Improved waste paper processing and treatment techniques in medium and small scale plants.

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ABSTRACT: -

This paper highlights the efforts made by the Indian Pulp and paper industry, especially the medium and small mills who use different types of waste papers as their input and convert them in to useful papers and also as specialty papers. In this scenereo their task is multifold. Converting waste into useful products with survival strategy and with stringent environmental regulations and concerns is not an easy task. Again with ageing machinery and not with state of the art technology in use, the task is much more difficult. They are working and even competing with the rest with improved inhouse knowledge, better management and timely change and adoption with better techniques to suit the changing demands. In this context the strategies adopted by small and medium scale mills which use different type of waste papers, to minimize water use and to maximize water reuse has been highlighted. This includes the right type of waste paper use, improvements done in pulping, bleaching and waste water treatment to suit its reuse.

INTRODUCTION

The per capita paper consumption in India is less than 10 kgs/annum as compared to world average consumption of 57 kgs/annum. This small consumption means 11.15 MTPA total paper consumption which figure will reach 24 MTPA by 2025 with a net consumption of 17 kgs/annum. The present paper and board production is 10.11 MTPA which will reach 22 MTPA by 2025. These figures highlight the rapid growth prospective this industry is having. Out of the above production 47% is based on waste paper, 31% on wood and bamboo and 22% on agricultural residues. This suggests the vast scope this industry is having for expansion and growth.

INTEGRATED PULP & PAPER MILLS:

In bigger sized integrated mills which use woods and bamboo and also waste paper have changed over the years with the adoption of latest technological advances to meet the stringent environmental norms. The noteworthy being the changes in the bleaching. The use of elemental chlorine was stopped with the adoption ECF system and further the use

of total chlorine was eliminated by change over to TCF system. This was made possible with the use of chlorine dioxide, hydrogen peroxide, oxygen and ozone. Use of these bleaching chemicals not only ensured the reuse of waste streams to the maximum extent but also reduced the fresh water consumption considerably. The absorbable organic halogens (AOX) and also organic chlorine compounds which were environmentally harmful were significantly reduced in the effluents and were brought within the limits by the above bleaching changes.

MEDIUM AND SMALL SCALE WASTE PAPER BASED MILLS:

