

AUTOMATION SOLUTIONS IN PROCESS, PRODUCTIVITY, AND QUALITY IN PULP & PAPER INDUSTRY FOR SUSTAINABLE PAPER MAKING



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Introduction:

India's first machine-made paper was manufactured in 1812. During this time there was 15 mills with total production of 1 lakh tons. At present there are around 800 mills with the total approximate production of more than 20 lakh tons. However, the low per capita paper consumption in India compared to world's average promises high growth of the sector in future. Moreover, the long-standing paper imports have been declining due to tremendous rise in the domestic production, which reflects that India has achieved self-sufficiency in paper and paper products over the years.

As per IPMA's (Indian Paper Mills Association) estimates, this industry contributes approximately Rs 4,500 Crore to the exchequer and provides employment to over 5 lakh people across approximately 800 paper mills. The broad characteristics of the industry are that it is capital, energy and water intensive and highly fragmented (small units account for ~60% of the industry size).

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

Technological Challenges:

As the Indian paper industry is largely fragmented with lower capacity with an individual paper mill, it is also prone to using outdated technology. Resultantly, it is estimated that both the raw material as

well as the power consumption is higher as compared to a modern paper mill. Adoption of new technology by domestic paper producers would lead to emergence of more competitiveness in critical areas including quantifiable increase in productivity, quality improvement with reduced cost, improvement in energy efficiency and better compliance with environmental protection legislation and safeguards for eco-sustainability of the products. The following chart showing the capacity-wise Indian paper mills.

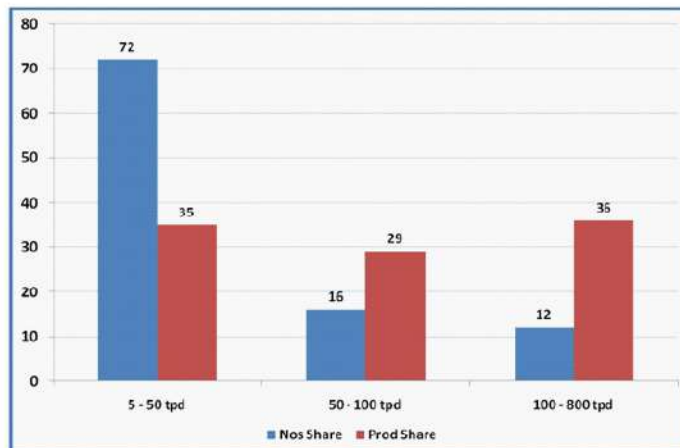


Figure 1: Indian paper mills – Capacity-wise & Production share

Why need of automation in Indian Paper Industry

Some of the reasons for need of automation are such as to achieve more with less, Elimination of human error, Cleaner Technology, Consistency of product, Minimize Energy consumption, Easy diagnosis of fault, Reduction in Resources, Reduction of Peak Loads, Reduction in Effluent, Environment Protection, Improve Safety and Health, Reduce Maintenance (Chemicals, water, energy etc), Reduce manpower, Data collection and consolidation, Effective application for Complex tasks, Trending and Report

generation, Reduce Errors, Increase Speed, Increase Productivity More automation equals more job capacity, shorter delivery times and optimized business operations, Reduced turnaround and fulfillment times add to overall productivity, Remove the Human Element against market standard job, Reduce Waste, Expand Capabilities -Automating all parts of the workflow will increase capacity, improve throughput and Optimize equipment use Workflow automation results in expanded capabilities and increased revenue.

Effect of Automation on Productivity

Automation affects the productivity in following aspects:-

- Increasing production by avoiding manual delays.
- Improving productivity by achieving the optimum efficiency of the machine.
- Avoiding reprocessing and improving the productivity.
- Automation improves the power saving possibilities and hence the cost of product goes down.
- By avoiding manual error it improves the quality of product and hence productivity.

