

Efficient and Environment Friendly Paper Making – Value Addition by Forming Fabric and Case Studies

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Indian Paper industry – Present scenario:

The Indian paper industry plays a significant role in the nation's economy with a turnover of more than 50,000 Crore of Rupees. The Indian paper industry ranks sixth among the energy intensive industries and occupies 15th position among the top global paper producers. Acute shortage of Raw materials and issues concerning environment and high cost of basic inputs has resulted in lowering of the operational capacities. The sum of capacity is around 17.1 million tons in 2017 -18. India's share in globe paper production is about 2.6%. The industry is fragmented with over 750 paper mills of which only 50 mills have a power of 50000 TPA or more. The manufacturing is working at 89 % capacity utilization.

The demand is projected to boost to around 20 Million tons in 2020 and 23.5 million tons by 2024-25. Indian paper industry market segmented as Packaging (46%), Writing & Printing (32%), Newsprint (18%) and Specialty (4%) with the raw material used as Recycled (65%), Virgin (24%) and Agro-residue (11%).

India has emerged as the fastest growing market when it comes to consumption, posting 10.6% growth in per capita consumption of paper in 2017-18, reveals the ASSOCHAM paper.

However, in most of the studies, it is observed that Indian paper industry is expected to grow from 8% to 10% in next 5 years.

Growth drivers:

Long term prospects of the Indian paper industry appear bright, with the education sector, heightened economic activity and changing lifestyles of Indians to accelerate future consumption. To elaborate, consumption will be driven by increasing consumerism; increased government allocation to the education sector, increase in private sector participation and expected expansion of e-commerce market. The sector continues to face several challenges which need to be addressed in order to spur the industry's growth. It is expecting paper consumption to grow by an average annual growth rate of 8%-10% during FY16-19. The mismatch between domestic demand and supply is likely to continue for the forecasted period where the deficit will continue to be met by imports.

It is found the projected growth rate @ 10% in Kraft & Packaging grade whereas @5% in Writing & Printing segment.

Table.1 – Projected market growth of Indian Paper industry (Ref: Care rating) (In Lakh MT)

S No	Paper grade	15 - 16	16 - 17	17 - 18	18 – 19 (P)	19 – 20(P)
1	Kraft	43.60	47.73	52.30	57.43	62.88
2	Writing & Printing	46.38	48.68	51.10	53.65	56.32
3	Paper Board	31.42	34.36	37.73	41.31	45.20
4	Specialty	2.09	2.13	2.17	2.21	2.25
5	Tissue	1.14	1.33	1.55	1.80	2.09
6	Newsprint	25.40	25.99	26.60	27.22	27.85
Total		150.03	111.54	171.45	183.62	196.59

Industry challenges:

The raw material consumption pattern has changed drastically over the last four decades due to availability, cost and environmental factors. While on one side the cost of wood and waste paper has increased in India, there is an availability of agricultural residue with limitations of proper collection and handling.

Apart from the raw material, the following are the additional challenges faced by the paper industry:

- Inadequate new technology & low level of modernization of mills
- Environmental issues related with water
- Higher energy costs

SWOT analysis of Indian Paper Industry:

Competitive strengths

- Large and growing domestic paper market – scope for improvement

- Know-how in non wood pulping and applications
- Well developed printing industry
- Local market knowledge

Competitive weaknesses

- Fiber shortage, especially virgin wood fiber and poor collection of waste paper
- Small and fragmented industry structure
- Difficult in attracting highly skilled manpower
- Increasing Environmental regulatory norms especially for pulp mill integrated industries
- Infrastructure, high transportation cost
- High energy costs

Competitive opportunities

- Domestic market potential
- Modern, world scale paper machine would be cost competitive in most grades
- Forest plantation potential
- Integrates of combined wood and agro based papermaking
- Government literacy program – increasing demand for printing/writing papers
- Low labor costs (allow e.g. cost effective sorting of imported mixed waste)
- Export potential

Competitive threats

- Unprepared mills for international competition - both on price and quality
- Decline in capacity due to environmental pressures
- Decline in capacity as some of the segments/group of mills are unable to compete at national and international levels with respect to quality and cost of products.

