

## POLLUTION ABATEMENT IN PULP AND PAPER INDUSTRY

Gharekhan, P.R.\*; Chakrabarti, S.P.\*\*; Tripathi, C.S.\*\*\*

### INTRODUCTION

Paper is the basic need not only for education but also for commerce and other social purpose. Their utility inside house, and in trade is so great that it is hard to conceive how we can do without it. Pulp and Paper is one of the largest group of industries in India. The raw materials like wood and bamboo which usually maintain ecological balance is again a vital need for this industry. The rivers and other water streams which are necessary for human and other aquatic species and also meet the requirement of Paper mill become recipients of wastewater effluents polluting them.

There are 271 pulp and paper and board industries in India, out of which 38 are big with production capacity of more than 10,000 tonnes per annum and 213 are small with capacity ranging between 1,000 and 10,000 tonnes per annum. Statewise distribution of industries with their capacity is given in Table 1.

The nature of pollution in paper industry varies with the type of raw materials used, which in turn is linked with the size of the unit. The raw materials used in the large pulp and paper and board units are generally locally available bamboo, hard wood and other fibrous materials in 65:30:5 ratio. Most of the small paper mills are based on agricultural residues (50 %), wastepaper (43 %) and other non-conventional material (7 %).

- 
- \* Member Secretary,
  - \*\* Technical Secretary,
  - \*\*\* Asstt. Env. Engr.

Central Board for the Prevention & Control of Water Pollution,  
5th & 6th Floors, 'SKYLARK', 60-Nehru Place, New Delhi 110 019.

TABLE - 1

## ZONE-WISE CAPACITY OF PAPER &amp; PAPER BOARD INDUSTRIES AS ON 1.1.86

Zone	No. of Units	Annual installed capacity(In tonnes)	Total
<b><u>NORTH Zone</u></b>			
Uttar Pradesh	43(7)	2,41,240	
Haryana	15(0)	1,31,930	
Punjab	15(0)	1,51,700	
Rajasthan	7(2)	43,350	
Himachal Pradesh	9(2)	36,310	
Chandigarh	1(0)	1,500	
	<u>90</u>		5,69,930
<b><u>SOUTH ZONE</u></b>			
Andhra Pradesh	14(0)	3,19,050	
Karnataka	13(0)	1,66,580	
Tamil Nadu	14(1)	1,76,985	
Kerala	2(2)	35,700	
Pondicherry	1(1)	9,000	
	<u>44</u>		7,07,315
<b><u>WEST ZONE</u></b>			
Gujarat	38(2)	2,22,009	
Maharashtra	35(2)	3,33,780	
Madhya Pradesh	11(0)	1,54,350	
	<u>84</u>		7,10,139
<b><u>EAST ZONE</u></b>			
West Bengal	19(1)	2,32,530	
Bihar	6(1)	89,400	
Orissa	5(1)	1,84,800	
Assam	2(1)	1,28,000	
Nagaland	1(1)	33,000	
	<u>33</u>		6,67,730
		GRAND TOTAL	<u>26,55,114</u>

NOTE: Figures in parenthesis indicate the number of paper mills which have started production during 1985.

This industry is a water-intensive one consuming 150-350 cubic metre of water per tonne of paper and consequently a major polluter of water. The extent of water and air pollution from paper industry depends on raw material used, the pulping process employed and the product quality demanded. The large mills recover chemicals from black liquor for which pollution problem is not significant, but a small mill has not been able to afford this facility. Hence the pollution problem in such industries is predominantly high.

#### MAGNITUDE OF THE PROBLEMS

In view of the steadfastly increasing demand of paper and pulp product, it is unlikely that the production from the natural forest even after they are fully tapped, will be able to meet the requirements of the mills. Mainly because of high investment necessary for setting up large paper mills, and scarcity of wood and bamboo, more and more small units are coming up these days as shown in Table 2 and Figure 1.