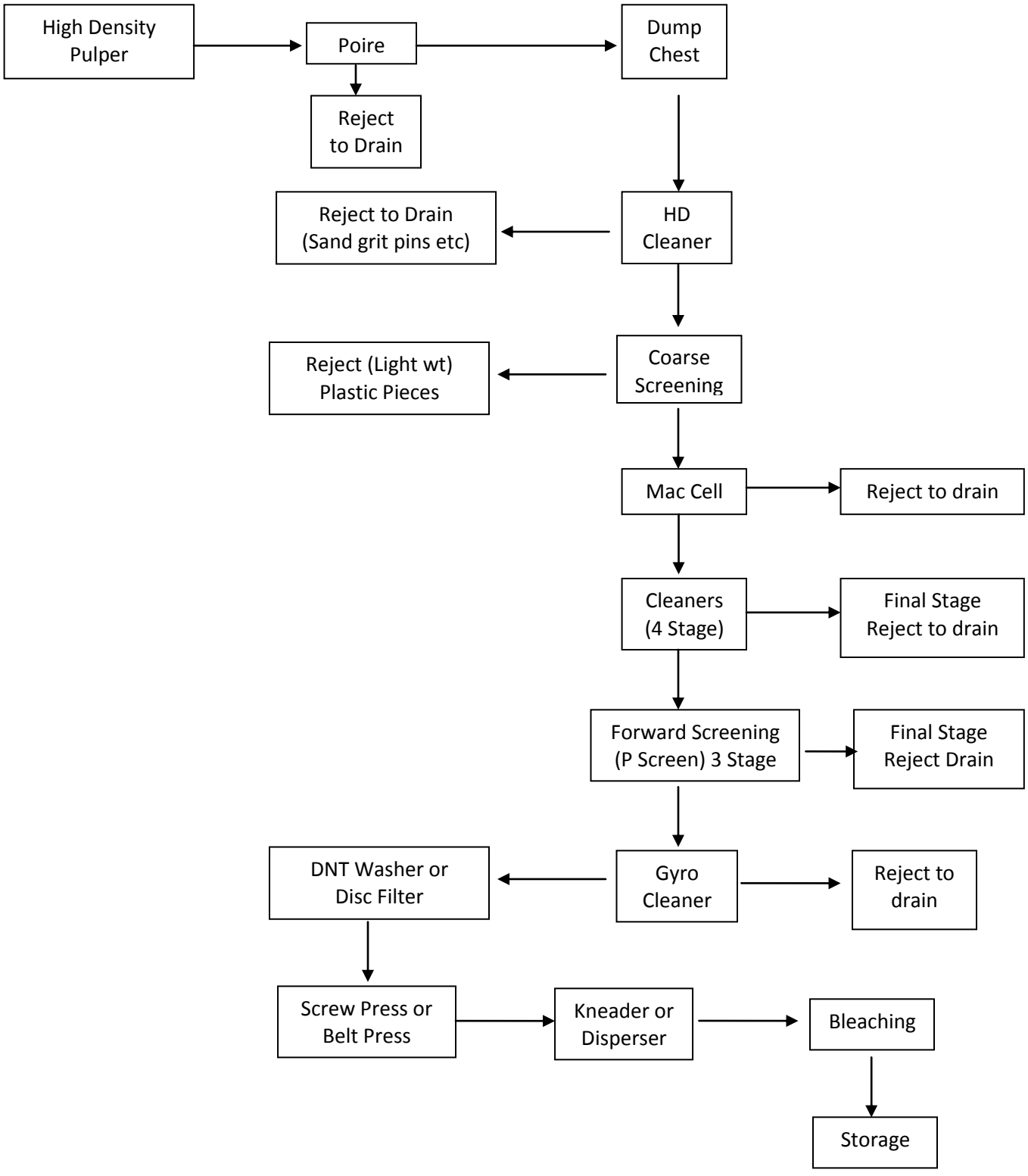
In this paper we are more concerned with the medium and small paper mills which are solely based on waste paper. These mills are totally different from the integrated and modernized mills. So their approach to the changing requirements are also different. In this category are those mills with old machinery, who have done certain changes over years to meet the competition and to survive. This survival strategy is not only from the financial angle but also from the change in environmental awareness and regulations. This has also helped these mills to improve their performance in regard to quality and competitiveness. Only these things are highlighted in this paper i.e. improvements made in waste paper pulping, washing and bleaching stages to reduce effluent volume and maximize reuse of the back water.

There are many categories of waste paper and their specifications. From our point of view we consider only those which fall in the following categories.

1. Bleached category: which need deinking and bleaching and yield pulps of 80 + brightness.
2. Bleached category: which need deinking & bleaching and yield pulps of 70 + brightness.
3. Newsprint grade: which need deinking / bleaching and yield pulps of 60 + brightness.
4. Unbleached grades: which are mostly used in kraft papers & do not need deinking & bleaching.

In the processing of the first three categories the mill will be having a deinking plant (DIP) which we can also call as a waste paper recycling / processing plant. The flow sheet of a typical waste paper processing plant (DIP) is given below:

Waste Paper Processing Plant (DIP)



In the above system the filtrate obtained from DNT washer or disc filter, screw press or belt press and kneader or disperser unit are clarified in a Poseidon or DAF unit. This clarified back water is used in dilution at different stages in the process. The rejects from Mac cell and reject from Poseidon or DAF unit is processed through decanters or belt presses as a disposable sludge.

