

REPORT

ON

TECHNOLOGICAL TREATMENT OF

WASTE PAPER FOR BETTER

UTILIZATION

SUBMITTED TO

**ALL INDIA SMALL PAPER MILLS ASSOCIATION
(AISPMA)**

BY



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EXECUTIVE SUMMARY

I BACKGROUND OF THE PROJECT

The project "Technological Treatment of Waste Paper for Better Utilization" was sponsored to CPPRI by All India Small Paper Mills Association (AISPMA), as it was felt necessary that a pre-feasibility study be undertaken before implementation of the project. Looking into the facilities and expertise available at CPPRI, AISPMA assigned this work to CPPRI.

It was also decided then that Mr. R.C. Rastogi President AISPMA shall be monitoring the project activities from time to time keeping in view the requirement of the Industry.

The objective of the study was to suggest an appropriate technology after evaluating the various technologies available elsewhere considering the issues being confronted by the waste paper based mills in India. Discussions held with experts in the field have revealed that this segment of the industry is facing serious problems in processing of imported and indigenous waste papers primarily due to poor quality of indigenous waste paper and presence of contaminants in imported waste paper. There is also lack of proper technical know-how particularly for production of deinked pulp from ONP/ OMG and stock containing mixed office waste and other grades of coated paper. The mills are confined only to produce industrial varieties and most of them end up producing low quality grades due to poor quality of indigenous waste paper.

In view of these constraints and to improve/upgrade the prevailing processing techniques in waste paper recycling, the activities envisaged cover the following issues that are considered to be the most important at present to achieve better operational and process efficiency. The issues are:

- Recycling of high wet strength papers.
- Identification of appropriate deinking technology for manufacture of writing /printing papers.
- Disposal/ utilization of waste sludge with specific reference to steam generation

Based on the data collected and literature reviewed on above areas, appropriate technologies have been identified and evaluated for their techno-economic feasibility for mills varying in size from 30-50tpd, which has been covered in detail in this report.

II METHODOLOGY ADOPTED

In view of the above problems confronted by the industry, an extensive literature survey was conducted, based on which the activities were formulated. The activities included both on site mill survey for technology assessment and studies conducted at CPPRI in the area of recycling of wet strength paper and characterization of waste sludge, which was collected during mill visits.

Following three mills were visited to assess the present state of the industry with respect to quality of waste paper used, process equipment and technology adopted, future sustainability and the problems faced by the mill. The mills visited are:

- Khatema Fibers Ltd, Khatema (U.P)
- Rollainers Ltd., Kundli, Sonapat (Haryana)
- Madhya Desh Paper Ltd., (MS.)

III ACTION PLAN

The information gathered from extensive literature review has revealed that lot of technological advancement has taken place around the world in the area of deinking. The technology for production of quality deinked pulp (DIP) for newsprint from ONP/OMG is fully established. Although for the production of writing /printing paper from mixed office waste (MOW) few installation have come up but continuous research is simultaneously going on to improve the quality of DIP pulp. This is primarily due to presence of toner or non-impact ink (difficult to disperse) in the MOW furnish. These research findings have led to a significant technology improvement in the area of deinking of MOW. Based on the available information, various technologies have been evaluated for their techno-economic feasibility under Indian conditions.

While reviewing the technological status of the waste paper based mills with respect to the identified problems, it was felt necessary that some R&D activities would be required particularly in the area of recycling of wet-strength paper since no tailor made technology/ processing technique was available.

In the area of waste sludge utilization for steam generation, though the technology is established and a number of installations are in operation, evaluation of the waste sludge from indigenous waste paper based mills, for its fuel characteristics to ascertain its suitability as fuel for steam generation was essential.

In view of these, samples of waste sludge and wet strength papers were collected during the mill visits and extensive studies were conducted at CPPRI. The processing technique and optimum conditions for recycling of wet strength papers has been established and fuel characterization of waste clarifier sludge, its potential and limitations for steam generation and characterisation of ash for heavy metals have been studied in detail.

IV CONTENTS OF THE REPORT

The contents of the report are based on available data and information published in various journals, periodicals, CPPRI's own data bank and also various discussions held with technical personnel in the field. The report comprises of three chapters, broadly covering the following areas.