TABLE - 2  
TRENDS OF GROWTH OF PULP AND PAPER INDUSTRIES

Year	Number of units		Per cent increase
	New	Total	
1980-81	15	136	-
1981-82	21	157	15.4
1982-83	18	175	11.5
1983-84	45	220	25.7
1984-85	29	249	13.2
1985-86	22	271	8.8

### POLLUTANTS GENERATED BY PAPER INDUSTRY

Water consumption in the small pulp & paper industries (SPM) often vary from 150-350 cubic metre per tonne of paper, and 100-300 cubic metre per tonne is released into natural water bodies as wastewater. Combined effluent characteristics from small pulp and paper based on agriculture residue and wastepaper is given in Tables 3 and 4. Major polluting parameters are colour, suspended solid (SS), Bio-chemical Oxygen Demand (BOD), sodium or Sodium Adsorption Ratio (SAR). While SS and BOD could be removed by conventional treatment, colour and COD removal through best available technology is a cost-prohibitive proposition for small pulp and paper industries.

### TREATMENT ALTERNATIVES

The problems from large pulp and paper mill effluent is not that menacing as in case of small mills, only problem is for colour/lignin removal for which no economic technology available. Central Pollution Control Board has taken up the task of preparing comprehensive industry document for large pulp and paper industry with the objective of formulation of Minimal National Standards based on treatability and techno-economic feasibility of treatment systems. Such an exercise for small units have already been completed and the treatment alternatives for agricultural residue based and wastepaper based mills have been prescribed as depicted in Figures 2 and 3. Final effluent characteristics have also been mentioned for each set of treatment system.

**TABLE - 3**  
**RANGE AND AVERAGE CHARACTERISTICS OF COMBINED WASTEWATER &**  
**POLLUTION LOADS FROM SPM BASED ON AGRICULTURAL RESIDUE**

	Based on data for 7 mills(7-30 TPD)		
	Actual Values*		Average**
	Min.	Max.	
Volume, Cu m/t	187	383	252 <sub>+57.4</sub>
Volume, Cu m/t (90 percentile value)	-	-	335
pH	6.0	8.5	-
Suspended solids, mg/l	400	1115	615
Suspended solids, kg/t	88	239	155 <sub>+46.8</sub>
BOD, mg/l	220	1067	698
BOD, kg/t	85	267	176 <sub>+55</sub>
COD, mg/l	2120	4763	2940
COD, kg/t	497	1087	741 <sub>+154.7</sub>
Lignin, mg/l	320	700	563
Lignin, kg/t	93	197	142 <sub>+30</sub>
Sodium, mg/l	200	548	389
Sodium, kg/t	48	142	98 <sub>+30</sub>

\* Eleven values are taken for working out minimum and maximum values.

\*\* Wastewater volume and production are taken for weighted average calculations.

TABLE - 4

**RANGE AND AVERAGE CHARACTERISTICS OF COMBINED WASTEWATER AND POLLUTION LOADS FROM SPM BASED ON WASTEPAPER AND/OR PURCHASED PULP**

	Based on data for 4 mills (2 - 25 TPD)		
	Actual Values *		Average**
	Minimum	Maximum	
Volume, cu m/t	72	159	107 <sub>+28.4</sub>
Volume, cu m/t (90 percentile value)	-	-	149
pH	7.1	7.7	-
Suspended Solids, mg/l	350	885	542
Suspended solids, kg/t	47	78	58 <sub>+10.7</sub>
BOD, mg/l	100	273	187
BOD, kg/t	9	38	20 <sub>+10.5</sub>
COD, mg/l	472	876	654
COD, kg/t	49	91	70 <sub>+15.2</sub>

\* Seven values are taken for working out minimum and maximum values.

\*\* Wastewater volume and production are taken for weighted average calculations.

**MINIMAL NATIONAL STANDARDS (MINAS) AND ITS IMPLEMENTATION**

The Minimal National Standards for small pulp and paper mill effluent have been evolved after looking into practical difficulties, limitations, techno-economic feasibility and economic impact on the industry.

The basic considerations that went into the development of the Minimal National Standards were, therefore, as follows:

- Characteristics of effluent from small pulp and paper mills without chemical recovery system.

- Achievability and techno-economic feasibility of various waste-water treatment alternatives.
- Maintained ratio of annulaised cost to the turnover of the industry.

The tolerance limits for effluents from small pulp and paper industries after considering the above mentioned aspects have been evolved as presented in Table 5.

