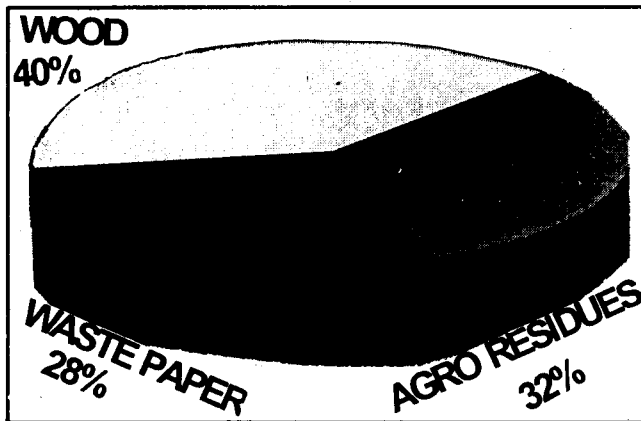
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Figure-1

TYPES OF RAW MATERIAL



materials is forcing the industry to rely on agricultural residues like bagasse, rice straw, etc. and waste paper.

If we look at the present scenario for papermaking raw materials, the agroresidues and waste paper constitute a major portion about 60% of the total raw material consumption (Figure-1). The use of these alternative renewable raw materials is likely to increase further. The use of recycled paper pulp is also increasing due to both the shortage of conventional raw materials and environmental concerns.

The quality of paper produced from agro-residues and waste paper is inferior to paper produced from standard wood pulps due to the short fibre lengths. In order to improve paper properties such as tear strength, bulk, porosity, etc. There is need for a reinforcement additive, such as SC PSF.

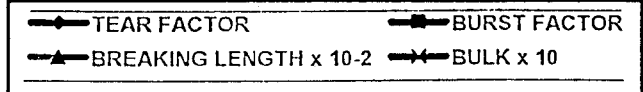
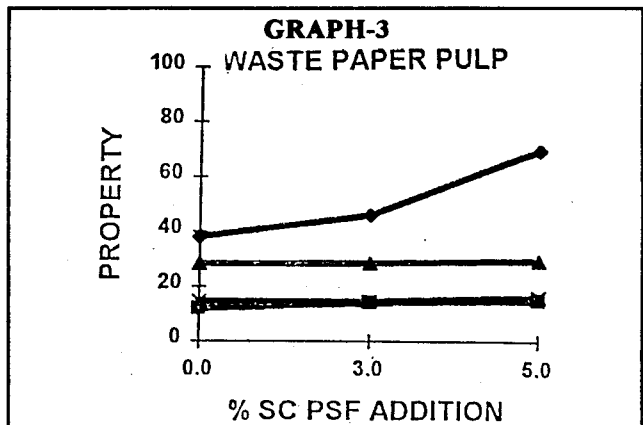
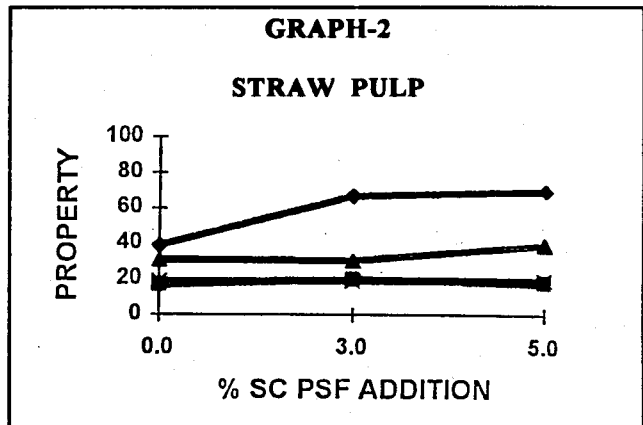
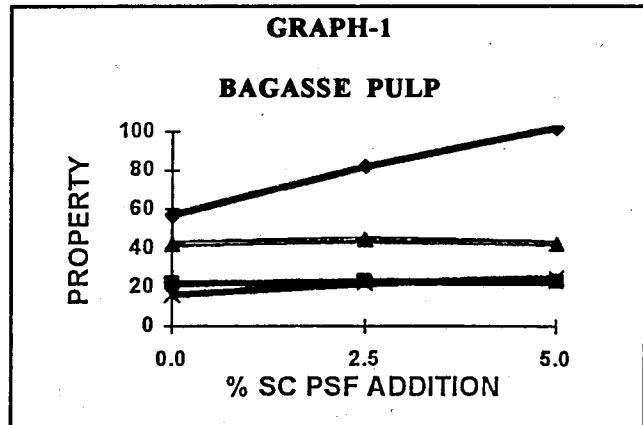
IMPACT OF 'RECRON' SC PSF ON PULP PROPERTIES

