# Effluent Treatment in Newsprint Manufacture An Example from Hindustan Newsprint Limited

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SUMMARY

Pollution control measures adopted from the planning stage for the Newsprint Mill are illustrated. Effect of in-plant control measures and recycling of waste water on reduction of pollutional loads and consumption of fresh water are shown. Segregation of sewers in the mill has resulted in economical sizing of the treatment units. The efficiincy of the effluent treatment units during the operation of the mill has beeh verified and reported in this paper. Colour removal by using the coagulating and flocculating agents in the primary clarifier has been found successful. BOD removal in the areated lagoon-polishing lagoon system has been found very effective. Pattern of oxygen dispersion in the lagoon by mechanical aerators is under study. Overall efficiency of the effluent treatment plant for removal of BOD, Suspended Solids and colour has been found over 90%

## INTRODUCTION :

Hindustan Newsprint Limited, a subsidiary of Hindustan Paper Corporation Limited, with a capacity of 80,000 Tonnes of Newsprint per annum is located at Mevelloor, about 30 Kms. south of Ernakulam in the State of Kerala. The construction of the Mill Started in Jan. 1977 and went on stream in February 1982. Environmental Pollution Control Measures have been adopted for the Mill from its planning and design stage itself and forms an integral part of the Mill. A paper "EFFLUENT TREATMENT & DISPOSAL SYSTEM FOR THE KERALA NEWSPRINT PROJECT—A CHALLENGE TO PLANNIG AND EXECUTION", giving details of proposed pollution control measure for the Newsprint Mill was presented in IPPTA annual Meeting & Seminar in 1979 at New Delhi. The present paper provides the details on functioning of the effluent treatment plant after the Mill was put in operation. It deals mainly with the efficiency of the different units of the treatment system including that of the colour removal which was added subsequently. The paper also elaborates the pulping process, internal control measures and recycling of waste water adopted in the mill which have reduced the pollutional loadings and thus resulted in economical and efficient design of the effluent treatment plant.

## PULPING PROCESS :

The newsprint in Hindustan Newsptint Limited is made using 70% chemi-mechanical pulp produced from Eucalyptus wood and 30% chemical pulp produced from Reed and Bamboo. The eucalyptus wood is chipped, screened and the chips are washed. The washed chips are treated with steam and caustic soda solution. The impregnated chips are pressed to remove the spent liquor and then refined in two stages. A.D.K.P. press is provided in between these two refining stages to extract the liquor. The unbleached pulp so produced is washed on brown stock washer and bleacoed by two stage hypo-

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chlorite treatment. The bleached pulp is again refined in a third stage refiner, screened, centricleaned and dewatered on a thickner and stored in high density chest.

The chemical pulp is produced from reeds and bamboo by using the conventional kraft process, The chips are cooked in stationery digesters. The pulp is washed on brown stock washers by counter current washing. The washed pulp after screening is bleached by conventional CEH sequence, The bleached pulp is then stored in high density chest.

The spent liquor from both, the chemimechanical and chemical pulp mills is processed in the chemical recovery plant for the recovery of chemicals, which are reused in the process.

The pulp furnish consisting of about 70% bleached chemi mechanical pulp and 30% bleached chemical pulp is further processsed in the stock preparation plant and finally the newsprint is produced over a twin wire paper machine—the duoformer.

The Mill has got a water treatmet system, demineralisation plant for boiler feed water, power boilers and a captive generation unit of 15 MW capacity.

## RECYCLING OF WASTE WATER :

The fresh water requirement of 35000M³/per day for production of 250 TPD at Hindustan Newsprint Limited is drawn from the river Muvattupuzha. Low water consumption of 140M³/per tonne of newsprint produced could be achieved mainly due to the recycling of the wastewater at the various stages, some of these are enumerated below :—

i. The filtrate from the brown stock thickner in chemical pulp mill is used in the centricleaners for dilution.

ii. The major portion of the filtrates from chlorination, alkali extraction and hypowashers in the bleach plant are recirculated in the respective stages for dilution.

iii. Filtrate from unbleached washer of chemimechanical pulp is cooled and reused in raffinators for pulp dilution.

iv. Filtrate from bleached washer of chemimechanical pulp is reused for pulp dilution in bleach towers.