- CHAPTER – I-** General Introduction and Present status of waste paper utilization in India.
- CHAPTER – II-** Waste Paper Processing system and latest deinking Technology
- CHAPTER – III-** Feasibility studies and system modules for waste paper processing with specific reference to following areas
- Section – 1** Recycling of wet-strength paper.
 - Section – 2** Production of newsprint from ONP/OMG furnish.
 - Section – 3** Production of writing/printing grade paper from mixed office waste (MOW)
 - Section – 4&5** Disposal/Utilization of waste sludge and plastic rejects for steam generation.

A brief account of each chapter is given below

- (i) **Chapter – I** - Gives an overview of the Indian paper industry with specific reference to use of recycled fiber (RCF) in the country. The chapter has primarily focused on the status of paper recycling in India, constraints in increased utilization and domestic collection of waste paper in the country and a detail review of waste paper based mills in the country with respect to process technology, process equipment and quality of products. The review is based on collected information through questionnaires and supported by case studies undertaken.
- (ii) **Chapter – II** – Broadly covers the various contaminant removal systems forming the integral process steps in the waste paper processing line. The chapter also covers in detail the role of process chemistry in performing various deinking mechanisms/functions which facilitate the removal of

non-sticky contaminants like inks, fillers, resins etc. and decolorization of pigments and dyes. In the later section of the chapter, the technological developments/advancements that have taken place world wide in the last few years has also been highlighted. These advancements have led to the improvement in various system components to achieve best efficiencies and also designing of new system configurations for higher yields and better product quality.

- (iii) **Chapter-III** – This chapter covers the feasibility studies and process modules for waste paper processing for the identified areas mentioned earlier. It is divided into five sections and each section covers the detail aspects of each identified area.

Section 1- The section has dealt in detail the processing aspects of wet-strength

papers. Based on extensive literature review, mill visits and laboratory studies carried out on repulping of wet-strength papers, CPPRI has proposed system modules for effective utilization of wet strength papers. Studies conducted revealed that combination of chemical, mechanical and thermal energies is essentially required to handle the problem.

Section 2- Broadly covers the deinking aspects of mixed furnish of ONP/OMG for production of newsprint, particularly the influence of ink types on deinking performance. Based on the literature review and mill visits producing newsprint grade paper, an appropriate deinking system is proposed. The section also highlights the role of process chemistry and other factors influencing the deinkability of mixed furnish of ONP/OMG.

Section 3- This part of the report cover the deinking aspect of mixed office waste (MOW) for the production of writing/printing grades of paper. The proposed system is based on extensive literature review on available technologies for deinking of MOW. The section also discusses in detail the type of contaminants present in MOW furnish and their removal strategies.

Section 4&5- This section highlights the disposal/utilization alternatives for solid waste generated in waste paper based mills. The section covers in detail the utilization aspect of waste clarifier sludge and plastic rejects as a fuel in boilers. The technology for sludge combustion is well established world wide, utilizing fluidized bed combustion technology. The proposed system is based on this technology however there are some limitations in plastic incineration, which has been dealt in detail. The environmental implications of sludge incineration have also been highlighted in this section.