Advantages of Automation:

- Automation is a need for today's competitive market where quality, cost and availability is playing major role.
- Through Automation only we can achieve these parameters and compete in the market.
- Automation increase Productivity and Growth.
- Workflow automation will help you reduce costs with labor savings. And, you will save supplies and toner by avoiding re-do's and makeovers. Good for your bottom line, good for the planet.
- Automating parts of your workflow will increase capacity, improve throughput and optimize equipment use. All this adds up to expanded capabilities and increased revenue.

Automation in Paper Industry:

Forming is the most critical phase in the paper production process. Fabric cleanliness throughout the entire operating life is essential to ensure that paper quality is maintained on a high level. Cleaning methods may be classified as chemical and mechanical. Mechanical cleaning is the most widely used method as the forming section would not function correctly without some sort of high pressure showering. With the increasing the effluent norms, now a days it is restricted to use of fresh water in the industries.

The best solution would be using the best showering system for reduced water consumption and automated for effective utilization of fresh water. Apart from the utilization, the uniformity in cleaning the clothing will result in improved quality cleaning leads to improved quality end products.

Secondly, fabric life mostly gets lost due to uneven wear in cross direction. The major reason for uneven wear is due to uneven roll surface. The uneven roll surface is developed due to uneven doctoring system or improper doctoring system. By selecting the proper doctor blades and holders with proper maintenance, the unevenness will be eliminated. Hence the fabric life can be improved a lot.

Thirdly, the sheet breaks is unavoidable in the paper making. However, how efficiently handling the sheet break lies in the improving the efficiency. The lesser the time to reel the paper, is the secret of increasing the efficiency. The automated tail cutter in Wet end or Dry end helps in the reducing time lost in every sheet break.

Showering system:

Single-layer forming designs by their very nature are easy to keep clean. They provide straight-through drainage. Showers can be mounted on the inside of the fabric (roll side) and blast the contamination from the inside out. But while considering life,

there is limit and also issue of bleeding due to much open structure.

With the increasing demands for improved formation and longer life, clothing suppliers introduced double-layer and two and half layer designs. While these structures created design flexibility in terms of wear and formation, they lacked straight-through drainage. The angular drainage paths meant that double-layer designs could not be effectively cleaned from the back side.

However, it has been triple-layer designs that provide the best of both worlds. STL forming fabrics provide the flexibility to design the bottom for life and the sheet side for formation, while providing straight-through drainage for effective cleaning and conditioning. By raising the technology, the best maintained fabric will yield better result in efficiency and life..

The best effectiveness of shower can be getting by optimizing good water filter operation, adequate water pressure, proper nozzles, and optimized diameter of nozzles, distance of shower from fabric, proper oscillation of shower and location of the shower. At present, most of the mills using back water for showering, hence, it is need for better filters to utilize maximum back water in the system and proper shower to handle the ppm of water are used.

Suggested water for showers:

The following table 1 shows the usage of water ppm with showers:

Sl No	Solids loading (ppm)(mg/L)	Application
1	0 - 50	Equivalent to fresh water
2	50 - 75	Usable in 1 mm & larger with minimal problems
3	75 - 100	Usable in 1.4 mm & larger with minimal problems
4	100 - 200	Usable in 3 mm & larger with minimal problems
5	200 - 500	Brush type shower recommended
6	500 and above	Purgeable shower recommended

Table 1: Solids loading (ppm) Vs shower applications

Benefits of Automatic high Pressure oscillators:

The automated oscillating high pressure shower will give the uniform cleaning process to maintain uniform CD profile & longer fabric life and increased production. Controlled cleaning for fabrics and rolls covering every point of the surface and in parallel lines whose pitch per fabric revolution is equal to the diameter of the cleaning jet due to its synchronized speed with Paper machine, and with instantaneous reversing action, there is no standstill at the switchover points with zero dwell time mechanism. The auto water shut off mechanism when oscillator mechanism malfunction will help in avoiding the damage of the fabric. Whenever, machine speed increases, the shower oscillation needs to be synchronized to match the stroke of the oscillation to keep the fabric proper cleaned.

