Current World Enviroment Vol. **3**(1), 189-193 (2008)

Studies on the effluent generated during the pulping process in paper industry

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(Received: March 12, 2008; Accepted: May 17, 2008)

ABSTRACT

Environmental pollution has become a cause for great concern as it continues to increases rapidly day by day. One of the major toxic pollutants comes through paper industry. It directly or indirectly in one form or other pollutes the environment. Pulping additives such as quinone-based additives have been used in the experimental work for the alkaline pulping of. Ipomoea Carnea Jacq (Beshram). In the present paper a thorough study has been done on the chemical analysis of the effluent from different storms, pollution load of the soda extraction stage effluent and pulp washer effluent was analyzed and studied. This pollution load affects the environment creating a wreak havoc on the surrounding eco system.

Key words: Industrial effluent, *Ipomea carnea,* paper industry.

INTRODUCTION

Ever increasing growth of industrialization causes gigantic problem of environmental pollution .The large volume of water consumed by Indian industries for various processes and the discharging of effluents done on to adjoining areas creates pollution. Industrial effluent is a complex liquid flowing out of the mill in enormous quantities. The quantities required represent the requirement of nearly 4000 per ton per day. These liquid effluents contain higher concentration of organic and inorganic pollutants. Rapid growth of industrialization has affected not only surface water but also ground water.

All industrial waste water affects in some way the normal life of streams, such as river and ponds etc. when the stream is over saturated with a specific pollutant, it becomes an effluent and has to be treated. Majority of effluents from sugar, distillery, pulp and paper industry contain organic wastes which is to be removed reducing COD and BOD values of the effluents does this. The left over that result from pulp and paper manufacturing include chemical compounds formed during papermaking, due to enormous quantity of waste water they generate thus the pulp and paper industry is considered a major industry with regard to waste water.

The greatest pollution threat in the wastewater of pulp and paper factories are the by-products from bleaching process that form when chlorine atoms bind to organic molecules in the pulp. These are the organochlorine in the pulp. These organochlorine byproducts are known as dioxins and furans, which are extremely toxic. BOD is a parameter for the concentration level of dissolved organic pollutant in the wastewater. Pulp mills are voracious water user.

MATERIAL AND METHODS

Ipomoea carnea Jacq sample was collected from Vidisha district, Raisen district of M.P. and Lalitpur district of U.P. respectively. The wood samples was cleaned and chipped. The chips were

chipped in the chipper .The chips were air dried and allowed to have uniform 12% moisture content. The screened chips were used in the experimental work. Cooking procedure and all the pulping experiment were carried out in an autoclave bomb digester, which consists of six stainless steel bombs. Each rotating in polyglycol bath .The cooking of chips was done keeping a control of soda digester for each set of experiment. Various additives such as anthraquinone, anthrone, 2.6.dichloroquinone4 chlorimde, and 8 hydroxyquinoline were added to get optimum dose. Black liquor extracted from each sample of pulp and additive mixture is collected and examined to check the various pollution parameter of water.

Table 1: Relation between absorbance at 465 nm and chloroplatinate units

S.No.	Chloroplatinate units	Absorbance
1.	100	0.030
2.	200	0.056
3.	300	0.083
4.	400	0.112
5.	500	0135

Table 2: Pollution loads in pulping process with and without additives

S. No.	Black liquor additives	TDS Mg/l	TSS Mg/l	COLOUR Mg/l	COD Mg/l	BOD Mg/l
1.	Soda pulping	1160	750	784867	174680	5467
2.	Soda AQ pulping	1408	464	729674	169700	4850
3.	Soda anthrone	1368	474	761429	188400	4240
4.	Soda 2 6 dichloroquinoline	1296	586	751280	174600	4360
5.	Soda 8 hydroxy quinoline	1374	589	762400	178600	4800

Table 3: Amount of hydrogen sulphide and mercaptan from the pulp mill and black liquor and black liquor evaporator

S. No	Chips	Pulping process	Cooking H_2S	CH_3SH	Black liquor H_2S	CH_3SH	Reduction compared
1	Soft	Kraft process low	0.05	0.107	1.15	0.425	00
	woods	sulphidity kfart	0.05	-	0.05		94%
		with quinone					100%
		soda AQ process					
2	Hard	Kraft process low	0.1	0.13	0.47	0.254	-
	woods	sulphidity Kraft	0.045	-	0.036	-	90%
		with quinone	-	-	-	-	100%
		soda AQ process					

Table 4: Additives percentage with unbleached and bleached pulp yield and its kappa number

S. No	Additive pulping	Unbleached pulp yield	Kappa Number	Bleached pulp yield
1.	Soda	40.1	33.3	30
2.	Soda AQ	45	24.2	40.8
3.	Soda Anthrone	43	29.3	38.5
4.	Soda 2.6 dichloroquinone	43.5	31	37.8
5.	Soda 8Hydroxy quinoline	40.2	32	36.9