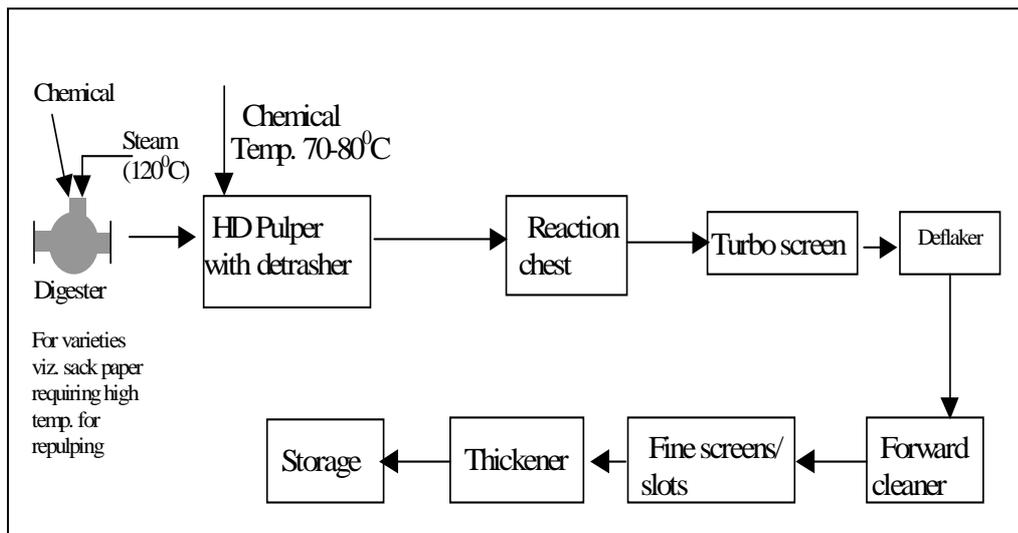
V RECOMMENDATIONS

1. There is need to have a configuration of appropriate technology/ technologies for processing different varieties of waste paper to produce good quality of Kraft paper writing & printing paper, Newsprint etc.
2. The different varieties of waste paper includes both imported and indigenous varieties and based on the quality and grades the different varieties should be utilized for specific end use as summarized below.

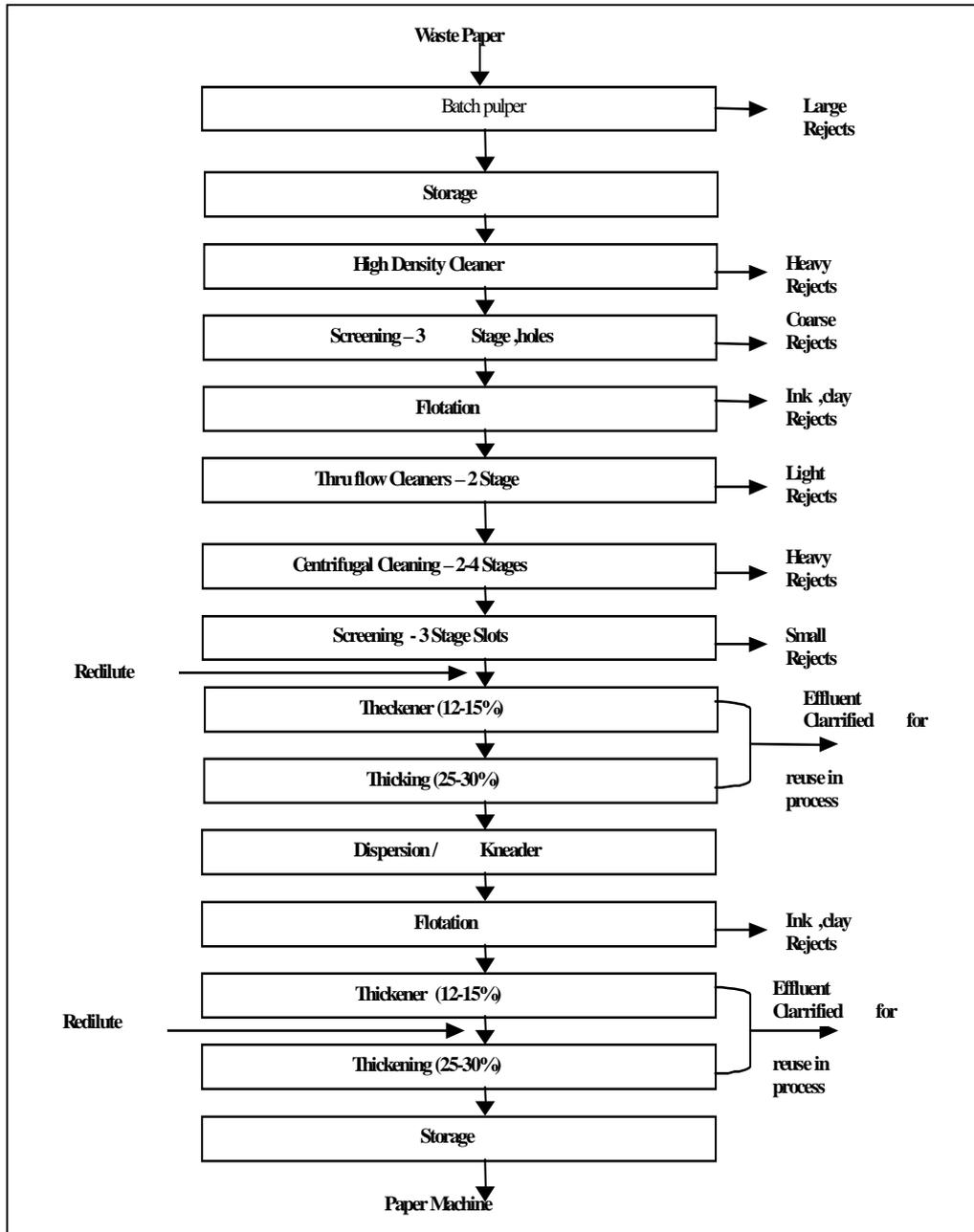
Grades of waste paper	End application
(i) Road Sweeping	Duplex bottom layer
(ii) Unbleached varieties OCC NDLKC KCB Polycoated	Corrugated medium, Box boards Bleached varieties (producing bleached pulp employing conventional pulping & bleaching process)
(iii) Bleached varieties White colour cutting Soft white cutting White sheet (wet strength)	White top liner Printing paper
(iv) Mixed Office Waste Maniflod white ledger Sorted white ledger Mixed Office waste White records Map stock (wet strength) Coated & un-coated varieties	Writing/Printing grades of paper
(v) Newsprint Old Newsprint (ONP) Old Magazine waste (OMG) Imported Newsprint	Newsprint
(vi) Office Records Ind./ Printers off Cutting (Ind.)	Low Quality Writing/Printing grades