Today’s Paper maker needs:

Now in Paper industry, the following are the requirements of paper makers to produce the paper at environmentally and efficiently by economically.

- Market emphasis on improvement of paper quality
- Improved paper surface due to modern printing technologies on all paper grades
- Efficient usage of less cost short fibers
- More filler addition to reduce input cost and improve paper properties.
- Lower basis weight and faster the machine speed

Hence to overcome the above-said issues, the solutions lie in New Generation SSB forming fabric with high drainage and increased Fiber retention to meet the requirement of economical paper making. The new concept of Forming fabric is well proven in Agro and recycled furnish, for efficient and environmentally paper making.

Forming fabric Properties & Effect on operation and Cost:

The basic properties of forming fabric like Drainage, Air permeability, Open area, Fiber support Index helped in the optimizing the cost of operation.

Table 2: Forming fabric properties & effect on Cost

Fabric Property	Effect on Operation	Effect on Sheet quality	Effect on Cost
Drainage (Air Permeability, Drainage Index, Surface Open area)	Power consumption & Draws	Formation Off-couch dryness Speed of the machine	- Energy cost - Efficient cost
Fiber Support Index	Cleanliness in return run	Wire mark Sheet release Porosity	- Fiber cost
Maximum Frame length	First Pass Retention Clear back water system Clean run of machine	Improved two sidedness Less fluff/linting Improved total retention Less ETP load on drained fines and fillers	- Fiber cost - Efficiency cost - Energy cost of ETP operation

Potential benefits of New design:

The following are the expected benefits:

- ✓ Improved retention helps in efficient use of fibers,
- ✓ Increased off-couch dryness thus machine runnability improved,
- ✓ Clean run due to less plugging by improved mechanical retention,
- ✓ Good sheet release due to fine surface of fabric,

- ✓ High drainage capacity with short forming available time (with increased speed)
- ✓ Reduced solid lost thus reducing ETP load with better sheet properties.
- ✓ Less shower pressure required due to free drainage holes
- ✓ Less vacuum requirement and less drive power required of Wire part due to good drainage & less sheet sealing.
- ✓ Improved paper surface with less wire/drainage marking for better printability.

The following figure 1 explains the demand of paper maker's and the solution with existing Single layer & new Generation fabric.

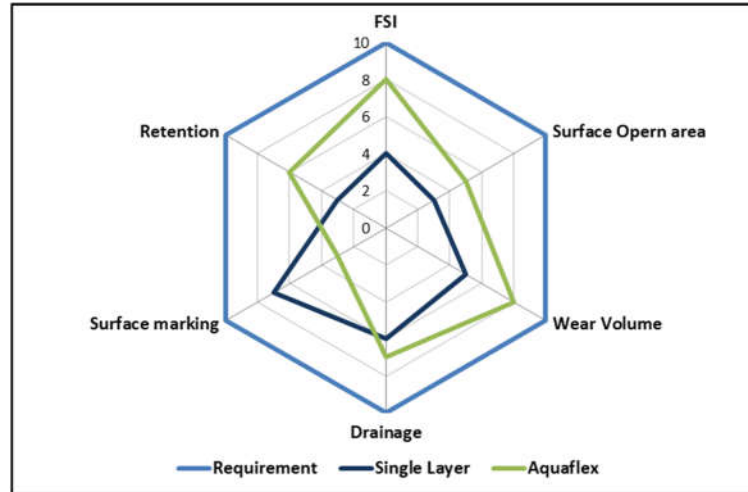


Fig. 1: Paper maker's demand and Solution

Laboratory analysis:

