AUTHOR'S PROFILE

- Dr. S. Arockiasamy is working as DGM (QC, R&D and ENV), Seshasayee Paper and Boards Limited, Unit: Tirunelveli, TN.
- Did his Doctorate in Environmental Toxicology and Master Degree in Environmental Sciences.
- Completed Master degrees in Education and Business Management too.
- Has 26 years of Industrial experiences in Environment, QC and R&D and 2 years of teaching experience in higher education.
- He has published 26 research papers in National and International Journals

RECYCLED FIBRE IN HIGH GRADE WRITING AND PRINTING PAPER MANUFACTURE

Dr. S. Arockiasamy, V. Sunderesan and R. Pitchai

SESHASAYEE PAPER AND BOARDS LIMITED
UNIT: TIRUNELVELI

SESHASAYE PAPER AND BOARDS LIMITED (SPB)
UNIT : TIRUNELVELI

- Established in 2009 by M/s. Subburaj Groups
- SPB acquired in 2011
- RCF and Ready pulp based
- Current production 90,000 TPA
- Certified under ISO 9001, ISO 14001 & OHSMS 45001 and FSC

CONCEPT OF "RECYCLING"

Recycling is an `**ecofriendly**' environmental practices which reduces the utilization of natural and environmental resources, resulting "**reduced environmental stress**".

SUSTAINABLE DEVELOPMENT STRATEGIES ON "RECOVERED PAPER (RP) RECYCLING"

1. Socially desirable

- Increasing annual global **production**
- **Consistent CAGR** of 4% (P&P) and 4.8% (WP) from 2023 to 2032.
- More emphasise from **Govt for the recycling of WP**
- **Statutory** - Import of waste paper shall be managed accordance with the provision of PWM Rules, 2018

SUSTAINABLE DEVELOPMENT STRATEGIES ON "RECOVERED PAPER (RP) RECYCLING"

2. Economically viable

- Recycling of recovered paper is an integral part of pulp and paper in **fibre supplementation**.
- Substituting recovered fibre in paper making **reduces energy costs**
- Recovered paper recycling takes part in Active **Circular Economy.**

SUSTAINABLE DEVELOPMENT STRATEGIES ON "RECOVERED PAPER (RP) RECYCLING"

3. Environmentally sustainable:

- Thrown away papers liberate GHG during its decomposition – **Paper making eliminates GHG** emissions especially CH4 and CO2.
- Recycling is a prominent **alternate for the crisis of climate change.**

SUSTAINABLE DEVELOPMENT STRATEGIES ON "RECOVERED PAPER (RP) RECYCLING"

4. Physically Retrievable

- Collection of RP from pre-consumer waste (conversion units, printing sectors etc.,) and post-consumer waste (offices, institutions) and from MSW - is a **defined process**
- Waste paper collection and supply is **a well established trade**; about 70% used papers are recovered annually

INTERNAL STANDARDS OF WRITING AND PRINTING PAPER GRADES

W & P Paper Grades	Brightness (% ISO)	ERIC Values (ppm)	Breaking Length ratio (MD/CD)	Fluff (mg/1000m)	Dirt Count (% uncertainty)
Non Surface Sized (NSS)	86 - 88	25 - 30	1.95	50 - 60	23
Surface Sized (SS)	89 - 90	9 - 12	1.87	30 - 40	27
Copier (Virgin)	93 - 94	3 - 5	2.0	25 - 35	39
Copier (RC Grade)	92 - 93	30 - 35	2.0	30 - 40	31

SOURCE OF RECOVERED PAPER

- RCF raw material mix for high grade writing and printing paper manufacture are **primarily printed and unprinted high grade white waste papers** such as
  - ✓ Sorted office paper (SOP) - *Imported*
  - ✓ Magazine (MG) - *Indigenous*
  - ✓ Sorted white ledger (SWL) - *Imported*
  - ✓ Flyleaf shavings (FLS) - *Imported*
  - ✓ No. 1 cuttings from printing press (NC) - *Indigenous*
  - ✓ White record (WR) - *Indigenous*
- Collected from conversion units, printing sectors and offices through designated agencies.

RECOVERED RAW MATERIALS

Sorted Office Paper (SOP)

White Record (WC)

Sorted White Ledge (SWL)

No. 1 cutting (N1C)

Fly leaf shavings (FLS)

Magazines (MG)