**TABLE - 5**  
**MINAS FOR SMALL PULP AND PAPER INDUSTRY**

Parameter	Concentration
pH	6.0 - 9.0
Suspended Solids	100 mg/l
Bio-chemical Oxygen Demand	50 mg/l

Permissible limits for chemical oxygen demand and colour due to non-bio-degradable lignin for which no suitable economic technology is presently available, are not prescribed at the moment. The COD limits shall be introduced in MINAS as and when the suitable economic treatment systems would be available.

The implementation of above prescribed limits will be made in a phased manner. in the first instance, the BOD and suspended solids of treated effluent should be reduced by 90 per cent of the total BOD and SS load in the effluent by June, 1987.

The tolerance limits for pH, SS and BOD(as prescribed in Table 5) will have to be achieved by all small pulp and paper industries latest by June, 1988.

### POLLUTION CONTROL SCENERIO AND APPAORAH OF POLLUTION CONTROL BOARDS

Four zonal task forces (South, North, East and West) have been constituted by the Central Board to provide thrust for smooth and effective implementation of pollution control measures to meet the standards within a specified time frame and also to look into various problems faced by the industries. Almost all large paper mills have been provided with effluent treatment plants but their performances are yet to be monitored. However, as per the information received from industries, they are meeting the standards except for COD.

Status of pollution control in small pulp and paper mills sector are not very satisfactory only 25 industries are having the full fledged effluent treatment systems and 60 industries have been provided with partial treatment.

After the first meeting of all zonal task forces, it has been decided to have a statewise discussion for giving more thrust and allowing free exchange of views from more and more industry representatives and experts. Persuasion is continued so that industries construct the effluent treatment plant within the prescribed time frame.

Task Force is also visiting best and worst industries with respect to pollution control for reviewing the problems and also examine the effluent treatment system for dissemination of information to other industries. To reduce the pollution problem and as well as for recovery of chemicals, practical applicability of chemical recovery process is being worked out in the interested industries and Research Institutions. To give incentives, a graded rebate in the cess after achievement of the first phase of MINAS is also being recommended to the Government.

#### CONCLUSIONS:

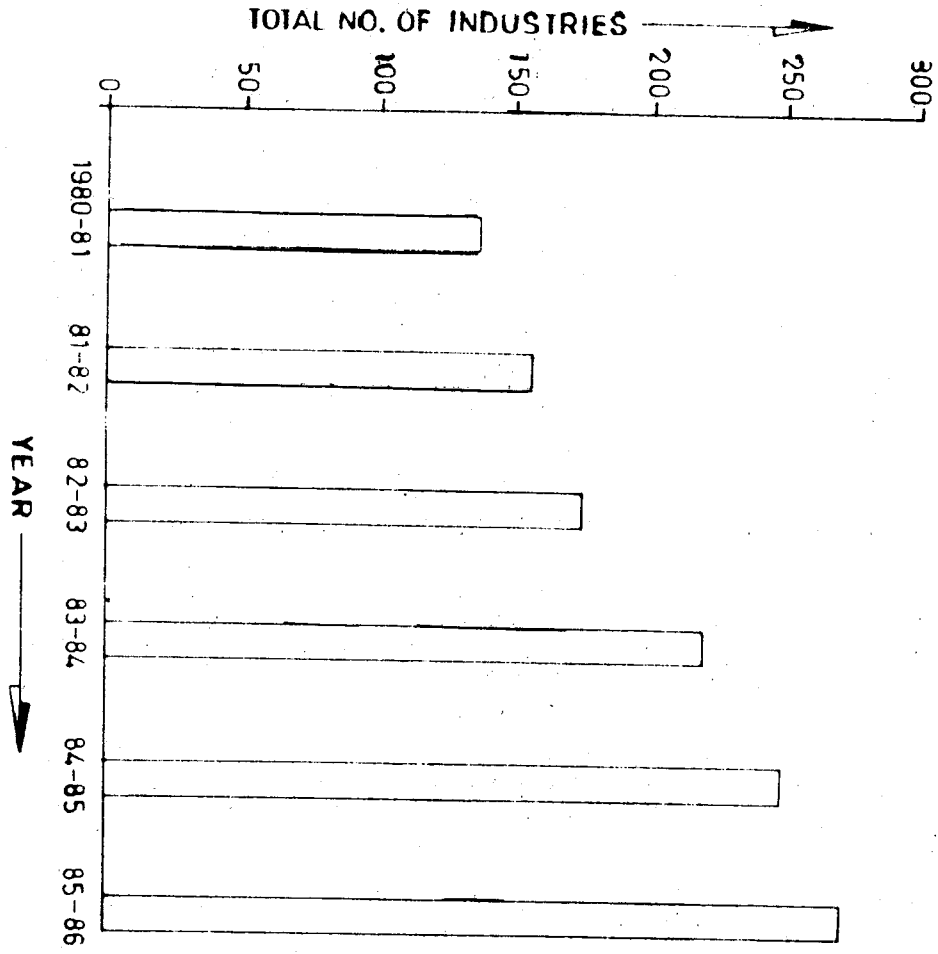
Ever increasing demand of paper and shrinking raw material resources have resulted in growth of small pulp and paper industries utilising agricultural residues.

