Eco-Friendly Usage of "CSRMP" Spent Liqour - A Case Study

B. H. Lashmana Reddy[1], H. M. Chandrashekara[2], Y. Ramababu[3], K. Ravi[4] and K. Vasanthakumar Pai*

The Mysore Paper Mills Ltd., has 350 TPD capacity of cultural and newsprint production and is integrated with sugar production. The mill has its own chemical recovery, heat recovery and Bio-methanation (UASB unit) to control loss of chemicals, energy and also reduce the environmental impact of the process waste waters and considerable energy savings arising from the generation of Bio-gas which is used as a fuel. In case of CSRMP pulping process, the spent liquor contains high colour due to lignin and its chromophores. The spent liquor contains 4000 ppm of COD, 2000 ppm of BOD, 700 ppm of Lignin in dissolved form. The mechanical pulp form a major constituent of the newsprint furnish. In order to achieve high yield of mechanical pulp, pulping is carried out using low chemical dosages. As a result a very small portion of lignin, hemicellulose and resinous materials get solubilised in the pulping process. The low chemical dosage does not make it economically viable to operate a chemical recovery unit. However if the effluent of mechanical pulp mill is sprayed on bagasse storage yard, it softens the bagasse fibre. In addition, laboratory studies have indicated that there would be reduction of 80% colour 60% to 70%BOD and COD. Also the effluent from the storage has pH higher by 1 to 2 units favouring UASB (Upflow Anaerobic Sludge Blanket) reactor and reclaimed bagasse from the yard require less amount of cooking and bleaching chemicals.

INTRODUCTION

The MPM Ltd has 350 TPD capacity of cultural and newsprint production and is integrated with sugar production. The company has ISO 14001 certification and is following environmental policies. As the pulping and paper making Industry is capital intensive, pollution prevention in the industry continue to rely on recycle, source reduction and process modification.

The present paper highlights the profile of recycling the waste generation and its management, reducing the waste and improving the productivity in Indian paper industry.

Environmental concerns in the paper industry have led to a need to reduce the Kappa number to maximum extent in order to increase the delignification. Kraft pulping requires more chemical dosage. It may cause high pollution load in effluent discharge i.e. weak black liquor. The Chemicals present in spent liquor can be recovered through Chemicals Recovery System leading to reduction in Pollution load. Where in case of mechanical pulp mill for e.g. CSRMP (Cold Soda Refined Mechanical) Chemi-mechanical process, the spent liquor contain 4000-4100 ppm of COD, 2000-2500ppm of BOD, and 700-800ppm of lignin in dissolved form. Newsprint mills use mechanical pulp which forms a major constituent of the newsprint furnish. The use of mechanical pulp makes the newsprint production economically viable. In order to have high yield of mechanical pulp, a very small fraction of lignin, hemicellulose and resinous material gets solubilised in the pulping process. The low chemical dosage does not make it economically viable to operate a chemical recovery unit. Hence the effluent of mechanical pulp mill will be problematic environmentally due to high colour, BOD, COD (pollution load), and low solids content.

The integrated sugar mill generates about 750 to 800TPD moist de pithed bagasse with 50% moisture. 2.5 to 3.0% constitency bagasse is pumped in slurry form from mixing tank to wide wet bulk bagasse storage yard. The drained water collected after filing the bagasse and recycled as sprinkler along with make up water. The CSRMP spent liquor is sprayed on Bagasse yard instead of sending to ETP plant to avoid pollution load as well as make

2 Sr. Manager R&D/QC MPM ltd Bhadravathi,
3 Deputy General Manager (P)MPM Ltd,
4 General Manager (P) MPM ltd
** Chairman. Dept of Ind. Chemistry Kuvempu university Kamataka.*

up water. The filed bagasse absorbs the colour in the spent liquor and minimizes the BOD and COD. A Series of experiments were carried in the laboratory to study the effect of spent liquor sprayed on bagasse.

- To compare the strength properties and brightness of pulps following TAPPI standard methods.
- To compare and analyse the reduction of colour, BOD and COD in discharge effluent, and increasing the pH of effluent by small extent.
- Comparative study and proximate analysis of water and spent liquor sprayed on bagasse separately.
- The bagasse yard effluent is not only acidic in nature but also has greater pollution load and subjected to an An-aerobic treatment.
- The MPM Ltd. has advanced UASB (Upflow Anaerobic Sludge Blanket) reactor meant for high pollution load treatment, and the Bio-gas generated used as fuel.

EXPERIMENTAL

A known quantity of bagasse is treated with known quantity of water and CSRMP spent liquor separately during about 72 hours. The discharge effluent subjected to analyze like pH, Colour, COD & BOD. The treated bagasse is subjected to pulping following TAPPI standard methods.

Environmental Factor

The comparative study of effluents from CSRMP, and effluents discharged from bagasse treated by water and CSRMP spent liquor separately. Details in Table no.1.