RCF PULP QUALITY OF DIFFERENT RAW MATERIAL - LAB TRIALS

Grades of Recovered Paper	Brightness (% ISO)		ERIC value (ppm)		Break-ing Length (m)	Tear Factor	Ash (%)		Yield (%)
	Initial	Final	Initial	Final			Initial	Final	
Sorted Office Paper (SOP)	72 - 74	81 - 83	500 - 600	85 - 100	2650 - 2950	32- 36	20 - 23	4 - 6	65
Magazine (MG)	65 - 66	75 - 78	550 - 650	100-120	2000-2300	28 - 30	30 - 35	10- 15	60
Sorted White Ledger (SWL)	75 - 76	85 - 90	400 - 500	25 - 40	2800 - 3050	30 - 32	20- 22	5-6	75
Fly Leaf Shavings (FLS)	68 - 70	84 - 87	450 - 550	120-140	2750 - 3000	32 - 34	20 - 22	5 -6	72
No.1 Cuttings (N1C)	79 - 81	86 - 90	100 - 150	10 - 20	2900 - 3200	60 - 64	10 - 15	3 -4	85
White Record (WR)	64 - 66	77 - 80	550 - 650	95 - 120	2850 - 3020	55 - 60	10 - 13	3 -4	68

Selection of Recovered Paper for De-inking

% RECOVERED PAPER USAGE IN DEINKING; WITH PULP QUALITY & YIELD

Grades Recovered Paper & RCF pulp quality	Year				
	2018 – '19	2019 - '20	2020 -'21	2021 -'22	2022 -'23
(SOP) Sorted Office Paper (%)	80	80	80	75	60
(MG) Magazine (%)	10	5	5	0	0
(SWL) Sorted White Ledger (%)	5	5	5	5	0
(FLS) Fly Leaf Shavings (%)	5	0	0	0	0
(N1C) No.1 Cuttings (%)	0	5	0	0	0
(WR) White Record (%)	0	5	10	20	40
Initial Brightness (% ISO)	66 - 68	68 - 69	66 - 68	65-67	65 - 66
Final Brightness (% ISO)	79 -81	80 - 82	80 - 82	81 – 83	80 - 82
Final ERIC Value (ppm)	55 - 60	52- 55	50 - 55	50-55	52- 55
Yield (%)	63	65	65	66	66

RECOVERED PAPER MIX FOR DEINKING

Findings

- Use of **SOP at 60 to 80%** as major raw material mix.
- SOP's **availability, cost and quality** such as high brightness (81 - 83%), good yield (65%), moderate ERIC content (85 - 100 ppm), low ash **promote maximum SOP use**
- **White record (WR)** addition in 2019-20 at 5% and consistently increased to **40%** in 2022-23.
- 77 to 80% brightness and 95 to 120 ppm ERIC achieved in WR-RCF pulp along with 68% yield - **2nd largest raw material mix.**
- **Combined SOP and WR** producing RCF with 82% brightness and low ash (<5%) - **suitable for W & P grade**

RECOVERED PAPER MIX FOR DEINKING

Findings :

- **SWL** provides **highest brightness** 85 – 90%, **highest yield** 75% and **lowest** ERIC 25 to 40 ppm. Availability and cost denied SWL mix.
- FLS gives 84 to 87 % bright, 72% yield and **ERIC 30 - 50 ppm**.
- N1C gives 80 to 82 % bright, 85% yield and **ERIC 10 to 20 ppm**
- **SWL, FLS and N1C** are also considered as **good raw materials** wrt **quality and yield**. Low availability and high cost are concern.
- SWL, FLS and N1C considered as an **optional mix for copier**.
- **Magazine** (MG) addition 5 to 10% gives **75 to 78% brightness**; 100 to 120 ppm ERIC and **60% yield**.
- **High ash content** (>30%) of MG **discourage** the mill to use as a regular furnish.

PERFORMANCE OF 'SOP' AND 'WR' IN TWO LOOP DE-INKING PROCESS

Raw material : 60% SOP and 40% WR					
Processes	**Accepts' quality**			**Rejects**	**Chemicals used**
	Brightness (ISO%)	**ERIC (ppm)**	**Yield (%)**		
Pulping	67 - 68	450-500	97	Plastics, metal, filler & outthrows	Na_2SiO, NaOH and Surfactant
Pre floatation	69 - 71	300-350	76	Ink & filler, stickies	H2O2, NaOH and surfactant
Oxidative brightening	70 - 72	150-200	74		
Post floatation	75 - 78	60-100	66	Ink & filler (sludge) and water	Sodium hydrosulphite (Na2S2O4)
Reductive brightening	80 - 82	55 - 60	66		
RCF - Pulp	**80 - 82**	**52- 55**	**66**		

RECOVERED PAPER PROCESSING

WP Feeding

Pulping

Plastic separation

RCF Pulp

SELECTION CRITERIA OF RECOVERED PAPER FOR MAKING HIGH GRADE WRITING AND PRINTING PAPER

- **Long fibrous, wood free, high bright and low ash** waste paper
- **Free from kraft, newsprint** (mechanical) and Internally sized **colour** material
- **Minimum plastics** content (< 2%), moisture (<10%) and out throw (< 3%)
- **Less fine fibre and lifeless** materials
- **RCF pulp** manufactured should **facilitate** higher end writing and printing paper quality