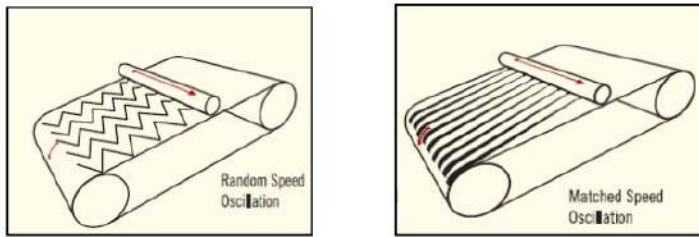


Figure 2: Effect of shower oscillation

Benefits of Automatic showers over Manual operations:

The major benefits of automation in shower oscillation are shown in below table 2.

Manual shower	Automatic Shower
Speed synchronization manually for proper cleaning	Auto synchronization through feed back from drive
Required man power to adjust the speed while machine speed increase/decrease	No man power dependant as automatic adjusts of the stroke with respect the machine speed.
Clogging of nozzle to be checked manually, and stop the shower to clean manually	Clogging sensed by pressure difference signal and initiate for cleaning, no lost in cleaning time.
Man power dependant	No man power dependant.
Improper cleaning of fabric – poor CD profile drainage	Proper cleaning of fabric – better CD profile drainage

Table 2: Advantages of automatic shower oscillation

Water filtering solutions:

Paper industry faces tremendous pressure on the pollution norms due to more water usage. To avoid the situation, mills are forced to reduce fresh water usage and increase the back water usage in system for cleaning and dilution. The back water contains rich fines and fillers. However, by ETP system, the return water having around 200 to 500 ppm as compared to less than 50 ppm of fresh water. The effective filter will give the best back water to use in the showers. The manual cleaning of the filter is difficult due to frequency of clogging. The simple automated self cleaning filter is the solution for reduce manual work.

The duplex or Gang filter is used to keep the water flow continuously by self cleaning device.

The automated cleaning system works in the principal of pressure difference between inlet and outlet. If pressure increase in the filter unit, the cleaning mechanism acts and getting cleaned by the back-flush action. Hence there is no interruption in the water flow to the showers.

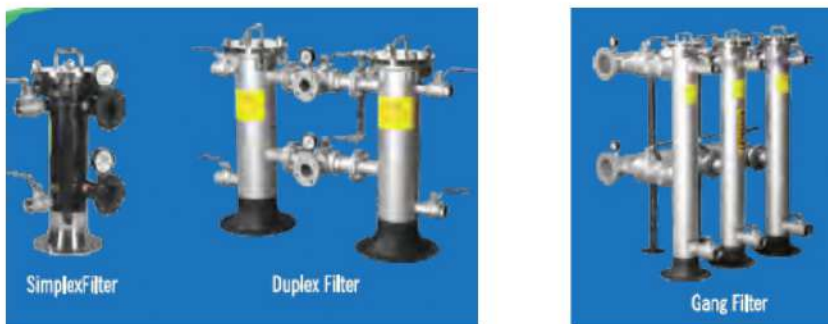


Figure 3: Different types of filters

Advantages of Automation in the filters:

Tail cutting system:

Successful threading relies on accurately controlled tail cutting. Uncompromising reliability is required from the wet-end tail cutter since threading cannot be performed without it. Using an accurate and defect free cutter speeds up the whole threading process. Time saved after a sheet break means higher machine efficiency.

Kingsley WetCut cuts the tail at the edge of the web and after threading quickly widens

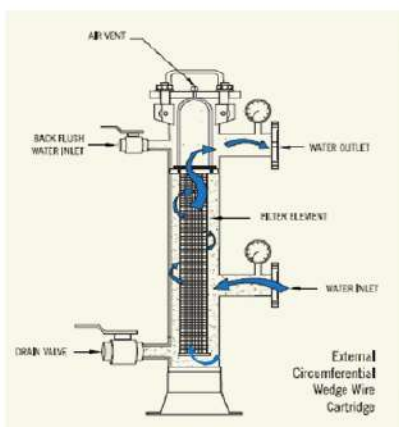


Figure 4: Auto-wash filter

Manual filter	Auto cleaning filter
Interrupted pressure and flow due to clogging	Uninterrupted flow & pressure as pressure drop sensed and cleaning by self
Cleaning time taken (at least 10 mn to arrange & cleaning) by man power	Instant cleaning without any man power requirement.
Life of filter media life may reduce due to clogged operation	Life of filter media not affected by clogged operation
Cleaning frequency may increased in case of more back water usage	No man power & extra time while using more back water.
Maximum of 30 minutes per cycle cleaning	No time lost for cleaning.