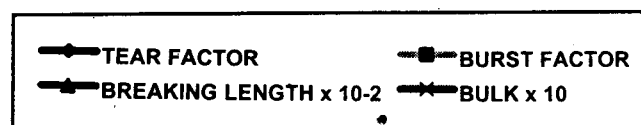
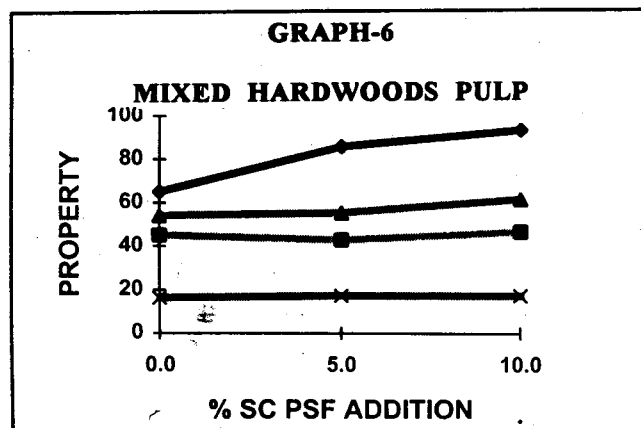
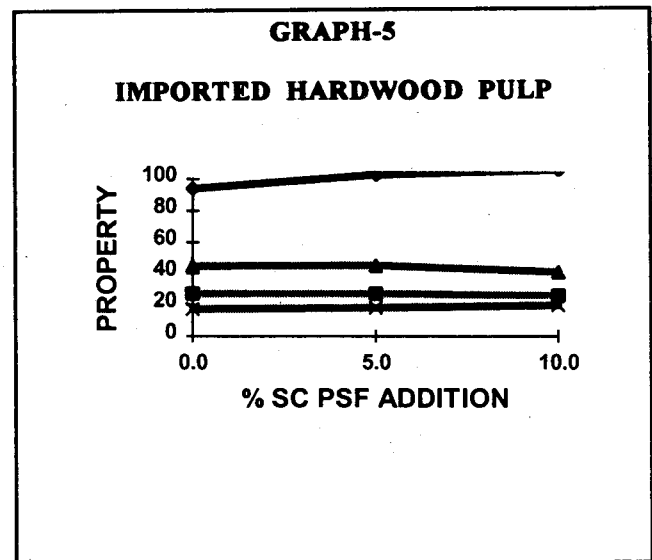
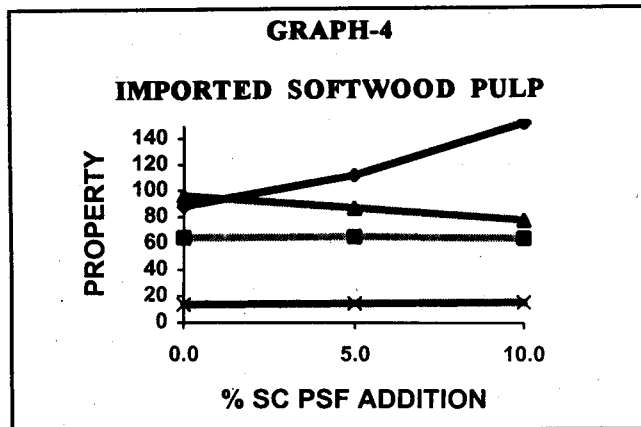
The effect of the amount of Short Cut Polyester Staple Fibres (SC PSF) in the pulp on paper properties has been studied using various cellulosic pulps. The scope of the study in terms of the type of pulps and range of paper properties is summarised below:

Pulps	Paper properties
* Bagasse	* Tearing strength
* Waste paper	* Bursting strength
* Straw	* Breaking length

- * Imported softwood
- * Imported hardwood
- * Mixed hardwood
- * Double folds
- * Porosity
- * Caliper

The dependence of the key paper properties on the amount of SC PSF addition (2.5% to 10% on pulp) is illustrated in Graph Nos. 1 through 6.