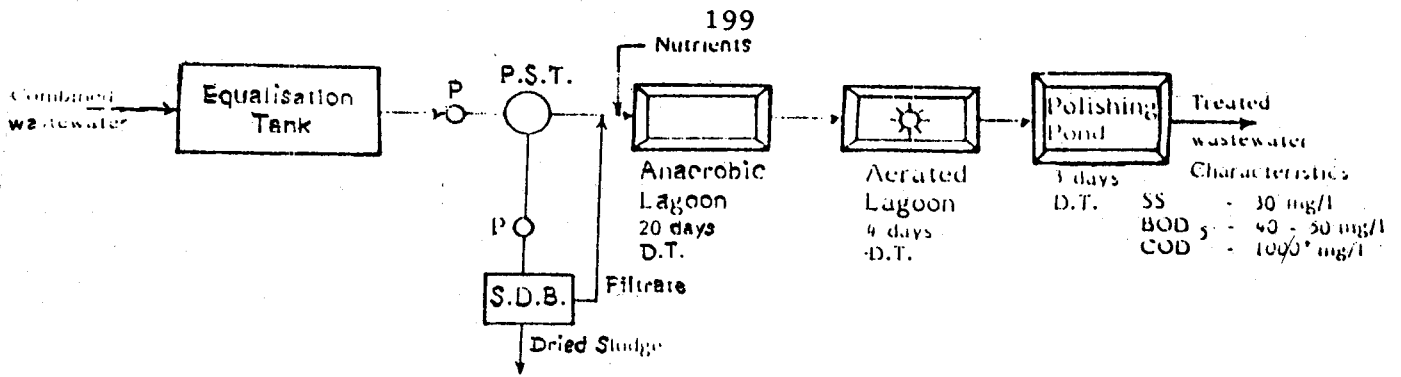


In spite of several concessions like investment allowance (35 %), depreciation allowance (30 %) and water cess rebate (70%) allowed by the Government for providing effluent treatment plant, the response of the industries are not forthcoming, and paper industry is also not an exception.

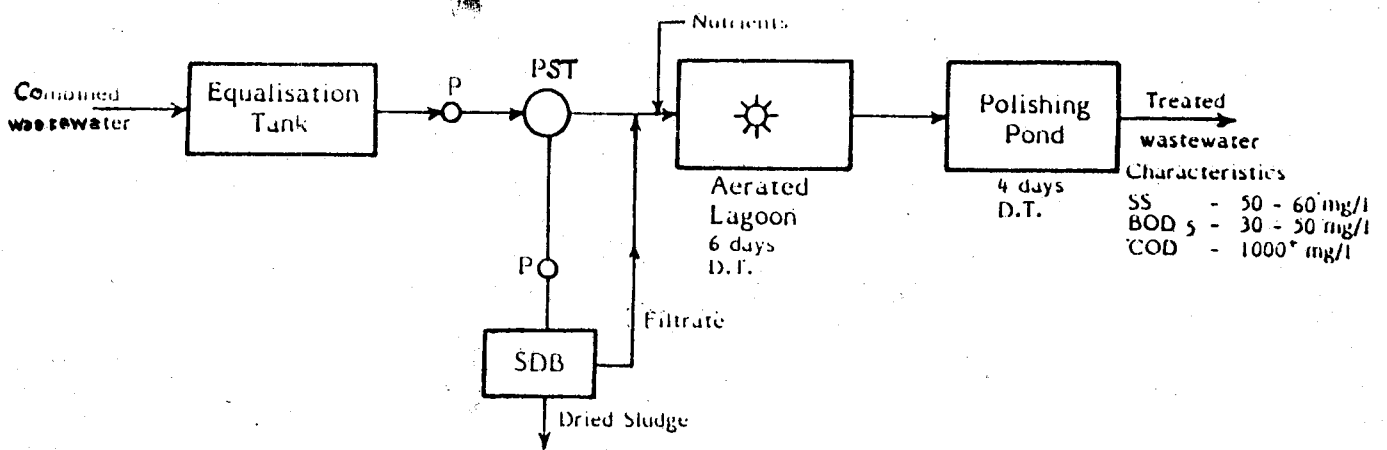
It is also often experienced that the industries who have installed effluent treatment plants, are not operating the units. Unless pollution control is considered a social responsibility, industrial pollution control programme cannot make any head way.