"RCF" CONTENT IN DIFFERENT GRADES OF PAPER

Writing & Printing Paper Grades	RCF in Furnish (%)	Brightness (% ISO)	ERIC Values (ppm)	Breaking Length ratio (MD/CD)	Fluff (mg/1000 m)	Dirt count (% Uncertainty)
Non Surface Sized (NSS)	20 - 25	86-88	25 - 30	1.95	50 - 60	23
Surface Sized (SS)	15 - 20	89-90	9 - 12	1.87	30 - 40	27
Copier (Virgin)	Nil	93 - 94	3 - 5	2.0	25 - 35	39
Copier (RC Grade)	28 - 32	92 - 93	30 - 35	2.0	30 - 40	31

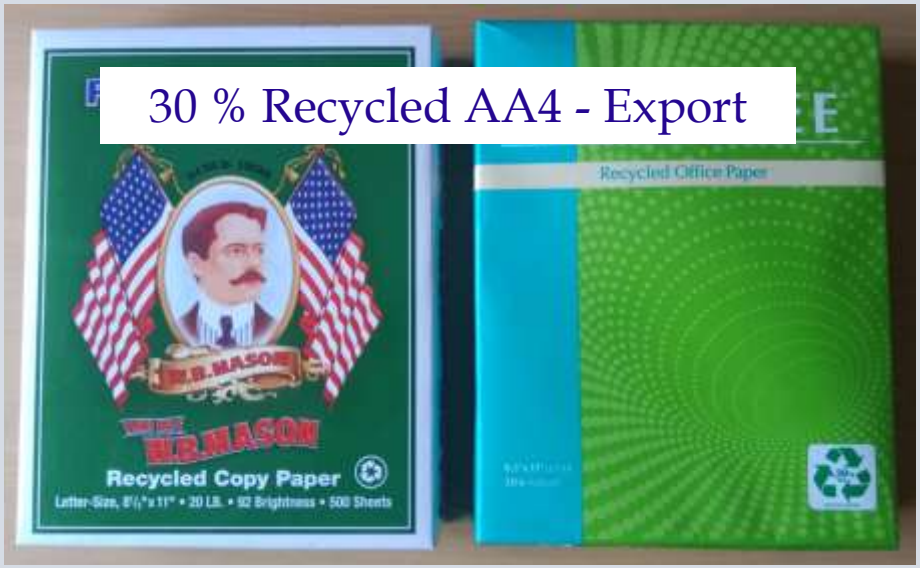
Standard for % uncertainty on dirt is >10

IMPACT OF RCF FURNISH ON HIGH GRADE W&P PAPER

Findings :

- DIP / RCF production **optimized** with **60% SOP and 40%WR**
- **NSS** have been optimized with **20 - 25% RCF** mix for 87±1%brightness with BL ratio of 1.9 – 1.95.
- **15 - 20 % RCF mix in SS** verities ensure the brightness level 90±1% and BL ratio as 1.85 – 1.9
- **30% RCF mix in high bright copier (**export) optimized for 92 to 93% brightness and BL ratio around two.
- **ERIC** value has been fixed as **< 30 ppm in NSS**; **< 12 ppm in SS** and **< 35 ppm in copier** grades
- % uncertainty on **dirt count** in NSS >23, SS >27 and in recycled copier >31 are within the customer perception
- **"RCF"** in paper **increases the paper breaking length** by 5%

FEW OF THE COPIER GRADES



"SUSTAINABILITY CHECK" ON RECYCLING

Desirability :

- Up to **30% of RCF mix** can be used in making high bright Copier grade
- Most of the Importing countries are **specific on RCF mix in paper**

Economic viability :

- Pulp **cost is low** when compare with virgin
- **Premium price for 30% recycled** export grade copier
- **Sludge and plastic wastes disposals** are the direct benefits under **circular economy**
- **High organic load** by DIP operation results good biogas generation and **reduction of fuel cost** in co-generation

CIRCULAR ECONOMY

Biogas plant

Biogas burning in Boiler

Plastic wastes to co-processing in Cement kiln

DIP sludge to Board units

"SUSTAINABILITY CHECK" ON RECYCLING

Environmental Sustainability :

- **Reduction in virgin pulp** consumption to the extent RCF supplemented.
- Prevention of **Biodegradation and GHG emission**
- Recycling of **1 ton RCF pulp saves 2< tons** of wood.
- 70% **Less energy** and 98% **less water**.
- Opportunity for **income and employment** generation

Retrievability

- Scrap contract and Engaging agents for systematic collection - ensures retrievability.

CONCLUSION

- **Combined SOP (60%) and WR (40%)** are capable of producing RCF with brightness (82%) and low ash (<5%), and suitable for high grade writing and printing paper
- High ash content (>30%) and low brightness (<78%) of MG **may not be a suitable option** for writing and printing grade.
- RCF pulp mix (**SOP 60% and WR 40%**) in the paper furnish suggest 20 - 25% for NSS; 15 - 20 % for SS and 28 - 32% for copier grade.
- RCF mix **increases the paper breaking length** by 5%
- Recovered paper recycling promotes social desirability, encourages economy and improves environmental sustainability

Thank you