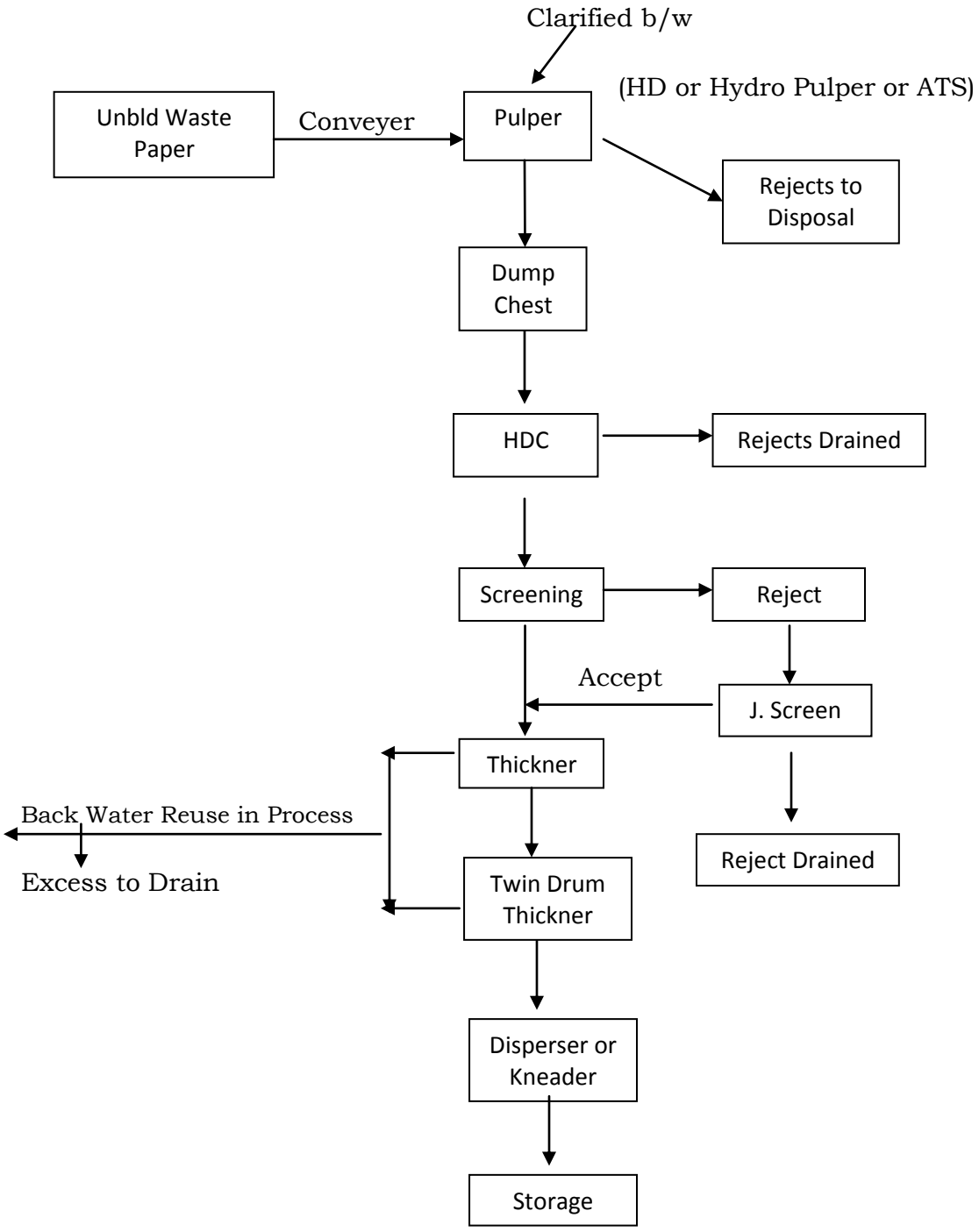
The water consumption in such a system is 10-12 m^3/Ton of pulp produced. With two stage bleaching and incorporation of a washing stage in between it will be 10-15 m^3/Ton of pulp produced. Part of this demand is met by clarified P.m/c back water. This backwater with Krofta Fibre saving unit and a primary clarifier will have a S.S. content from 100-150 ppm. This can be brought down considerably to within 30-50 ppm limit with the installation of a fabric press. This clarified water can substitute fresh water demand even in the high pressure showers. These efforts have yielded results, in reducing water consumption, increasing water reuse and reducing effluent discharge.

At the waste paper pulping stage chemicals like NaOH, Na_2SiO_3 and a surfactant or soap are used. The purpose being fibre swelling, ink break up seponification, ink dispersion, wetting and fibre separation. At this stage use of an enzyme ensures above activity reducing the chemicals requirement considerably. In the enzyme pulping system, though the pulper rotor time is more, thus increasing the energy consumption, the overall cost factor is less. A typical chemical requirement in the HD pulper stage with and without an enzyme is given below.