Table 3: Benefits of automations in filtering operation

the web to its full width. The equipment features versatile adjustment possibilities, and selecting the desired tail width is easy. By operating from the operator desk of wet end and also from the dry end is possible with the requirement. The easy operation wet end tail cutter helps in reducing the time delay of sheet break and reducing the jamming of paper in the dryer section which is much harm for operation and clothing.

The main features of the Wet end tail cutter are smooth and stable tail making, at reduce the time lapse by intimation or hooter. The break sensor gives signal to the tail cutter and instantly the tail cutter reach to the required position.

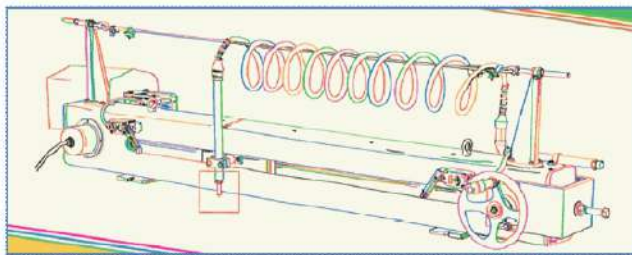


Figure 5: Wet end tail cutting system

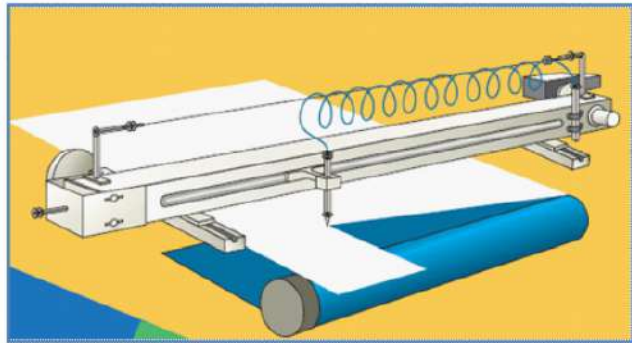


Figure 6: Wet end tail cutter

The basic features of dry end tail cutter system are reducing the time delay by manual operation. This can be automated as programmable tail width for easy operation. Normally, in manual operation, one person to cut the tail and another person has to pass the tail. By automation, the man power can be reduced by easy operation.

Dry end Tail cut system advantages:

- ✓ Minimum production loss
- ✓ Optimize paper machine efficiency
- ✓ Secure operators safety during sheet break phases.



Figure 7: Dry end tail cutter & operating panel

Advantages of Automated tail cutting system

Operation	Manual operation	Automatic operation
Tail cutting time	Hooter – man power readiness – tail cutting Time required : 45 sec (min)	Paper break signal – nozzle movement instantly Time required : 25 sec (max)
Tail width adjustment	Signal/intimation provide manually to adjust Time required : 10 – 15 sec	From panel – preset position Time required : 2 – 3 sec
Full width operation	Signal/intimation provide manually to adjust Time required : 10 – 15 sec	From panel – preset full width Time required : 2 – 3 sec

Table 4: Benefits of automated tail cutting system

Conclusion:

Hence, the major advantages of using automation are:

- Reduced direct human labor costs and expenses
- Increased productivity with higher realization
- Enhanced consistency of processes or product
- Delivery of quality products

There are simple solutions available for automation in showering system, filtering system and tail cutting system. The showering and filtering system will help in more utilization of back water in the system. The effective automated tail cutting system helps in increase the productivity. It was found that the benefit of this automation in improving the consistent quality of the end product. Hence, by 'Reduce, Reuse, Recycle' concept, the simple necessity of automation helps in improving the efficiency in Paper making industry.

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