**FIGURE-1 TREND OF GROWTH OF PULP & PAPER INDUSTRIES.**

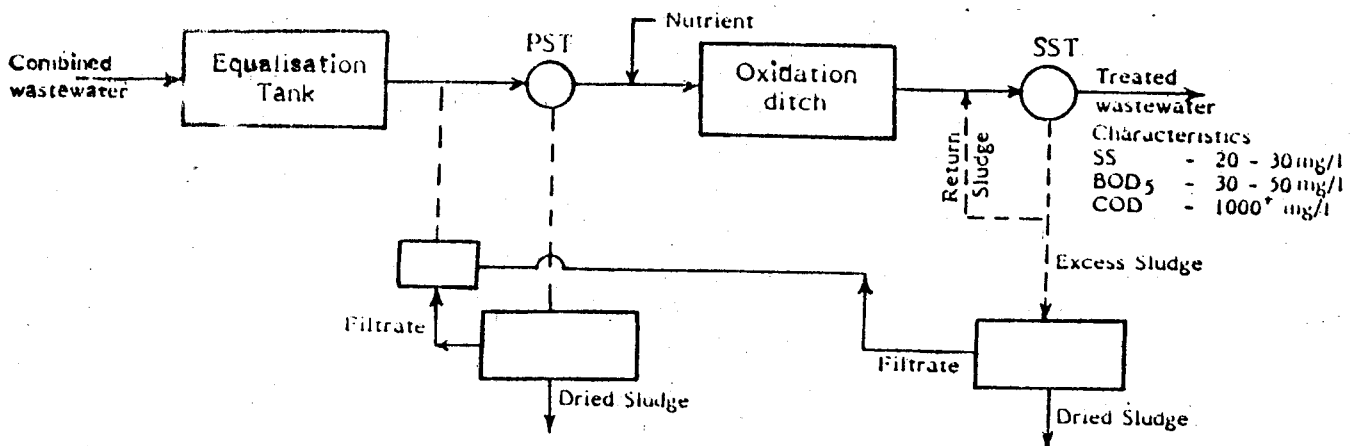




TREATMENT ALTERNATIVE [ A ]



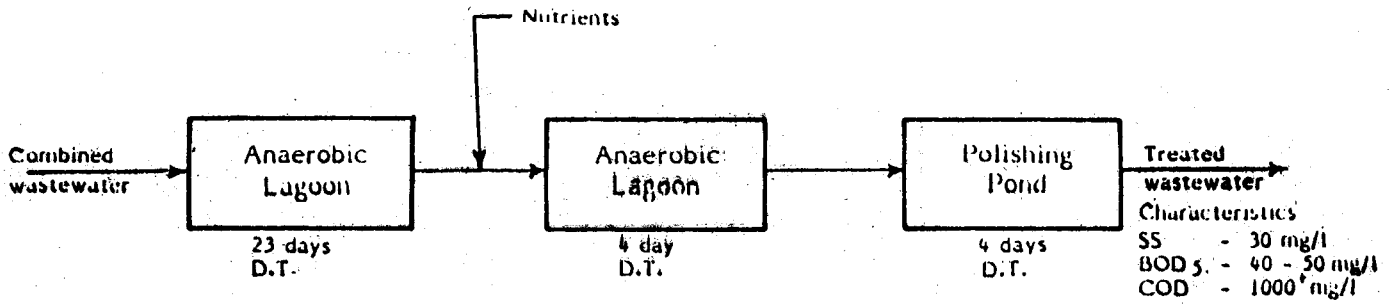
TREATMENT ALTERNATIVE [ B ]