- ✓ The hand sheet former used to measure the drainage time taken for different design of forming fabrics which is used for Writing & Printing grade paper. 40 gsm sheets made with same consistency for measuring the time taken in seconds for standard Single Layer & New generation fabric (AQUAFLEX) designs.
- ✓ The following table shows the drainage time taken (in sec) for different type of forming fabric which is used for producing Writing & Printing papers:

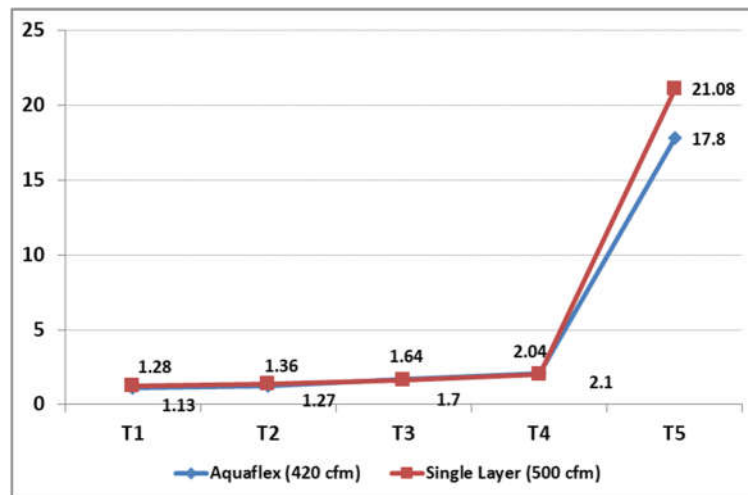


Fig. 2: Laboratory drainage analysis (Drainage time in Sec)

New generation fabric has the better free drainage capacity than the Single layer. It has less drainage time than the Single layer fabric with the standard pulp mixture.

Features:

The high drainage capacity of the fabric, will give better drainage like Single layer with the existing vacuum system on the machine. The increased fiber support points lead for improved first pass retention of fibers & chemicals. This fabric will require less shower pressure to keep the fabric clean to utilize the vacuum for drainage in the vacuum augmented zones. The top plain weave gives the better printability of the end product which is the most required by printing industries. The uniform drainage holes will give less drainage marks as compared to existing Single layer designs.

Table 3: Specification comparison of Single & New Generation fabric

	5 Shed Single Layer	AQUAFLEX
Drainage Area %	29.9%	45.80 %
Fiber Support Index	76	140
Air Permeability, CFM	500	420

The basic structure of new forming fabric explains(Fig.3) the plain top surface with finer warp and weft, which will not leave any mark on the paper and provide good sheet release from the wire part.

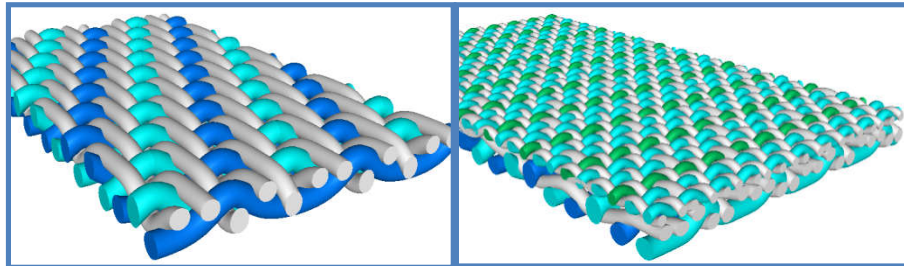


Fig. 3: Surface topography comparison of fabrics (Single Layer & New design)

Case Study # 1:

Objective of trial: Improved retention and drive load reduction.

Trial was conducted in the Fourdrinier machine making 44 to 90 GSM with 360 m/min. speed with Recycled furnish where previously single layer was used. The following benefits were achieved with the new design fabric.