v. Filtrate from bleached thickner and the reject filter is used for the dilution of the pulp at raffinator, pressure screen and centricleaners.

vi. Clear filtrate from paper machine disc saveall is used in CMP bleach washers, knock off showers of disc saveall, duoformer LP Showers, tertiary reject tank dilution, broke chest dilution etc.

vii. Cloudy filterate from the paper machine disc saveall is recycled in the disc saveall, consistency controllers and white water silo.

viii. Cooling water from surface condenser in black liquor evaporation plant is used in digester house, chemi-mechanical pulping plant and paper machine chemical additive preparation section.

ix. Foul condensate from black liquor evaporation plant is used in causticizer plant and ash handling section of power house.

x. Vacuum pump seal water in paper machine is reused again after cooling through cooling towers.

xi. Pressure screens are used in screening plant to reduce the losses of water and fibres to the effluent drains. It also minimises the foaming.

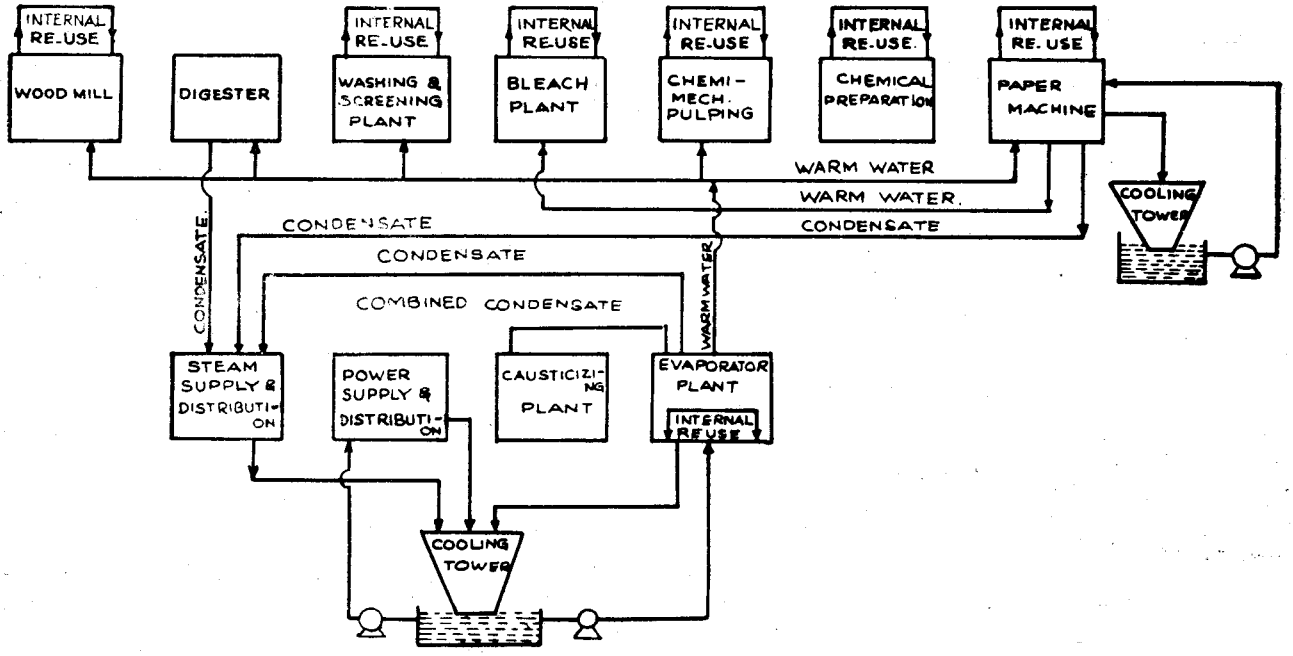
These inplant control measures are illustrated in Fig. 1.

It has been reported that consumption of fresh water by most of the Swedish Paper Mills is at about 70M³/T whereas one Mill in Canada has achieved complete recycling of wastewater. Recycling of wastepaper is, however normally adopted to the extent it provides overall economy in the treatment of the effluent.