Table 5: Chemical analysis of effluent from different streams

Particulars	pH	Color	Alkalinity	Total solids	TSS	COD	BOD	Temp	Pollutant character
Digester	11.5	38000	1159	2890	180	2000	870	50	pH, colour, BOD,
Chlorination	2.1	280	480	2800	170	800	184	28	Solids, COD
Alkaline	9.4	8700	380	1484	178	1000	110	39	pH, high BOD
Papermaking	7.6	80	140	1040	790	640	140	38	Low BOD
Chemical recovery	12.4	240	68000	80474	76407	600	120	40	Solids, BOD,
Complete addition	8.9	1410	940	2828	2100	740	290	38	-
Primary clarifier	7.8	560	280	420	170	300	100	32	-
Secondary clarifier	7.5	180	140	148	72	210	50	30	Clear

Table 6: Pollution load of soda extraction stage effluent during bleaching of pulp

S.No.	Additive pulping	TSSMg/l	ColorMg/l	CODMg/l	BODMg/l
1.	Soda	1.75	3164	2688	500
2.	Soda AQ	1.1	2821	1232	100
3.	Soda anthrone	1.3	2925	2688	800
4.	Soda 2.6 dichloroquinone	1.74	2928	2688	500
5.	Soda 8Hydroxy quinoline	1.64	3017	2688	100

Table 7: Water pollutuion load from pulp washer effluent

S.No.	Effluent sample	TDSMg/l	ColourMg/l	CODMg/l
1.	Soda	2.85	26531	72800
2.	Soda AQ	3.05	25714	58000
3.	Soda anthrone	3.1	37412	24080
4.	Soda 2.6 dichloroquinone	2.76	19285	11600
5.	Soda 8Hydroxy quinoline	3.07	27142	97280

RESULTS AND DISCUSSION

Table 1 shows the relation between absorbance at 465 nm and the chloroplatinate units .the criteria for selecting the 465 nm wavelength is the position of the absorbent maximum Pt-Co complex at this wavelength. The wavelength falls just at the boundary of violet and blue region of the spectrum .A curve can be plotted against color unit. The curve will show a steady increase in absorbance with respect to chloroplatinate units. Color is directly proportional to the absorbance.

Table 2 shows the pollution load in pulping process with without additives of black liquor .it is clear from the table that all the parameter of pollution was lower in case of soda AQ pulping except a little high value of TDS than others, wheras the load of black liquor and soda pulping was having higher pollution load.

Soda AQ pulping which is an alternative to Kraft process it will extent lower pollution load, particularly of water and air. Results in table III shows that the mercaptan formation and loss in sulphur in the form of organic sulphur that has been eliminated in soda AQ process. Thus pollution load due to sulphur at different stage was completely eliminated by employing soda AQ process.

Table 4 shows the yield and kappa number of unbleached pulp and other quinone additives carbohydrate dissolution was almost the same as in case of soda pulping .the fraction of COD are on the higher sides. Spent liquor for soda 2.6 dichloroquinone 4 chlorimide pulping shows higher BOD and COD value. Soda AQ pulping proceeds spent liquor with BOD and COD. Colour varies marginally and slightly higher solid content that was due to the dissolution of more lignin during pulping .It was observed that additives did not have any influence on the suspended solids in the pulping liquor.

Without using additives at ideal conditions results obtained from various streams of effluent mixed during the treatment of effluent plant i.e. primary and secondary clarifier is expressed in Table 5.

Table 6 shows alkali extraction stage effluent from soda AQ pulping which has lower COD and BOD.Soda pulping and pulping with other additives shows bleached pulp yield due to the degradation during bleaching which results in high BOD and COD load. Soda AQ helps in the reduction of pollution load by producing less degraded pulp with low kappa number.

Results in table 7 show the various pollution loads in washing of pulp produced with different additives .the colour of the washing of soda AQ and soda pulp are significantly lower than the other pulp washing. Washing from soda AQ, soda anthrone, and soda 2.6 dichloroquinoline 4 chlorimide as lower values as compared to soda pulping and soda 8hydroxy quinoline.

CONCLUSION

The soda pulp was with quinone additives, which completely eliminated mercaptan formation

and loss of sulphur. It can be conclude that odour nuisance is complete eliminated the addition of quinone additives in soda pulping and the effluent load can be lowest by the quinone additives. The BOD reduction is due to the higher retention of carbohydrate fraction in the pulp and reduction in the alkali extraction stage effluent due to low kappa number.

In soda anthraquinone spent liquor there was a significant reduction in BOD value than in COD as compared to soda pulping spent liquor .The BOD reduction was 29% whereas COD reduction was only marginal about 3%. There was not significant reduction in COD and BOD in Soda.2.6 dichloroquinone 4 chlorimide pulping liquor. Spent liquor from 8 hydroxy quinoline showed highest pollution load.

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