3. The unbleached imported varieties of waste paper viz. NDLKC, OCC, KCB, and similar grades which has fiber quality comparable to virgin fiber (Non-woods) should be utilized for the production of bleacheable grades employing conventional pulping and bleaching process
4. For production of different grades of paper viz. Packaging, Writing/ Printing and Newsprint grades from un-bleached varieties (containing wet strength) , mixed office waste(MOW), Newsprint, Magazine waste and other coated & un-coated grades different process technology proposed should be implemented.

(i) **Proposed system for producing un-bleached pulp from wet strength paper.**

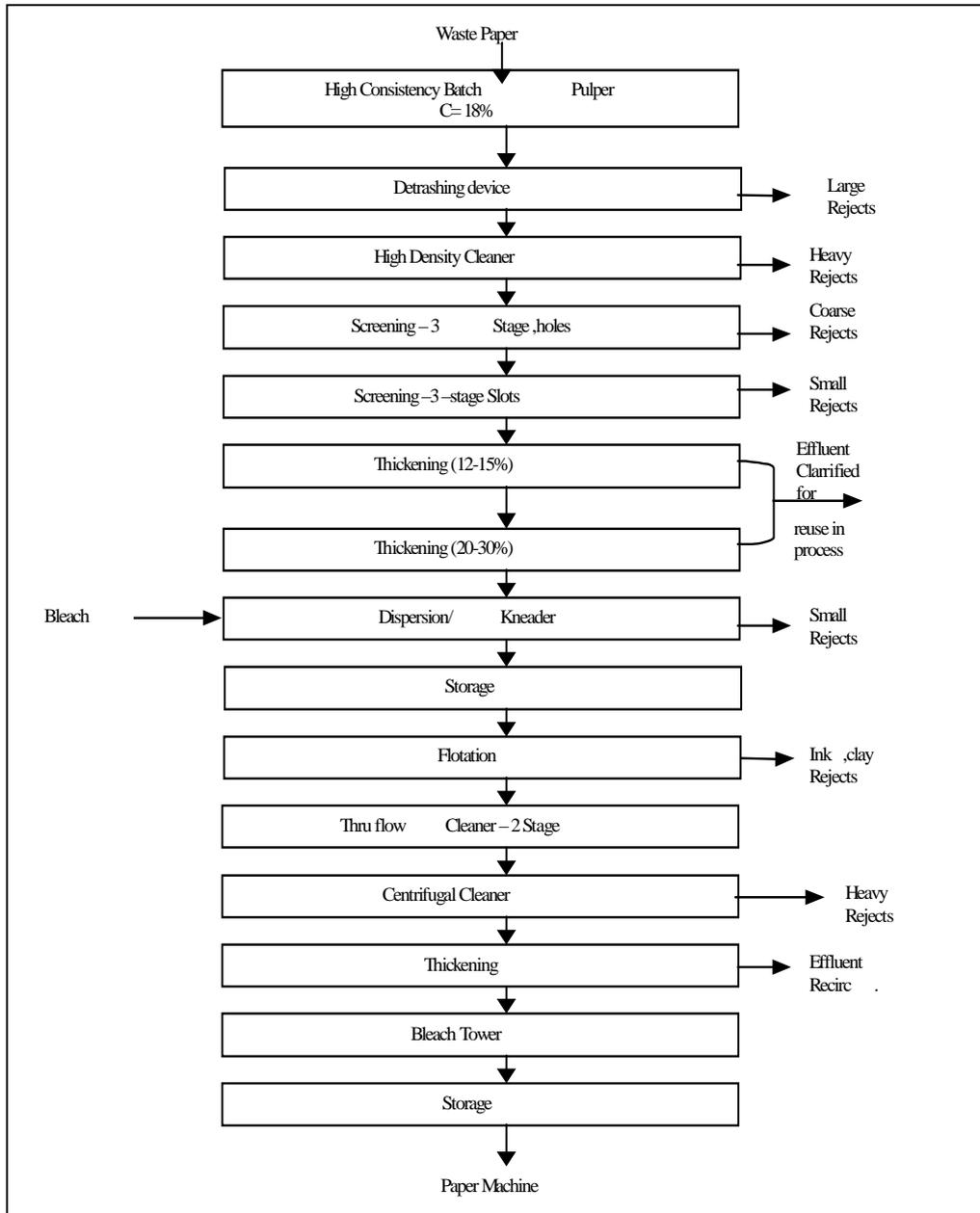


(ii) Proposed system for producing deinked pulp from ONP and OMG for the production of newsprint.