## IN—PLANT CONTROL MEASURES :

The pollutional loadings on the effluent stream has been kept minimum by adopting a number of inplant control measures. In Paper Industry, pulp mills are the main source of pollution The contamination of effluents with ligneous spent liquor has been completely avoided by adopting the following control measures :—

WATER RE-USE DIAGRAM (FIG. 1)




i. Spent liquor from chemical pulp mill is processed in Soda Recovery plant for the Recovery of chemicals and at the same time making use of the heat value of the dissolved organic matter present in it for steam production.

ii. The alkali extraction stage in pulp bleaching contributes to around 95% colour and BOD from any pulp mill. This has been almost completely eliminated by following sequential addition of calcium hypochlorite in the extraction stage. The colour of the effluent from this alkali extraction stage is within 100 Pt—Co units against 5000 Pt—Co units in other paper mills.

iii. The total load both of BOD and colour on the effluents from the bleaching section is also low as the brightness of the bleached pulp is kept only 65% Elrepho. against 75—80% in other paper mills.

iv. The spent liquor from the chemi-mechanical pulping process is completely pressed out from the chips and pulp and is again recycled in the process. The spent liquor initially pressed out from the chips after the impregnation is utilised for the dilution of the caustic lye to prepare the impregnation liquor.

The spent liquor pressed out from the pulp at the DKP, press is passed through a DSM screen and the filtred liquor is utilised in chemical pulp mill for adjusting the ratio in the digesters and for blow tank dilution and is ultimately processed in chemical recovery section. The washings from the unbleached washer from the chemi-mechanical pulp is cooled and partly reused for unbleached pulp dilution and remaining is purged out to the effluent system which contributes very high colour to the effluents.

v. Inspite of all care taken to avoid the contamination of effluents with the black liquor, in a continuous process, the contamination by spilages can not be ruled out. The black liquor from the pulp mill and soda recovery, if by and means finds its way into the euffluents, can upset the whole effluents system and all efforts to minimise the pollution load on effluents will be defeated. In order to combat such situations, spillage tanks or sumps are provided in the chemical pulp mill and black liquor evaporation plant. The spillages occuring in these sections are diverted into these sumps, fitted with conductivity meters and pneumatically operated slide gates operating on conductivity sensing. The coloured effluents, so collected in these

sumps are then taken into the black liquor system.

## EFFLUENT TREATMENT & SEWERAGE SYSTEM :

**Pollutants :**

The major polluting parameters in the paper/newsprint industry are BOD and suspeded solids. Though the colour is not a pollutant but an easthetic point of view it may need treatment. As practiced in the paper industry to provide treatment only for removal of BOD and suspended solids, HNL also initially planned and designed the elaborate system for effluent treatment only for removal of BOD and suspended solids. Soon after commissioning of the mill. the agitation by the people living on the downstream of Muvattupuzha River posed a serious problem and as a social obligation, HNL added in the existing effluent treatment system, colour removal system based on indegenous technology.

The colour to the effluents from a newsprint mill is mainly from the mechanical pulp mill. This is more so, if the process used is chemi-mechanical where colouring tannins and ligneous compounds will be leached out from the wood during the chemical impregnation stnge. It may not be economical to process this spent liquor in the chemical recovery plant to recover the chemicals because of the very low solids content in it. Even though some arrangement is made to recirculate and reuse the spent liquor coming out at the first instance, it is almost impossible to reuse the brown stock washings (i.e. the unbleached filtrate from a chemi-mechanical pulp mill) This results in the discharge of these washings in the effluent system which give very high colour to the effluents.

**Mill's Sewer System :**

The Kerala State Pollution Control Board has stipulated limits of 100 mg/l suspended solids, 100 Pt—Co units colour and 30mg/l BOD for the effluents discharged into the river. Based on these specifications the entire effluents from each section of the mill are segregated into three sewers as follows :

I. **High Solids—High Colour Sewer :**

This sewer consists of all the effluents from each section having suspended solids more than 100 mg/l and colour more than 100 Pt—Co units. These effluents having high suspended solids and high colour, require retreatment for suspended solid removal, and thereafter BOD removal.

II. **Low Solids—Low Colour Sewer :**

The effluents from each section having suspended solids lower than 100 mg/l and colour less than 100 Pt—Co units and which have high BOD due to the organic matter present in them are diverted into low solids low colour sewer. Since, the suspended solids and colour of these effluents are within the specified limits by the Pollution Board, it does not require any treatment for the removal of these pollutants. But as the BOD of these effluents is high it requires treatment for BOD removal.