EXPERIMENTAL EVIDENCE

Laboratory trials with SC PSF-Mill pulp blends were successfully conducted in 19 paper mills. The key paper grades identified for SC PSF reinforcement and the various kinds of pulp furnishes studied in different paper mills to make these paper orders are summarised in Table 1.

The property improvement in Newsprint and Writing & Printing papers has been shown in Graphs 7 and 8.

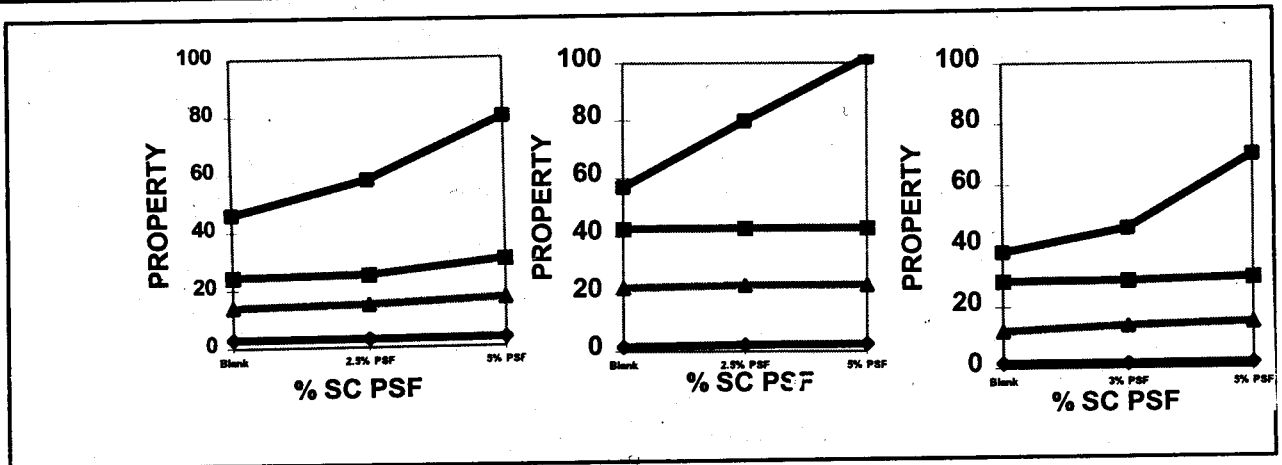
Table - 1

PAPER GRADE (gsm)	PULP	No. OF MILLS
Newsprint (45, 49)	Bamboo/wood/Chemical Pulp	1
	Bagasse pulp	1
	Waste Paper Pulp	2
Writing and Printing (43-60)	Bagasse/wood/Eucalyptus	7
	Straw Pulp	2
	Waste Paper Pulp	1
Kraft/Packaging (80-180).	Bagasse/Waste paper	1
	Waste paper pulp	1
Paperboards (100-450)	Waste paper pulp	3
	Total No. of Mills	19