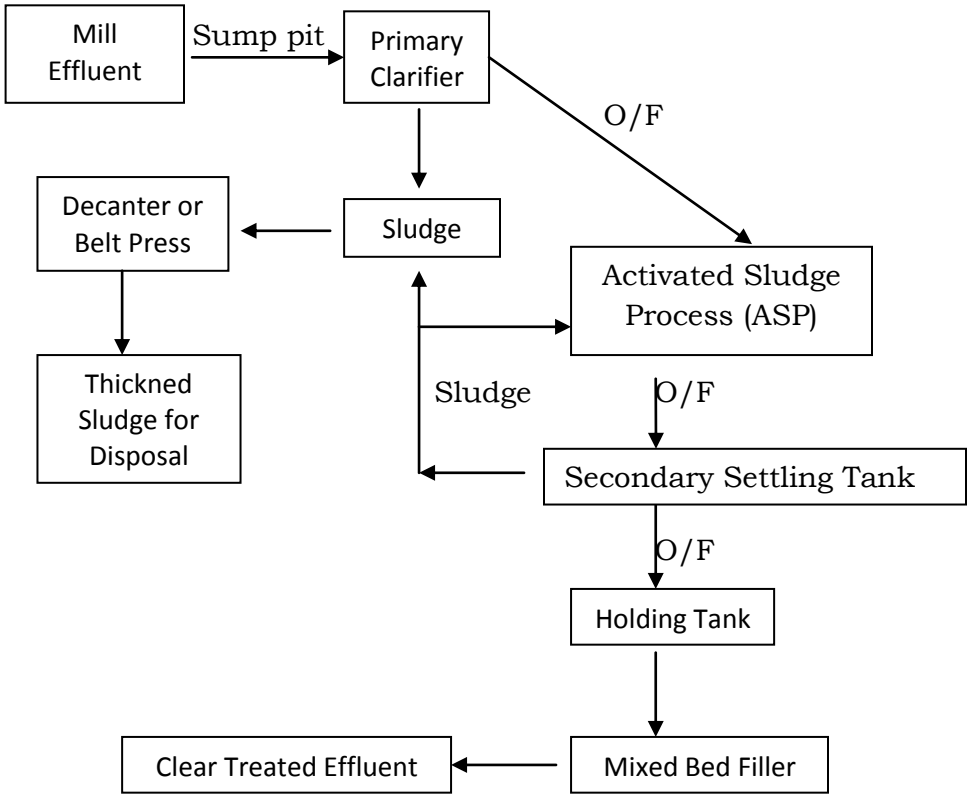
Sr. No.	Particular	Without Enzyme	With Enzyme
1.	NaOH, Kgs/MT Pulp	15	2
2.	Na-Silicate, Kgs/MT Pulp	20	2.0-3.0
3.	Enzyme, Kgs/MT Pulp	-	0.1 to 0.15

Enzyme addition during the initial mixing of paper and reaction medium is more effective. It works in the pH range of 5 to 7 and at lower temperatures i.e. 45-50°C. This condition also helps in sticky control. It has been noted by the laboratory experimental work that COD loads produced by the enzyme treatment is about 50% lower than those for the conventional deinking. Presoaking with enzyme before pulping appeared beneficial. A 10min presoak gave brighter and also stronger pulp. The other benefits of enzymes in deinking are pulps require less bleaching chemicals, give slightly higher yield, have reduced fines content and improved drainage. Thus enzyme deinking result in cost saving with pulp quality improvement and pollution reduction.

The processing of unbleached waste papers is more simpler those of the bleached varieties. Here the process involves waste paper slushing or pulping, cleaning, screening thickening and storage. A typical flow sheet can be as follows.