III. **Clear water sewer :**

Pump glands and bearing cooling water from the different sections of the mill are collected separately in the clear water sewer. The water in this sewer is uncontaminated in the sense it is having no load with respect to suspended solids, colour and BOD. So these do not require any treatment at all and can directly be discharged into the river. The characteris tics of the effluents ensuing from different sections of the mill are tabulated in Table I.

## PRIMARY TREATMENT :

The combined high solid—high colour effluents which contain 500—700 mg/l suspended solids, 3000—3500 Pt—Co units colour and 300—4000 mg/l BOD are first passed through a bar screen to remove the big particles like coal pieces, chips and other foreign materials and is then taken to 30 meter die clarifier. The colour removing chemicals, a mixture of alum, rare earths chloride and polyelectrolyte is added into this steam just before the bar screen where it is thoroughly mixed with the help of an agitator. The process adopted for colour is very sensitive to pH and the system works well at pH around 7.5—8.5. In normal conditions no pH correction is required but sometimes when the pH in the high colour effluent is on the higher side, it is adjusted to around 7 5—8.5 by addition of hydrochloric acid before the addition of the colour removing chemicals The suspended solids along with the sludge produced due to precipitation of

TABLE—I

CHARACTERISTICS FO THE EFFLUENTS ENSUING FROM DIFFERENT SECTION OF THE MILL

| Section | Sewer | Flow lit/min. | P or pH | Suspended solids mg/lit | Colour Pt-Co Units | Dissolved oxygen mg/lit | COD mg/lit | BOD 5 at 20°C mg/lit |
|---|---|---|---|---|---|---|---|---|
| Paper Machine | High Solids | 4500--5000 | 6.5--7.5 | 500—800 | 50--60 | 2—3 | 800—1000 | 200—300 |
| | Low Solids | 2500—3000 | 6.5—7.5 | 80—100 | 50—60 | 2—3 | 800—1000 | 2 0—300 |
| Chemi-mechanical Pulp Mill | High Solids | 1000—1500 | 8—9 | 800—1000 | 15000—20000 | Nil | 4000—5000 | 1000—1500 |
| | Low Solids | 5300—5800 | 8—9 | 60—80 | 60—80 | 3—4 | 500—800 | 200—300 |
| Chemical Pulp Mill | High Solids | 1000—1500 | 8—9 | 300—500 | 200—400 | 2 - 3 | 500—800 | 150 - 250 |
| | Low Solids | 2500—3000 | 6 - 7 | 60—80 | 80—100 | 2—3 | 500 - 800 | 150—250 |
| Soda Recovery | Hlgh Solids | 400—500 | 8—9 | 500—800 | 60—80 | 4 - 5 | 200—300 | 50—100 |
| | Low Solids | 400—500 | 8—9 | 50—60 | 80—100 | 2—3 | 200—300 | 50—100 |
| Power House | High Solids | 400—500 | 8—9 | 100—150 | 50—60 | 4—5 | 100—150 | 40—80 |
| | Low Solids | 400—500 | 6—7 | 60—80 | 40—60 | 4—5 | 80—100 | 30—50 |

colouring matter settled in the clarifier is taken continuously into a sump pit in the effiuent filter house where the lime sludge from the calcium hypochlorite preparation plant is also pumped. Both these are filtered together over a vacuum belt filter. The sludge from the filter is taken out and diposed as a solid waste.

It has been noticed that the fiberous suspended solid present in the high solids effiuents facilitate the coagulation and flocculation of the colour and helps in its proper settling in the clarifier. Also, due to the presence of suspended solid, the sliminess of the coagulated material is reduced by which the difficulty anticipated in filteration of the coagulated materials at the vacuum filter is overcome.

The overflow of the clarifier contains 60—80 mg/l suspended solids and 70—90 Pt—Co units colour. Thus the colour removing efficiency in the clarifier is over 95% and the suspended solids removal is around 90%. This combined treatment for the removal of the colour and suspeded solids also helps in the reduction of BOD and COD. 30—35% reduction in the BOD has been observed in the clarifier.