GRAPH -7

PROPERTY IMPROVEMENT IN NEWSPRINT

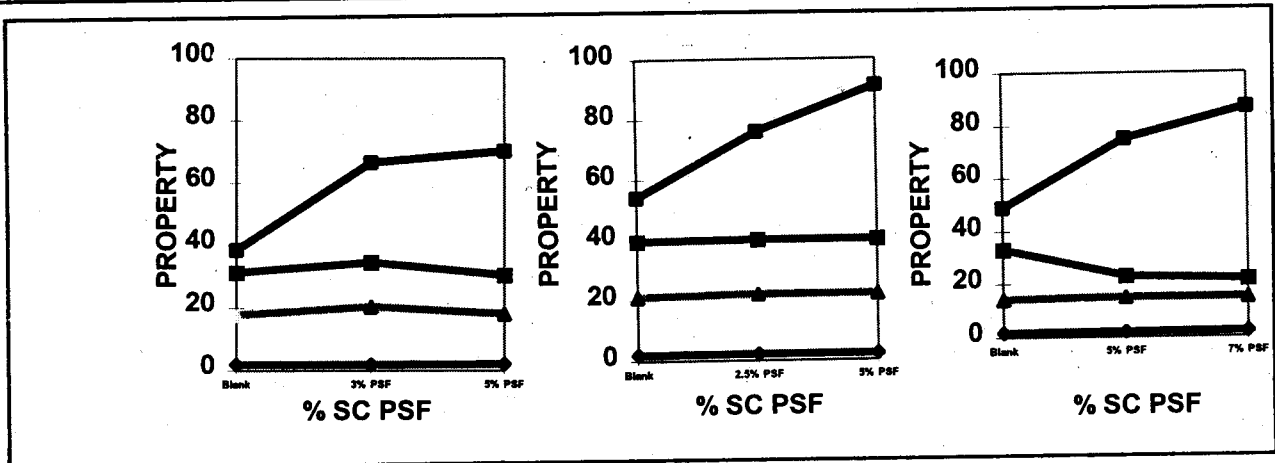
	<u>Mill -A</u>	<u>Mill-B</u>	<u>Mill-C</u>
Furnish	60% CSRMP 22% Bamboo/Wood/Chem. Pulp 18% CTMP	100% Bagasse Pulp (Chemical and CMP)	100% Waste Paper Pulp
Pulp Freeness. °SR	48	54	48



GRAPH -8

PROPERTY IMPROVEMENT IN WRITING & PRINTING PAPERS

	<u>Mill -A</u>	<u>Mill-B</u>	<u>Mill-C</u>
Furnish	100% Straw Pulp	75% Bagasse Pulp 15% Long fibre pulp 10% Eucalyptus pulp	100% Waste Paper Pulp
Basic Weight, gsm	43-45	53-60	45-60
Pulp Freeness. °SR	58	46	40



The effect of SC PSF at 5% addition to different pulp furnishes on Tear and Bulk Properties are given in Table-2.

SC PSF-pulp blends in paper mills following conclusions are drawn:

Table - 2

Sr. No.	Pulp Furnish	Tear Factor		% Tear Improvement	Bulk, cc/g		% Bulk Improvement
		Without SC PSF	With 5.0% SC PSF		Without SC PSF	With 5% SC PSF	
1.	Bagasse+Straw	44.0	69.0	57	1.7	2.3	36
2.	Straw	51.4	92.6	80	1.6	1.8	13
3.	Bamboo+Wood	46.0	79.0	72	2.8	3.2	13
4.	Waste Paper	49.0	87.0	78	1.8	2.1	16
5.	Hardwood+Waste Paper	71.0	96.0	35	1.8	2.3	24

PLANT TRIALS

Plant scale trials with SC PSF have been successfully conducted on selected grades of paper made from ago-residues and waste paper in 4 paper mills. Six more paper mills are keen to conduct the plant trials in the near future. The actual plant trial results are summarised below in Table-2.

RESULTS

Based on the laboratory & plant scale trials with

PROPERTY ADVANTAGES

Addition of 2-5% 'Recron' SC PSF to cellulosic pulps leads to an outstanding improvement in paper properties:

- Increase in Tear strength by 10% to 65%
- Increase in Bulk by 10% to 30%
- Improvement in Porosity by 10% to 20%

Table-2

Sr. No.	Name of the Mill	Grade of Paper	% SC PSF Addition	% Tear improvement
1.	Hindustan Newsprint Ltd., Newsprintnagar, Kerala	- Newsprint	2.0	10-25
2.	The Mandya National Paper Mills Ltd., Belgula, Karnataka	- Writing & Printing - Kraft/Packaging	5.0 5.0	30-35 60-65
3.	Pudumjee Pulp and Paper Mills Ltd., Pune	- Specialty	3.0	40-45
4.	Mukerian Papers Ltd., Mukeria, Punjab	- Writing & Printing	3.0	15-25

- Tensile, Burst and Folding strength remain comparable to 'control' without SC PSF.

'Recron' SC PSF addition for property improvemnet is more effective when used with 'Low quality' short fibre length pulps.