- ✓ Higher First Pass Retention from 74.12 % to 78.88%.
- ✓ Higher First Pass Ash Retention from 42.93% to 51.16%
- ✓ Higher FPR yields less cost of fiber, high couch solids and thus less steam consumption.
- ✓ These improvements with reduced dosage of Retention aid chemicals.
- ✓ Drag load reduction by 7%
- ✓ Good printability by mark-free paper.

The cost analysis of the study shows the benefits as below:

- Fiber saving due to Fiber retention – **Reduced cost of fibers**
- Reduction in Retention aid chemicals – **Reduced cost of chemicals**
- Drive load reduction – **Reduced Energy cost**
- Improved off-couch solids– **Increased productivity by speed up the machine**
- Quality improvement of end product

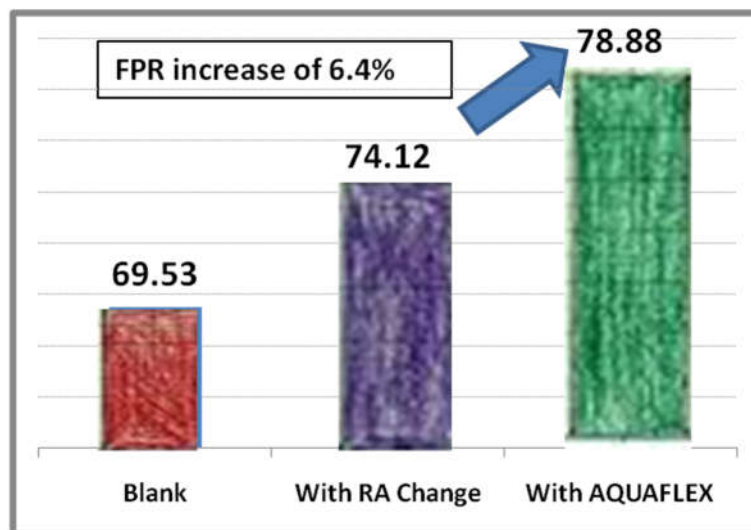


Fig. 4: First Pass retention increased by ~4.6% (i.e. 6.4% from previous data)

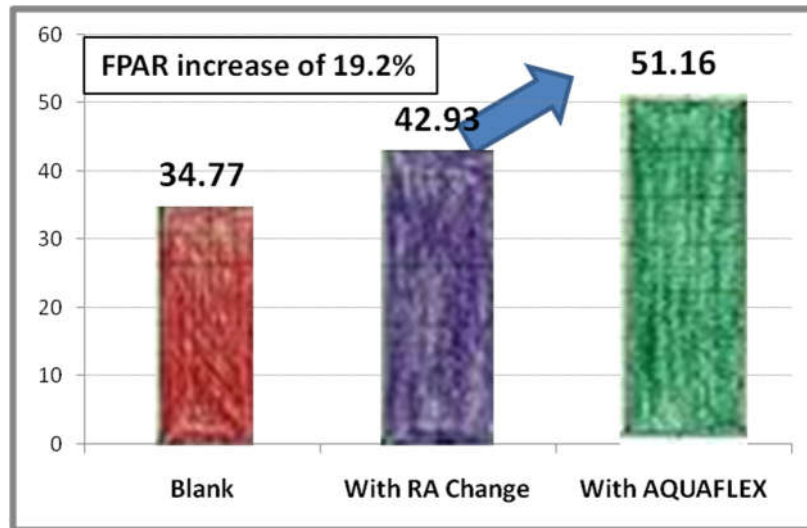


Fig. 5: First Pass Ash retention increased by ~ 8% (i.e. 19.2 % from previous data)