The pH of the effluents at the clarifier overflow will be around 4.5 tc 5.0 and that for the combined low solids effluents is around 7 to 8. When these two are mixed, the pH of the combined effluents is around 6.5 to 7.5 and needs no further pH correction. However, if in case of abnormalities, the pH of the effluents after

mixing of low solids and clarifier overflow deviates from 6.5 to 7.5 range, this is again adjusted by the addition of acid or alkali, as required at the mixing point. On—line pH meters are provided at different stages for continuous monitoring of the pH of the effluents and then to take the corrective measures.

## THERMAL REDUCTION :

The water consumption of the mill has been kept very low by effective recycling af the waste water wherever possible. Due to the large extent of this recirculation, the temperature of the combined effluents may go above 45—50°C. However, for the best biological activity, the most suitable temperature is around 35—40°C. Hence, to achieve this temperature two cooling ponds are provided in series. The combined effluents after the pH adjustment are taken into No. I cooling pond and then to No. II cooling pond. These cooling ponds are spread over an area of 6 hectares and the effluents are getting a retention time of 2 days and 2.5 days respectively in No I and No. II cooling ponds.

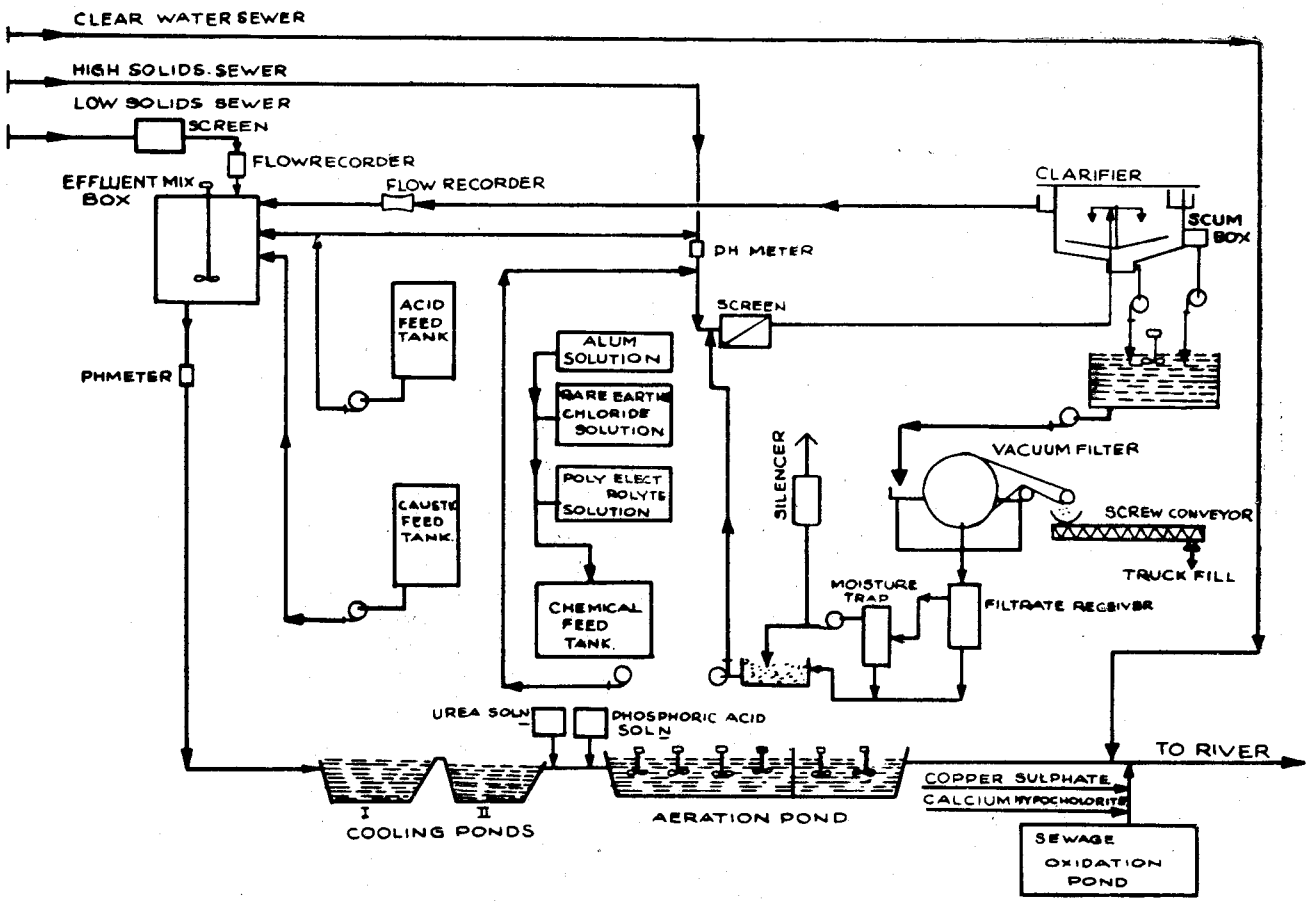
The cooling pond No. I also acts as settling tank for the suspended solids which find their way into the low solids sewer. Thns the suspended solids in the effluents at the outlet of cooling pond No. II is normal.y 50—60 mg/1. Provisions in the cooling ponds have been made such that either pond can be bypassed and dewatered for the removal of accoumulated solids.

