POSSIBILITY OF TREATEMENT, CONTROL AND REUSE OF EFFLUENT FROM BLEACH PLANT IN PULP AND PAPER MILLS.

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Friends,

I will be talking you on the possibility of treatement, control and reuse of effluent from bleach plant in Pulp and Paper Mills. In the last few years efforts towards closing up the bleach plant effluent in chemical pulp mills are aggressively followed and two approaches holds promise in the direction.

1. Diverting the effluent to chemical recovery
2. Use of membrane separation techniques.

To meet these requirements the concept of a bleach plant from being an Art is viewd more through sound application of Scientific & Engineering principles, The basic thing that has come to be realised is that bleaching whether carried out through conventional or non-conventional bleaching chemicals should be minimal and this has necessiated following changes/consideration:

1. SUBJECTING PULPS WITH VERY LOW RESIDUAL LIGNIN CONTENT TO BLEACHING

Chemical technologies have been developed and implemented for lignin reduction. Examples are use of additives such as anthraquinone or incorporating polysulfide cooking liquor to allow pulping to a lower kappa number without unaccepitable degradation of cellulose. Extended delignification and oxygen delignification also are examples of chemical approaches for removing more lignin.

2. IMPROVED WASHING OF UNBLEACHED PULP:-

Diffusion washing, use of improved dewatering equipments viz presses etc. to reduce carry over of dissolved organics as measuared by COD to the bleach plant.

3. REDUCE WATER REQUIREMENT IN BLEACHING:-

This will be possible through adoption of short sequence bleaching, selecting bleach sequence which will greatly mininize water usage with Ion control and heat control, including counter current washing.

4. Bleach plant effluent is amenable to treatement using plysical, chemical and biological treatement processes mainly for detoxification since all effluents are toxic whether produced through elemental chlorine or no elemental chlorine bleaching (ECF) including no chlorine bleaching (TCF).

Since for my presentation treatement is associated with greater reuse of waste water the approaches based on use of absorbent / Ion exchange resins and ultrafilteration / reverse osmosis holds great promise. The studies carried out using absorbent resins have been limited, Lindberg & Borjeson (1,2) developed the concept of a "non polluting" bleach plant which relied on a combination of (a) counter current recycling of bleaching filterates and (b) purification of the entire bleach plant outfall with absorbent resins. Field trials showed that effluent toxicity and mutagenic activity could be elimiated, the colour could be reduced dramatically and the BOD , COD and chloride contents could be reduced substantially. In addition the concentration of chlorinated phenols and guaiacols were redued by approximately 90% by this treatement from 30 g / ton to around 3 g / ton pulp in the treated effluent.

Ultrafilteration and reverse osmosis makes use of generic membrane technology. Both are pressure driven filteration separation occuring on a molecular scale. In the case of ultra filtration separation range from 2 to 20 nm. Membrane retained components are collectively called concentrate or retentate, materials permeating the membrane are called filtrate, ultrafiltrate or permeate, Data on few laboratory/pilot plant trials are presented here.

DDS of Denmark alongwith a Swedish Company, Electrokemiska Alktiebolget (EKA) developed a large scale system for efficient colour removal in the effluent from the alkali extraction step by UF, A large UF plant was installed at Iggesund Bruk Sweden in 1978. The total membrane area was of 168 m^2 and 25 m^3 / hr of E stage effluent was processed. It consisted of four DDS modules each with 42 m^2 membrane area. The following table gives the analytical figures of the above described Iggesund plant.:

	E Stage filtrate	Ultrafiltration concentrate	Ultrafiltration filtrate	Reduction %
Volume m3	12	0.6	11.6	-
Colour Kg/t Pulp	150	130	20	87
BOD " "	5.6	1.3	4.3	25
COD " "	44	27	14	70
Total organic solids Kg/t Pulp	30	19	11	65
Total inorganic solids Kg/t Pulp	43	7	36	20
Organic Chlorine kg/t Pulp	2.3	2	0.3	87
Inorganic Chlorine Kg/t Pulp	13.4	0.5	12.9	4

Ultra filtration reduces acute toxicity by about 50 percent and this explains the relatively high BOD filtrate value.