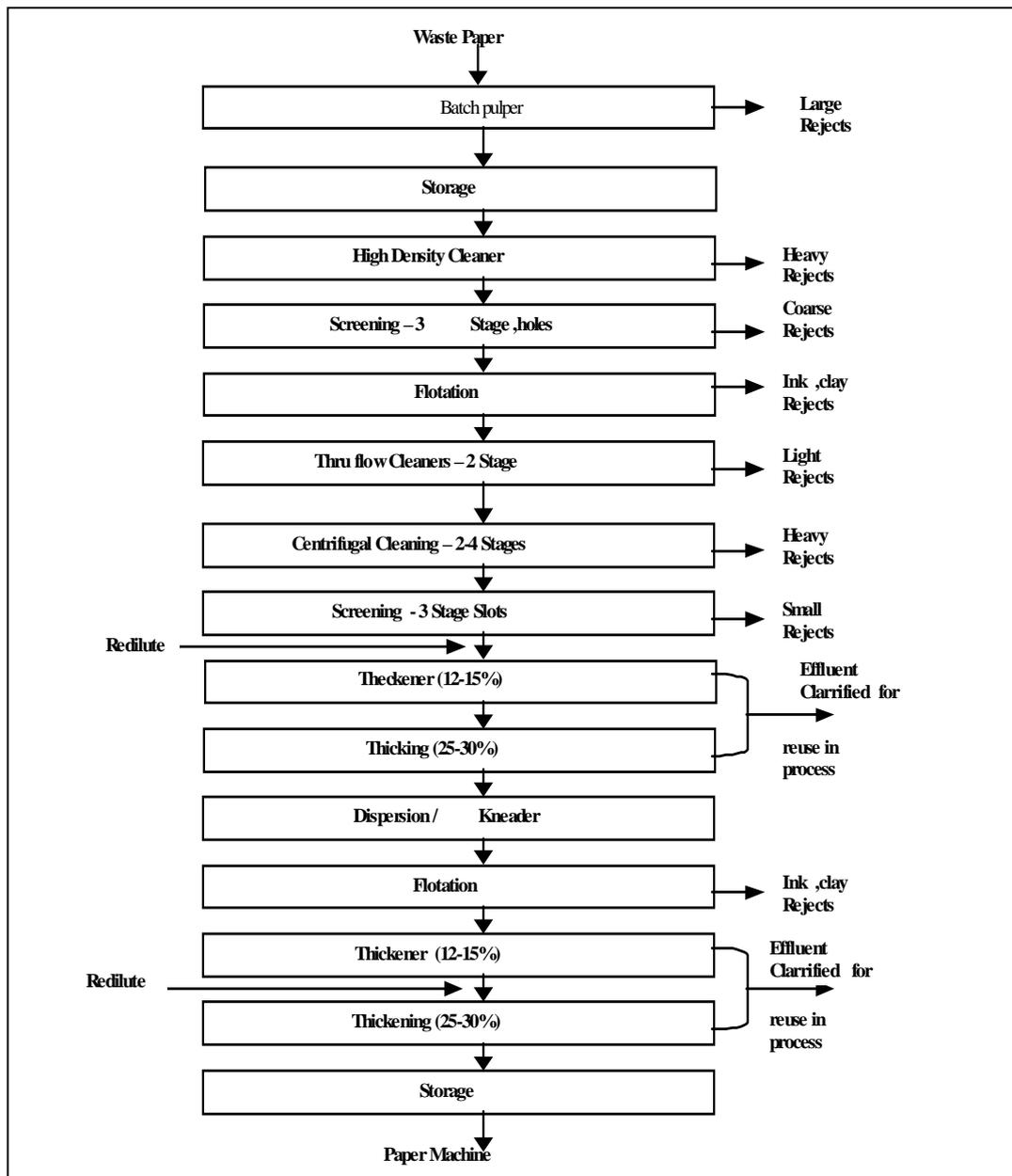


- (iii) Proposed system for producing deinked pulp from Mixed Office Waste and other printed bleached varieties for the production of acceptable quality writing/ printing grades

SYSTEM –I



SYSTEM –II



5. The waste paper based mills produce large amount of waste sludge (Clarifier and Deinked sludge) due to number of cleaning step during processing. As a part of waste management, incineration of sludge (clarifier sludge) in FBC boiler along with coal/ rice husk (HHV fuels) is proposed for implementation as a disposal alternative. Since the calorific value of sludge is close to black liquor, it can partially substitute the conventional fuels.
6. The sludge generated during deinking operation has high ash content and low calorific value, and when burned with conventional fuels will

reduce the thermal efficiency of the boiler and auxiliary fuels requirement will be high. Other option of deinked sludge disposal is land spreading for loamy soil, which may be considered as an alternative.

7. Sludge dewatering is a necessary step to increase the dryness content of waste sludge to 40-45% . Belt press can be employed for sludge dewatering.
8. The mills using poly-coated waste generate sizable quantity of plastic waste, disposal of which is a problem. Incineration of plastic waste in inclined furnace with fire tubes can be an option, however problems of emission of toxins has to be taken care of.

VI IMPEMENTATION OF THE RECOMMENDATIONS

Various commercially available technologies were reviewed and a universal system is proposed which can handle various grades of waste paper available (Indigenous & Imported). Schematic of the system is shown in **figure-1**. Preliminary coasting of the equipment has also been worked out which is enclosed