It may be noted that suitable temperature and pH are essential prerequisite for successful working of biological treatment system and HNL takes all care to control them.

## SECONDARY TREATMENT :

The secondary treament for the removal of BOD is accomplished in aeration ponds. The aeration ponds have been found to be the simplest and most effective method for secondary treatment of the effluents. This could be achieved due to the vast land availalbe in the form of a natura. nalla in between two hillocks.

To the cooled primary treated effluents are added the nutrients-nitrogen and phosphorous




EFFLUENT TRBATMENT SYSTEM (FIG. 2)

in the form of urea and phosphoric acid. The solution of urea and phosphoric acid at the required concentration are added separately to the effluents at the cooling pond No. II outlet,

The aeration pond has been divided into two cells—the primary cell and the polishing cell. These aeration ponds are spread over in an area of 14 6 hectares of land. Sixteen floating aerators of 55 KW rating each, are provided in the aeration lagoon, 12 in primary cell and 4 in the polishing cell. The positioning and operation of these aerators is done in such a manner that there is no chanelling of the effluents through the lagoon and the entire effluents are invariably subjected to thorough aeration. The retention time for the effluents in the lagoon is 9 days in the primary cell and 16 days in the polishing cell. Theoritically, the retention time required in the lagoon is less but due to various other reasons the higher sizing of lagoon was done at the initial stage itself to take care of effluent for expended capacity of the mill. Due to this large retention time for the present capacity, the requirement of nutrients is found to be very much lower than the standard figures. Normally, the feeding of the nutrients is not required. Occasionally, the nutrients are added in the ratio of 100 : 1.4 : 0.4 for BOD : N : P. The BOD reduction efficiency in the aeration lagoon is nearly 90%. All the characteristics of the effluents at the outlet of the aeration pond are well below the specified limits. Complete effluent treatment plant is shown in Fig. 2.

## SEWAGE TREATMENT :

Hindustan Newsprint Limited has put up a colony consisting of around 1000 quarters wherein nearly 5000 people live. The effluents in the sewage from this colony and also from the mill is around 1000 lit/min. Septic tanks are provided for the sewage and the overflow from these septic tanks are taken into an oxidation pond. Chlorination is done in the overflow of oxidation pond using calcium hypochlorite for reduction of coliform bacteria and also copper sulphate in controlled dose is added to these effluents to control the algae growth. The effluents from the sewage oxidation pond after treatment joins the effluent from the aeration pond before the discharge point.

## EFFLUENT DISPOSAL :

The treated effluents from the aeration lagoon are mixed with the uncontaminated effluents from the clear water sewer and the treated effluents from the sewage oxidation pond. The characteristics of these effluents at the final discharge points are tabulated along with the specitications laid down