The Oven dry bagasse is made into a powder form and subjected to Proximate analysis according to TAPPI standard methods. Details in table no.2.

Table 1

Sample	PH	Colour (HU) (Pt.Co, unit)	COD ppm (mg / L)	BOD ppm (mg / L)	Lignin ppm (mg / L)
CSRMP spent liqour	10.5	12500	4000	2200	1100
Bagasse +spent liqour	4.3	4375	2690	1000	800
Bagasse+ water	3.8	Turbid	2500	900	—

Table 2

Proximate ananlysis of Treated Bagasse

Method of testing	Bagasse + water	Bagasse+Spent liqour
Ash %	1.71	2.2
1% NaOH Solubility	38.25	14.9
Alcohol benzene Solubility	1.03	2.6
Cold water Solubility %	2.035	1.856
Hot water Solubility %	1.92	1.998
Pentosans %	17.1	15.9

The following average results are taken by recycling of water and CSRMP spent liquor by 5 to 6 times in the laboratory..

Pulping Process

In the Laboratory digester, keeping the constant sulphidity, Active alkali, and bath ratio obtaining the Kappa number of charge used were at the temperature 165°C and 3 hours of cooking time. The pulp is washed and screened on a

Trial No,1	Active alkali	Bath ratio	Kappa number	Cooking liquor
Bagasse+water	20%	1:8	11.60	686ml
Bagasse+spent liquor	20%	1:8	12.06	610ml
Trial No, 2				
Bagasse+water	19%	1:6	12.60	643ml
Bagasse+spent liquor	19%	1:6	12.00	587ml

Table 3

Strength Properties of Pulp

Unbleached pulp	Brightness %	Tear Factor	Burst Factor	Breaking length (metre)
Bagasse +water	22.8	42.5	42.77	5553
Bagasse +spent liquor	23.0	42.8	43.50	5600
Bleached Pulp				
Bagasse +water	80.0	42.0	42.07	5400
Bagasse + spent liquor	80.0	42.0	43.2	5580

laboratory screen fitted with an appropriate screen plate.

Bagasse taken : 316 g

Temperature : 165°C -170°C

Time : 3.0 hours

The comparative study of strength properties of Unbleached and bleached pulp of treated bagasse followed by TAPPI standard methods i.e. the kraft pulp was bleached through CEH sequence and then both the pulps were beaten with the same freeness 350CSF in the PFI mill and compared with the quality of both the pulp samples as follows in the Table no. 3

RESULTS & DISCUSSION

It could be observed that spent liquor treated bagasse has maintained the positive strength properties and as well as the pollution load of the discharge effluent has reduced 80% colour and 60-70% in terms of COD, & BOD.

- According to proximate analysis the 1 % NaOH solubility is reduced by 40-50%. It shows the fibre is in good condition.
- Requirement of cooking liquor is in lower side, when maintaining the same Kappa Number and Bath ratio with same Active alkali.
- The pH of discharge effluent is increased by 1 to 2 units causes flexibility in UASB reactor, it generates - 2000-m^3/day Bio-gas, which is used as fuel in the boiler.
- 3000m^3/day spent liquor sprayed on bagasse could minimise the pollutant load on effluent treatment plant and as well as the usage of make up water.
- Micro-organisms present in bagasse to degrade the bio-refractory components like lignin in spent liqour may further enhance the efficiency of bio-methanation process.
- Cellulose being the polymers of the pentosans and Hexosans having number of -OH groups. which are hydrophilic in nature, readily come in contact with water forming innumerable hydrogen bonds between each of them.
- The cellulose is more hygroscopic in nature having the hydrogen bonds readily formed either in the surface or-in the layers within.

CONCLUSIONS

Research work is followed by the colour removal in paper mill effluent discharge. Colour of effluent is due to Lignin and its chromophores. Recycling the spent liquor on bagasse fibre causes reduction of colour, BOD &COD. This is due to absorption and interaction of OH and H bonds between cellulose and lignin molecules.

The sprayed bagasse softens by the spent liquor containing alkali and water molecules. During long standing of bagasse swelling volume ratio increases. It causes the lower consumption of cooking liquor helps and to maintain the same strength properties of pulp. The wet storage of bagasse is preferred as the fibre degradation is less, because the organic acids formed due to decomposition of residual sugars.

ACKNOWLEDGMENTS

The authors are thankful to MPM management for granting permission to present this paper at IPPTA conference.

REFERENCES

1. Combination of Anaerobic - aerobic process for effective treatment of pulp and paper mills effluent. S. panwar IPPTA conv, issue 2004.
2. Improved effluent treatment process in an Agro based paper mills. A. K Chattergi, IPPTA conv issue 2004.
3. Systematic approach - Key to better environmental performance - K Radhamohan IPPTA Conv issue 2004.
4. Daily ETP and EPC effluent analysis reports.
5. T APPI standard methods of analysis.