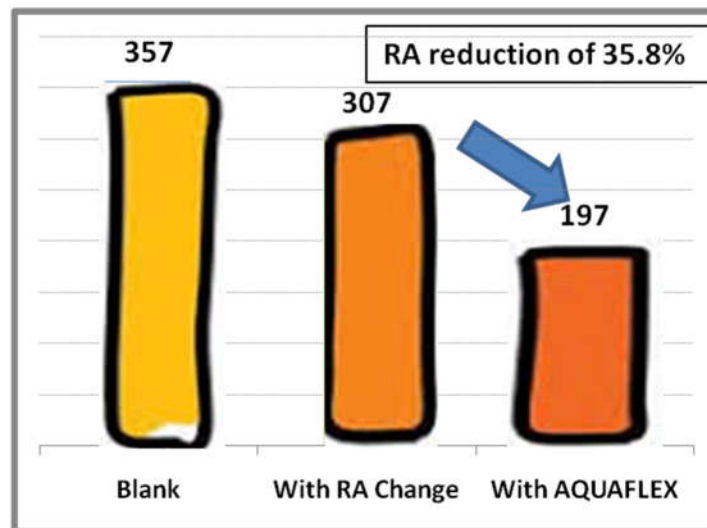


Fig. 6: Improvement achieved even after reduction of the Chemical by 35.8%

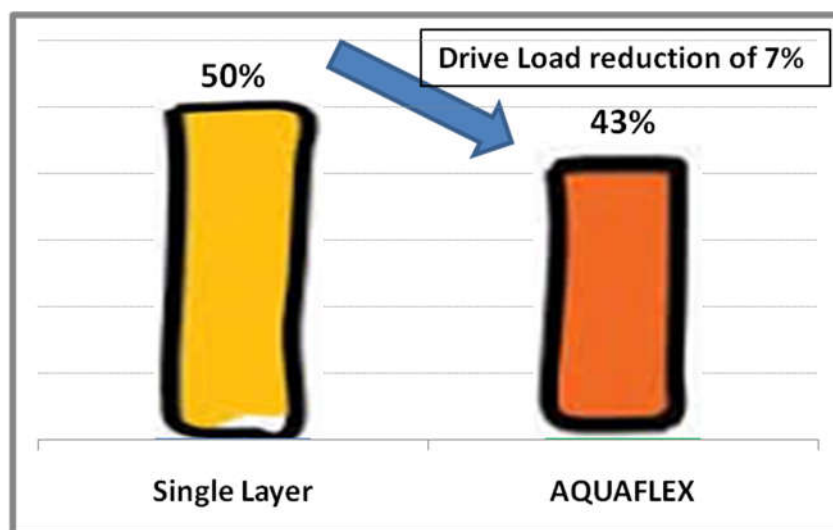


Fig. 7: Wet end drive power reduced by 7%

The following picture (Fig.8) shows the sample of paper produced. By comparing the wire marking, the paper made with Single layer shows distinct wire marking, whereas the paper made with New design fabric is not showing the marking.



Paper made with Single Layer



Paper made with AQUAFLEX

Fig. 8: Surface marking comparison

Case study #2

This trial conducted in the Fourdrinier machine making 44 to 90 GSM with 360 m/min. speed in Recycled furnish with the objective of

- ✓ Improved First pass retention
- ✓ Reduced back water ppm
- ✓ Reduced Drive load
- ✓ Improved formation by controlled initial drainage