TABLE—II

CHARACTERISTICS OF THE COMBINED EFFLUENTS

| Effluent | Flow lit/min | pH | Suspended solids mg/lit | Colour Pt-Co Units | Dissolved oxygen mg/lit | COD mg/lit | BOD5 at20°C mg/lit |
|---|---|---|---|---|---|---|---|
| Combined high solids sewer | 7000—9000 | 7.5—8.5 | 500—700 | 3000—3500 | 0—1 | 1200—1400 | 300—400 |
| Combined low Solids sewer | 11000—13000 | 7—8 | 60—90 | 80—100 | 2—3 | 600—700 | 150—250 |
| High solids sewer after primary treatment (clarifier overflow) | 7000—9000 | 4.5—5.0 | 60—80 | 70—90 | 1—2 | 800—1000 | 200—300 |
| Combined low solids and primary treated high solids | 19000—21000 | 6.5—7.5 | 60—90 | 80—100 | 1—2 | 600—800 | 150—250 |
| Aeration lagoon outlet | 19000—21000 | 6.5—7.5 | 60—90 | 80—100 | 5—6 | 120—150 | 15—20 |
| Clear water sewer | 1800—2500 | 6.5—7.5 | 40—60 | 30—50 | 4—5 | 20—30 | 4—5 |
| Sewage oxidation pond over flow | 800—1000 | 8.0—8.5 | 70—80 | 40—80 | 5—6 | 70—80 | 10—15 |
| Final discharge at check point | 22000—24000 | 7.0—7.8 | 70—80 | 80—100 | 5—6 | 120—150 | 15—20 |

by the kerala State Pollution Control Board in Table III. These results can briefly be summerised as follows :

| Parameter | | Effluents discharged from HNL | Tolerance limits from Kerala State ollu tion control Board. | ISI Tolere nce limits IS 24⁰0-1974 |
|---|---|---|---|---|
| Colour | Pt–Co Units | 117 | × + 100 | Not Specified |
| Suspended solids | mg/lit | 73 | 100 | 100 |
| $BOD_5$ | mg/lit | 17 | 30 | 30 |
| COD | mg/lit | 121 | 250 | Not Specified. |

TABLE III

CHARACTERISTICS OF THE EFFLUENTS AT FINAL DISCHARGE POINT

| Parameter | Units | Results | Specifications laid down by Kerala State Pollution Control Board, |
|---|---|---|---|
| Quantity discharge | KL/Day | 34380 | 33000 |
| PH | — | 7.6 | 5.5–9.0 |
| Temperature | °C | 31 | Ambient |
| Suspended Solids | mg/lit | 73 | 100 |
| BOD5 at 20°C | mg/lit | 17 | 30 |
| COD | mg/lit | 121 | 250 |
| Oil and grease | mg/lit | 3.5 | 10 |
| Sulphides as 'S' | mg/lit | 0.34 | 2.0 |
| Total residual chlorine | mg/lit | Nil | 1.0 |
| Hexavalent Chromium as'Cr' | mg/lit | Nil | 0.1 |
| Colour | Pt-Co Units | 97 | × + 100* |
| Phenolic compounds | mg/lit | Nil | 1.0 |
| Mercury as Hg | mg/lit | 0.001 | 0.01** |

*Where × is the river water colour which is normally 30 Pt-Co units.

**Specification as per IS 2490 (Part-I) 1974.

These results indicate the effectiveness of the effluent treatment at HNL. These effluents are not at all harmful to the aquatic life and can safely be discharged into the inland surface water These effluents are then taken through an underground RCC pipe, 1200 mm in diameter and are discharged below the surfac of water in the Muvattupuzha River, about 5 Kms. down stream of water in take point. At the discharge point the river has a minimum flow of 12.75$m^3$/sec. which provides about 30 times dilution to the treated effluents. The characteristics of the river water before and after the discharge point are tabulated in Table IV.

TAELE—IV

RIVER WATER CHARACTERISTICS—UPSTREAM AND DOWNSTREAM

| Characteristics | Units | Upstream | Downstream |
|---|---|---|---|
| PH | — | 7.3 | 7.5 |
| Suspended solids | mg/lit | 23 | 31 |
| Colour | Pt-Co Units | 30 | 40 |
| Dissolved Oxygen | mg/lit | 7.6 | 7.2 |
| COD | mg/lit | 8 | 16 |
| BOD5 at 20°C | mg/lit | 1.0 | 1.5 |

Facility of gravity flow of the effluents through the entire treatment plant and disposal pipe line was available as the land has the sloping gradient from the mill towards the effluent discharge point of the river. A separate drainage has been provided in the mill site to take care of the storm water.