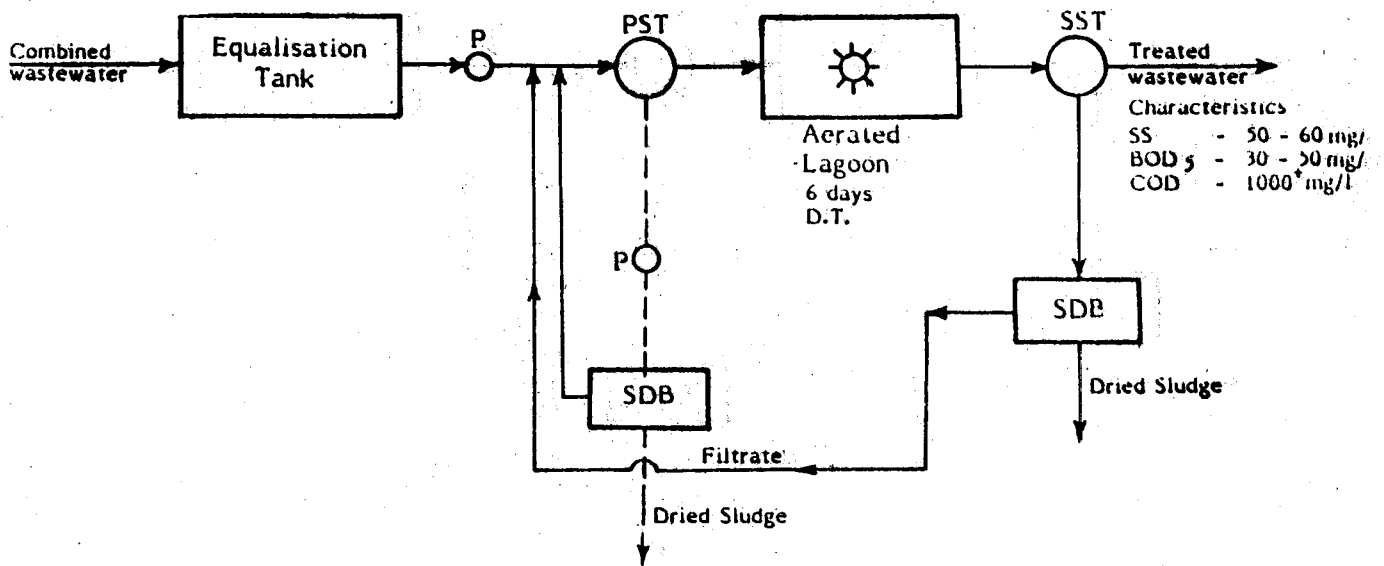
TREATMENT ALTERNATIVE [ C ]