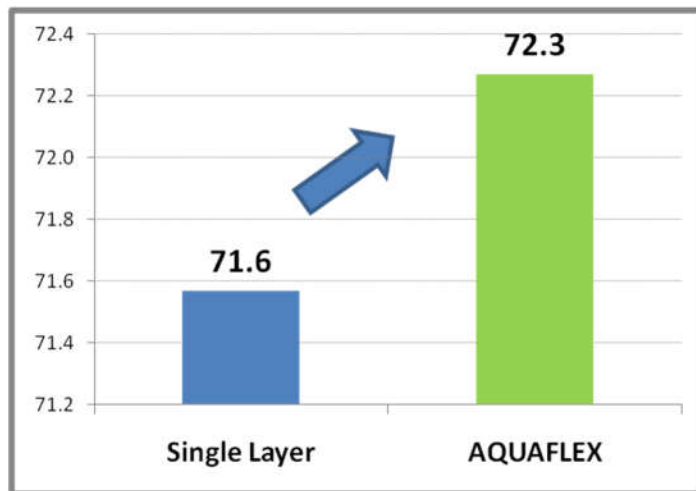


Fig. 9: First Pass retention Improvement

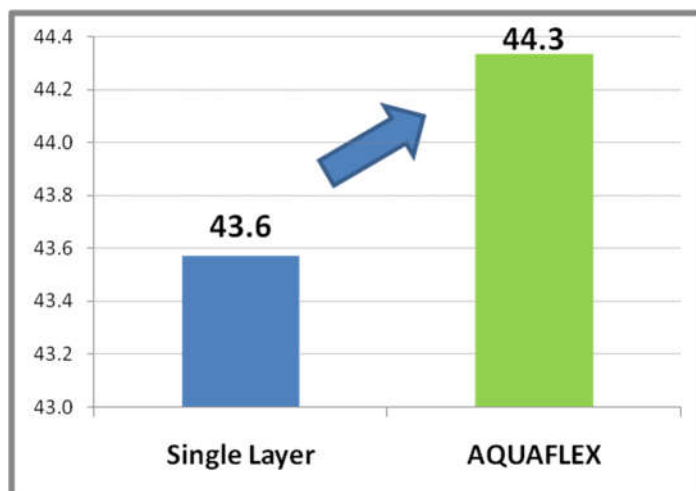


Fig. 10: First Pass Ash retention Improvement

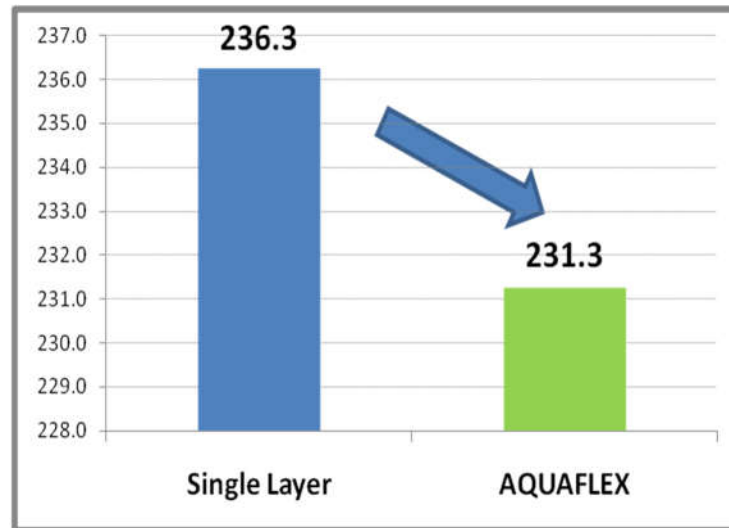


Fig. 11: Increased First Pass Ash retention by 0.7%

Result:

- Improved First Pass Retention & First Pass Ash retention
- Higher FPR yields less cost of fiber, high couch solids and thus less steam consumption.
- Improvement in FPR with same dosage of Retention aid chemicals.
- Drive load reduction

Conclusion:

Paper makers can produce paper in efficiently and environmental friendly by reducing cost of Operation and Quality improvement in the final paper making with the help of improvement in technology through 3 E's – Efficiency, Environment and Energy. The new forming fabric design will help in

- Improved First pass fiber & ash retention for improved paper finish and reduce the fiber cost
- Reduce Energy cost by reduced drive load & steam cost by increasing off-couch solids
- Improvement in machine runnability by reduced stickies with required drainage capacity to match with Single Layer forming fabric
- Reduce solid lost in forming section to reduce ETP load and clean back water system
- Necessity has come to improve quality and reduce cost of operation for success in competitive way to fulfill the demand of growth of Quality paper in India.
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