## OTHER POLLUTIONAL ASPECTS :

A newsprint mill can be as polluting as any other paper mill if proper care is not taken for the effluents treatment. However, there is scope for modifying the process to bring down the load on the effluents. At Hindustan Newsprint Limited, the pollution load has been brought down by adopting various measures explained in the above section.

The pulping process is also modified in such a way that the pollution load on the effluents is

minimum. In case of chemical pulping process, the effluents from the bleaching section exhibit the least possible BOD and colour load due to the sequential addition of calcium hypochlorite in the alkali extraction stage and also due to low brightness level maintained for the bleached pulp. Similarly, the load on the effluents from chemi-mechanical pulping process is also kept low by keeping a very high pulp yield of 85% and above.

The BOD load from paper machine is low as no organic additives are used. The suspended solids load from paper machine could be brought down due to the high total retention of 75—80% on paper machine and also due to the high efficiency of the disc saveall and because of the various recirulation measures.

The pollution load on the effluent stream and also at various stages of the effluent treatment process is indicated in table V. From these results it can be noticed that the BOD, colour and Suspended Solids from the various sections is low in comparison with that from any other proper mill of same capacity. However, the colour load from chemi-mechanical pulp mill is on the higher side. This necessitates the colour removing treatment in a newsprint mill.

TABLE—V

POLLUTION LOAD FROM DIFFERENT SECTIONS

| Section | Sewer | Flow $M^3$ /day | $BOD_5$ at 20°C Kg/ day | Suspended solids Kg/day | Colour Kg/day |
|---|---|---|---|---|---|
| Paper Machine | High Solids | 6600 | 1650 | 4290 | 363 |
| | Low Solids | 4000 | 1000 | 360 | 220 |
| Chemimechanical | High Solids | 1700 | 2125 | 1530 | 34000 |
| pulp mill | Low Solids | 8000 | 2000 | 560 | 560 |
| Chemical Pulp Mill | High Solids | 1700 | 340 | 680 | 510 |
| | Low Solids | 4000 | 800 | 280 | 360 |
| Soda Recovery | High Solids | 720 | 54 | 468 | 50 |
| | Low Solids | 720 | 54 | 40 | 65 |
| Power House | High Solids | 720 | 43 | 90 | 40 |
| | Low Solids | 720 | 29 | 50 | 36 |
| Combined High Solids | High Solids | 11440 | 4212 | 7058 | 34960 |
| Combined low solids | Low Solids | 17440 | 3883 | 1290 | 1240 |
| Primary Treated High Solids (clarifier overflow) | | 11440 | 2860 | 800 | 1830 |
| Combined Low Solids and Primary Treated High Solids | | 28880 | 6743 | 2090 | 3070 |
| Aeration Lagoon outlet | | 28880 | 5-7 | 2266 | 3070 |
| Clear water sewer | | 4000 | 20 | 200 | 160 |
| Sewage oxidation pond overflow | | 1500 | 18 | 112 | 68 |
| Final Discharge at check point | | 34380 | 585 | 2578 | 3298 |

The total BOD load from a normal paper mill is around 40—60 Kg/T of paper[6]. However, due to the various recirculation carried out and also due to the basic process adopted, BOD load on the effluents stream from Hindustan Newsprint Limited is 30--32 Kg/T of newsprint produced This low BOD load has made the effluent treatment easy and effective. Added to this the high capacity of the aerated lagoon at Hindustan Newsprint Limited has made the effluent treatment system fool proof.

The dissolved oxygen at the outlet of the aerated lagoon is normally 5 5 to 6.0 mg/1. The results given in Table III indicate that the affluents dischnrged from Hindustan Newsprint Limited are not at all harmful to the aquatic life. This is also supported by the fact that a large number of good quality fish are grown in the polishing lagoon. A look at Table IV shows that there is no major change in the quality of the river water after the discharge of the effluents.

**Study for D.O. pattern in lagoon**

HNL is carrying out a study to know the pattern of dissolved oxygen in the wastewater in the aeration pond to establish the following aspects :

i. Power requirement for oxygen demand and BOD removal,

ii. Placement of aerators in the lagoon,

iii. optimum depth of lagoon for aerobic condition.

Some valuable information have already been collected but it needs further study to arrive at some definite parameters for economical and efficient design of aerobic lagoons.

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