FIG 2

TREATMENT ALTERNATIVES FOR AGRICULTURAL RESIDUE BASED PAPER MILLS



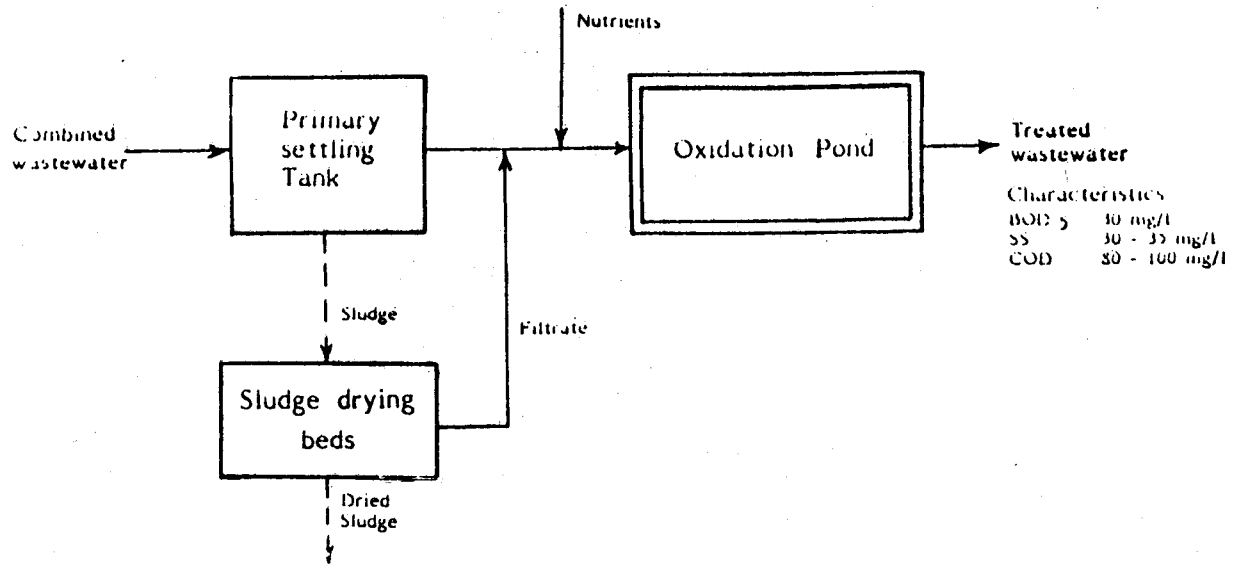
TREATMENT ALTERNATIVE [ D ]



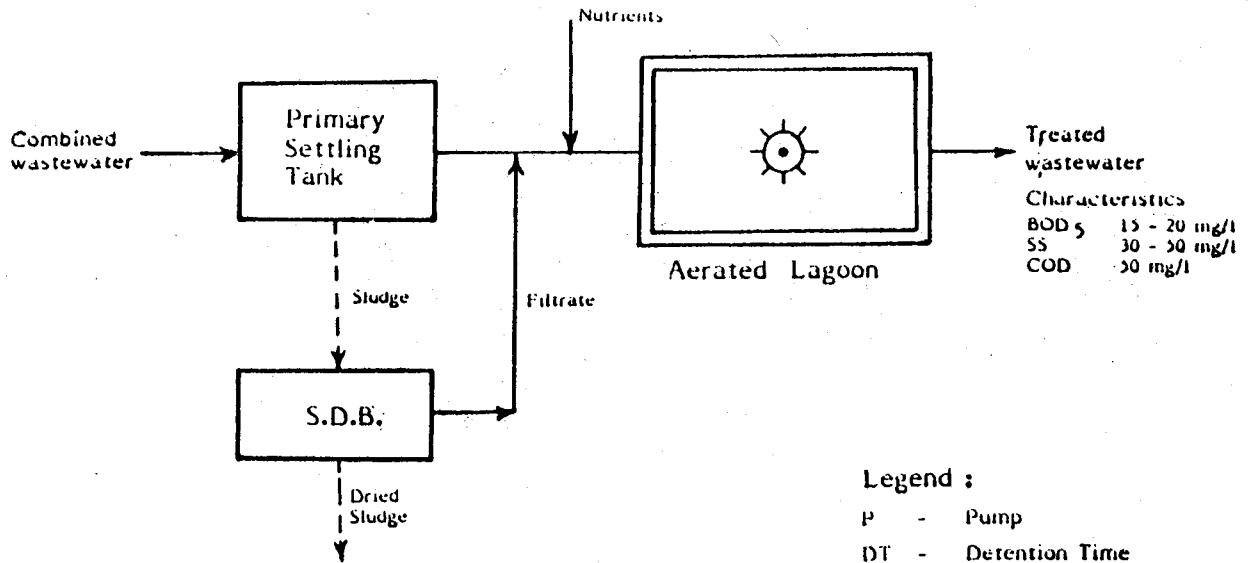
TREATMENT ALTERNATIVE [ E ]

FIG 2

TREATMENT ALTERNATIVES FOR AGRICULTURAL RESIDUE BASED PAPER MILLS



1. TREATMENT ALTERNATIVE [ A ]



2. TREATMENT ALTERNATIVE [ B ]

Legend :

- P - Pump
- DT - Detention Time
- PST - Primary Settling Tank
- SDB - Sludge Drying Beds
- SST - Secondary Settling Tank

FIG 3

TREATMENT ALTERNATIVES FOR WASTE PAPER AND PURCHASED PULP BASED PAPER MILLS