PROCESS ADVANTAGES

Along with the property improvement in paper, the use of 'Recron' SC PSF offers following process advantages:

- Faster drainage
- Less wet-web breaks
- Faster drying of paper
- Greater thickness (low density) papermaking possible
- Improved runnability

The experimental evidence on the process advantages mentioned above are with respective paper mills where the plant trials have been conducted and the same were not quantified by Reliance Technology

Centre.

The use of 'Recron' SC PSF as a reinforcing additive to pulps shall certainly help the papermakers to replace the long fibre component, if present in their furnish, and manufacture high tear, long life end products.

Parallel to the above developments, Reliance Industries Limited have established commercial production of 'Recron' SC PSF.

MARKET TRENDS

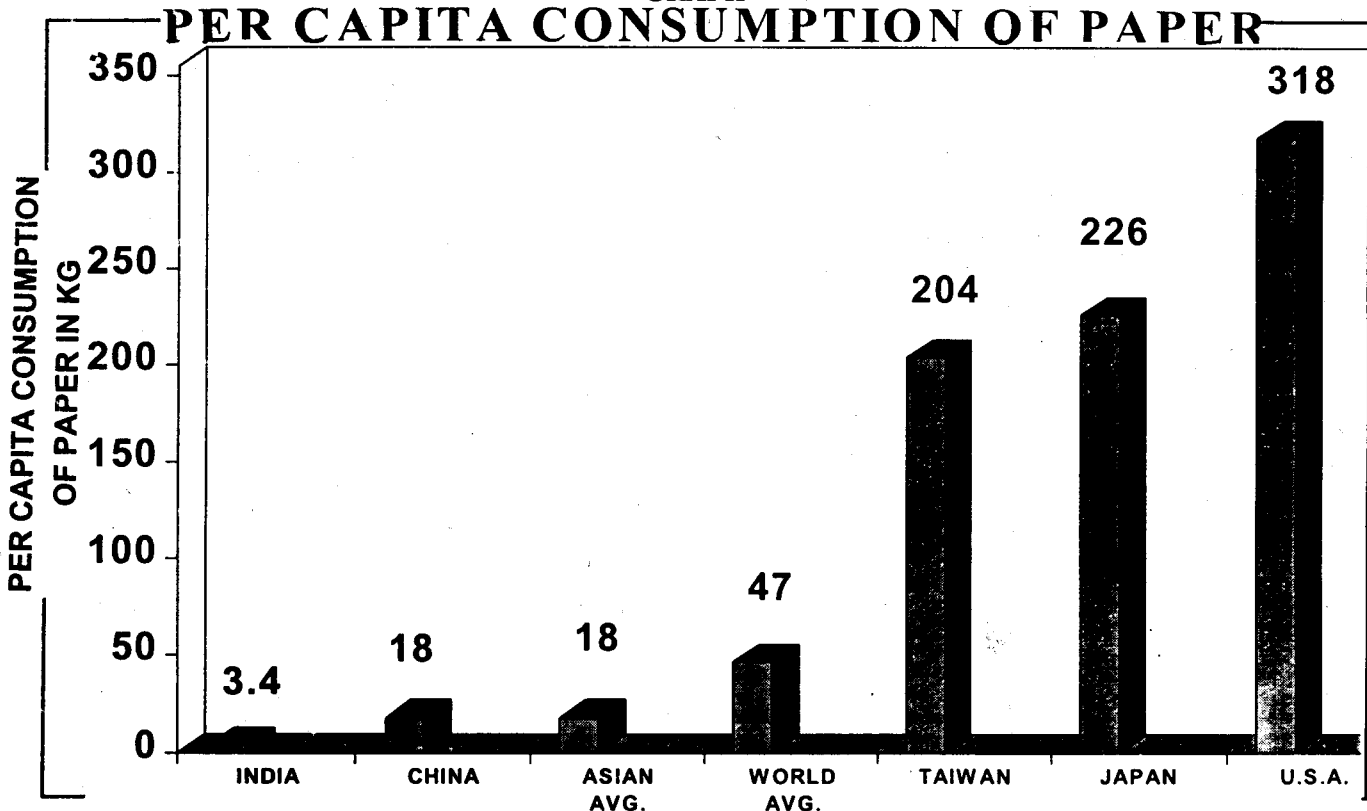
India has been way behind in per capita consumption as against key countries in the world. With economic liberalisation, It indicates huge potential for growth in India.