A UF plant was installed in 1981 at the Sanyo Kokusaku, Iwakuni Pulp Mill, Japan for the concentration of the E stage effluent in one of the kraft pulp production lines. The annual capacity of this line is 1,10,000 tonnes of bleached pulp, the ULTRASEP installation replaced the earlier method of treating bleach plant effluents using lime precipitation Polysulphone membranes are used with a total membrane area of 672 m^2 . In this plant 104 m3 / hr of bleach effluent is treated giving 13 m^3 / hr concentrate which is returned to the recovery suystem. The permeate is partly used as wash liquor in the brown stock washer but mainly discharged.

Another Japanese Mill has installed an UF plant for the treatement of E stage effluent. Taio Paper Company put up an UF plant into operation around 1981. About 145 m^3 / hr of bleach effluent is treated by UF. The permeate is treated further by activated sludge. The concentrate is taken back into the black liquor recovery system to be incinerated. The heat value of concentrate is claimed to balance the capital and membrane replacement cost, the total membrane area is 1480 m^2 with one and half year operational life.

Sometime in 1986 a study was carried out on "complete effluent recycling in the bleach plant with ultrafiltration and reverse osmosis" (3). Following were the recommendations made, the filtrate for the first two stages was obtained from a mill using C/D E H D E D bleaching sequence.

a) Ultrafiltration of the first stage caustic extraction effluent to remove colour and organics.

b). Separate reverse osmosis of the ultrafiltration filtrate and C/D effluent to remove chloride and colour.

c) Removal of chlorides from the ultra filtration and reverse osmosis concentrates.

In 1986 studies were also carried out at Ballarpur Industries Limited Unit Shree Gopal with the help from Scientists from Thapar Corporate R & D Centre Patiala. In these studies spiral wound cellulose diacetate membrane modules were used at various applied pressures and feed flow rates. Due to poor flow control and difficulty in cleaning the membrane, it was concluded that spiral wound modules are not suitable for these effluents.

Combined effluents from C H^1 H^2 sequence for bleaching of Eucalyptus pulp was preated for suspended solids removal. The pretreated effluent was fed to the spiral would cellulose diacetate UF membrane modules with 5.6 m^2 area at an applied pressure of 14 kg/cm^2 . The permeate was collected for reverse osmosis experiments. The feed thus prepared was fed to the spiral wound cellulose diacetate R.O. membrane modules with 8.4 m2 area at an applied pressure of 28 kg/cm^2. Test results obtained in a typical experiment are given below:

ULTRAFILTRATION OF (C + H1) EFFLUENT OF 14 KG/CM^2

		Feed	Permeate	% removal
pH		5.2	5.3	-
Total dissolved solids	mg/l	2670	913	66
Organics	mg/l	1310	511	61
Inorganics	mg/l	1360	402	70
Na^+	mg/l	165	73	56
Cl^-	mg/l	891	286	68
COD	mg/l	260	66	75
BOD_5	mg/l	160	32	80

To conclude membrane sepration techniques using ultrafiltration / reverse osmosis holds promise in future for treatement and reuse of effluent from bleach plants where minimal bleaching is carried out. It is felt that there is a need to carry out a National R & D programme for generating data using model bleaching sequences on Pulps from Indian Fibrous Raw Materials and study all aspects of techno-ecnomics suiability using membrane sepration techniques.

REFERENCES

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IGGESUND PLANT- ULTRA-FILTRATION STUDIES ON E STAGE FILTRATE

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MEMBRANE AREA	168 M^2
EFFLUENT TREATED	25 M^3/HR

ULTRAFILTRATION PLANTS IN JAPAN FOR E-STAGE EFFLUENT

	SANYO KOKU SAKU IWAKUNI PULP MILL	TAIO PAPER COMPANY
MEMBRANE AREA, M^2	672	1480
EFFLUENT TREATED, M^3	104	145

ULTRAFILTATION OF (C+HI) EFFLUENT AT 14 KG/CM^2 AT BILT-YAMUNANAGAR.

	FEED	PERMEATE	% REMOVAL
pH	5.2	5.3	--
Total Dissolved Solids mg/lit	2670	913	66
Total Organic Solids mg/lit	1310	511	61
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