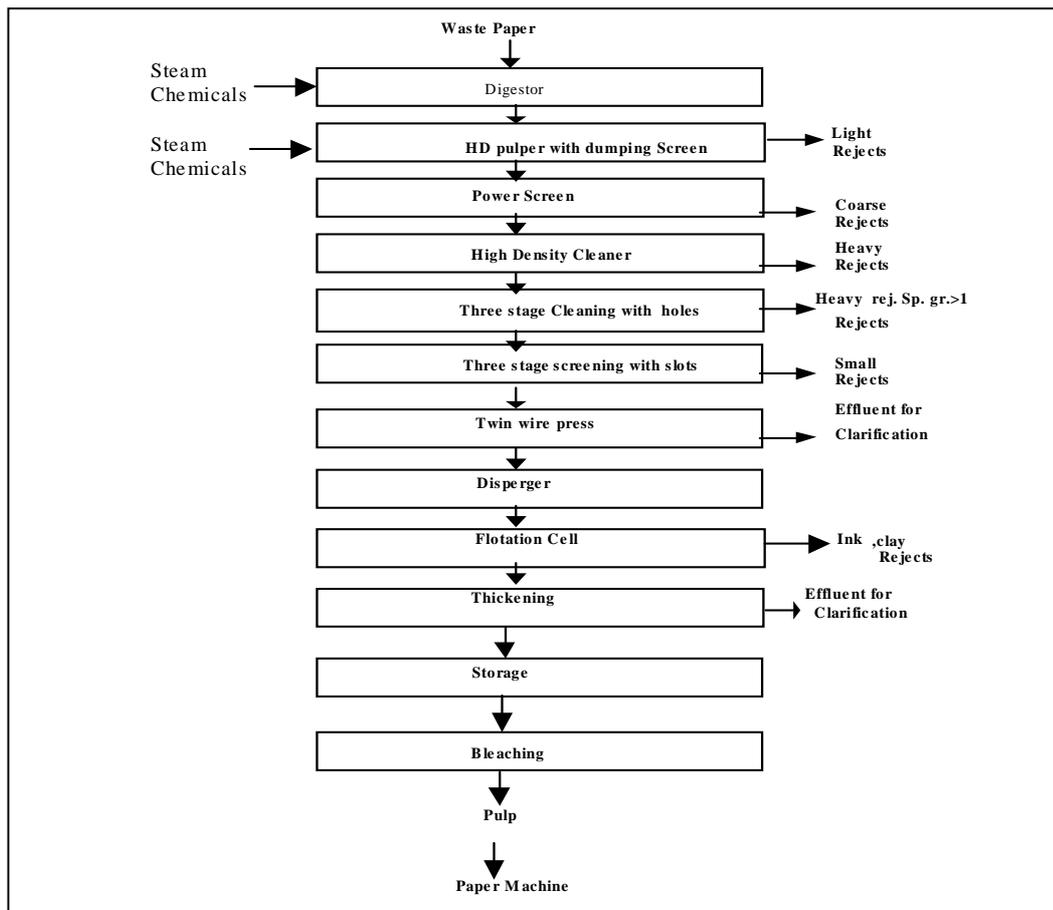


FIG.1 UNIVERSAL SYSTEM FOR PROCESSING OF WASTE PAPER

COST INPUTS-

Basis 50tpd

Equipment	Specification	Cost (Rs in lacs)
1. Digester	Vol. Cap. – 40 m ³	20.00
2. High density pulper	Vol. Cap.- 10m ³ Rotor speed 180 rpm. Motor HP- 200KW 960rpm Cy. - 15 - 18%	31.00
3. Dumping screen	Screen vol. –1m ³ Hole size – 5mm Motor HP- 30 KW	13.00
4. Power Screen		40.00
5. High density cleaner	Flow rate- 990 lpm Inlet press.- 2.5/3 bar Outlet press.- 1.5 bar	4.25
6. Three stage cleaning with (holes)	Cleaner flow rate –500lpm Differential pressure –0.82 – 1.3 bar	12.15
7. Three stage screening with (slots)	Perforation: 0.15 mm Press. Drop- 0.4 bar Motor HP- (75 +55+22) KW Basket dia.- 800, 600, 400	22.00 18.00 12.75
8. Twin wire press and Disperger	Through put 50 – 60tpd Wire speed 5 – 25mpm Wire width 1500mm Motor HP 22KV	125.00
9. Flotation cell	Vol. Cap.- 15m ³ Flow- 3500 lpm Retention time- 8 min Inj. Press. – 2 bar max.	49.00
10. Three stage Bleaching system	Bleached tower – (1st stage bleaching), Washer, storage tank	100.00
11. Pumps, motors, pipe lines walls		40.00
12. Electrical & Instrumentation		25.00
13. Civil work		20.00
Total		Rs. 532.15 lacs

Based on the discussion held with Shri R. C. Rastogi, President All India Small Paper Mill Association, it is felt that such a universal system should be installed and commissioned in an existing mill already equipped with some of the facilities for waste paper processing to demonstrate the various options available on commercial scale to produce improved grades of paper from different varieties of bleached and unbleached grades of waste paper. This shall not only provide a process flexibility to the mill but will also enhance the utilization rate of waste paper by the Indian paper Industry.