Clarified b/w
(HD or Hydro Pulper or ATS)
Unbld Waste Paper
Conveyer
Pulper
Rejects to Disposal
Dump Chest
HDC
Rejects Drained
Screening
Reject
Accept
J. Screen
Thickner
Back Water Reuse in Process
Excess to Drain
Reject Drained
Twin Drum Thickner
Disperser or Kneader
Storage

If the waste papers do not contain wet strength material, then there is no problem in the pulping stage and no chemicals are required. This also helps in controlling the pollution load. If the waste papers (Unbld) contain less contamination usually plastics and other foreign material, the yield obtained will be 94+ percentage and the effluent street is easy to handle. In case of NDLKC the applied gum or resin get dissolved and exert a dissolved solids load and also contribute to COD. In case of Kraft and NCC, the sizing chemicals find their way in to effluent street. A mill which is using neutral or alkaline sizing using AKD, the resultant effluent street pH will be in the desired neutral range. A systematic and effective effluent treatment plant can be out lined as below.



In case of higher volumes, one need to install secondary clarifier after the secondary treatment. This type of elaborate arrangement may not be practicable in many cases due to financial, operational and other reasons. The above system ensures the final effluents are within the disposal norms and can be utilized for reuse, for land disposal for irrigation or disposal in to CETP line or into the receiving stream.

A set of laboratory experiments done using one of the coagulants has given good results. It has helped in reducing S.S. by 93 to 95% and COD by 15-20%.

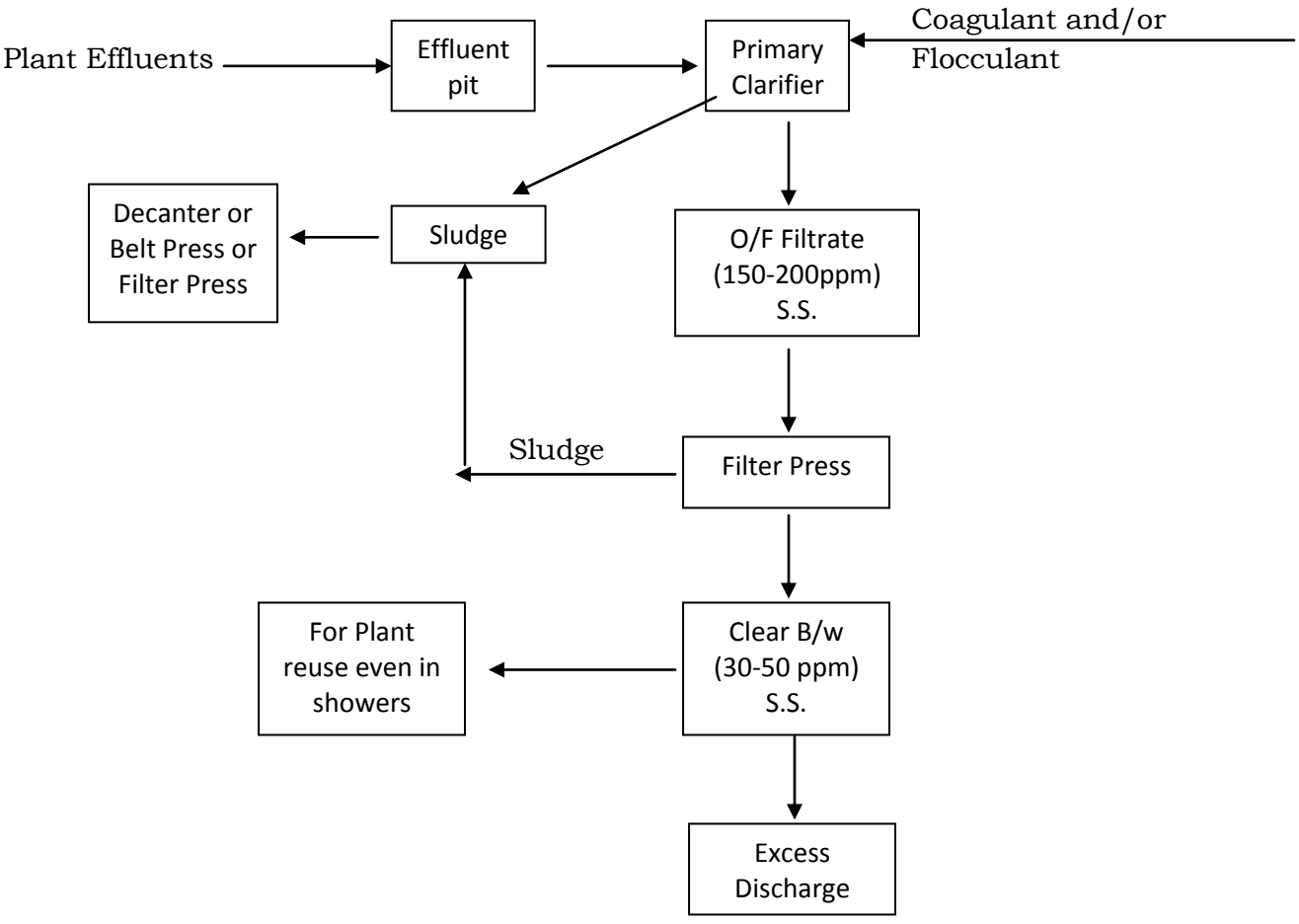
The results are recorded below:

Addition of 4 ppm of Cusol-1624- Coagulant on effluent settling characteristics.

Particulars	As Such	Plain Settling	% Redn.	Settling with 4ppm Cusol Addition	% Redn.
Total Suspended Solids, ppm	2300	530	77.0	154	93.3
Total Dissolved Solids, ppm	6620	6600	0.3	6500	1.8
COD, ppm	4600	4500	2.2	3910	15.0
SET II					
Total Suspended Solids, ppm	1756	250	85.8	95	94.6
Total Dissolved Solids, ppm	5730	5690	0.7	5580	2.6
COD, ppm	4350	4280	1.6	3500	19.5

The above results clearly indicate the benefits of a coagulant and/or flocculant in improving primary clarification. It also helps in reducing the colloidal and suspended COD in the effluent. Hence, dosing an effective chemical in to the primary stage is always desirable and incorporated in many treatment schemes.

Small and medium sized mills usually do not possess elaborate treatment capability. However, they can effectively process and reuse their plant effluents at below.



This type of Systems are effective and existing.

A literature survey and mill experience who use deinking unit and utilize the pulp inhouse, have over the years felt that it is very difficult to reduce fresh water consumption less than 10-12 M^3 per tone of the pulp made and 25-30 M^3 per tone of the paper made. These mills source their in take water from rivers. The expert experience suggest that, if one wants to reduce the water consumption below this figure, he should have a tertiary treatment stage after the secondary treatment (ASP), consisting of reverse Osmosis (RO) and evaporation, otherwise it is not only very difficult but also unhealthy to the plant working. In a similar way, the effluent to be discharged in an unbleached waste paper processing unit (good variety) should be at least 4-5 M^3 /Ton of the pulp processed. This is not only essential but also required to keep the system healthy. This target is by no means easy but it is achievable and sustainable. Some of the developed countries also have come to the same conclusion. The mills who have drastically cut their discharge less than the above limit have done so by adopting total recirculation and compromising with product quality and their consequences on the system. This type of a solution is no good for the industry whose major input is water.

SUMMARY:

1. Large integrated pulp and paper mills have changed their bleaching sequence to TCF system with use of chlorine dioxide, oxygen, hydrogen peroxide and ozone. This has not only helped them in controlling AOX and organic chlorine compounds but also in maximum recirculation and reducing the water discharge to 30-50 M^3 per tone of paper.
2. Waste paper plants who use deinking, have cut down the chemical use in the pulping stage with the use of a suitable enzyme. This is effective as well as economical. Experimental work showed that if reduced the COD load by 50%.
3. Use of a good coagulant has resulted in the suspended solids reduction by 95% and COD reduction by 15-20% in the experimental study, of the effluent entering the primary treatment.
4. If the primary clarified effluent having 100-150 ppm s.s, is passed through a fabric press, the resultant effluent will be having a s.s. of 30-50 ppm and can be utilized at every point of use.
5. An effluent discharge of 4-5 M^3 per tonne of the product is very realistic target to achieve & sustain. This target is essential and also healthy to the industry. Drastic reduction with total closure of the system is at the cost of the health of the industry and its output quality.

LITERATURES:

1. Paper Mart India Feb-Mar'2013
2. Paper Aisa, Vol 26 No. 3 May-June'2010
3. Unpublished R&D work