Demand for paper in India has been growing @ 7.5% per annum. 'SC PSF' can be used to substitute scarce pulp and improve paper quality at the same time.

COST BENEFITS

- Higher productivity through better runnability
- Low production cost due to higher speeds
- Higher sales realisation due to low 'gsm'

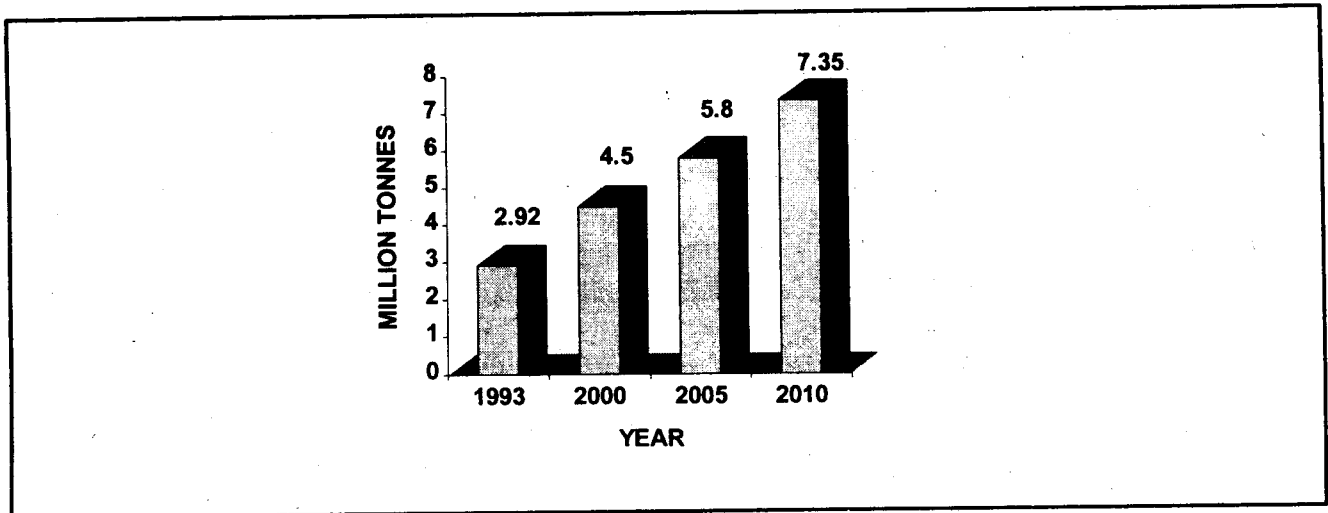
GRAPH-9



(Source : InPaper International, Vol. 2, Dec.-1997, "Status of the paper industry and its future growth potential"-By Mr. Arun G. Bijur)

Graph-10

Paper Demand Forecast (India)



(Source : InPaper International, Vol. 2, Dec.-1997, "Status of the paper industry and its future growth potential"-By Mr. Arun G. Bijur)

- Low raw material cost due to more filler addition
- Substitute for expensive imported pulp

RIL IN CONTEXT

- 'Recron' Short Cut Polyester staple fibre : 1.5 denier x 6 mm

Physico-Chemical Properties

Breaking strength	: 7.0-9.0 g
Elongation at break	: 25%-35%
Relative wet strength	: 100%
Fibre shrinkage 196°C/30'	: 5% (max.)
Fibre shrinkage 100°C/30'	: < 1.0%
Softening/bonding temperature	: 210°C
Melting temperature	: 245°C
Moisture content (dry@ 20°C, 65% RH)	: 0.4%

(Good resistance to acids, alkali, oxidising agents and conventional organic solvents)

- Packing : 25 kg plastic bags
- Raw material : Own
- Customer services : Process support, Product development & Process studies at Reliance Technology Centre
- Regional network : All over India
- World ranking : 5th largest in Polyester

ACKNOWLEDGEMENTS

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We also extend our thanks to the paper mills who have co-ordinated with us for conducting plant trials with 'SC PSF'.

CITATION

1. In Paper International, Vol. 2, Issue - 2 Dec., 1997.