

Eco-deinking of ONP by Using "Csrmp" Spent Liquor

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ABSTRACT

With the fibrous raw materials becoming scarce day by day there is increased ecological concern and conservation of raw materials through recycle, reutilization and reduction of industrial waste and end products are important. Recycling of waste paper and old news paper (ONP) not only save trees and minimize pollution, but also reduce the bio mass waste reduction. The De-inking process (DIP) saves 75% water, 60-70% energy, and reduce the pollution by 75% per tonne of pulp production. The de-inking of waste paper is normally carried out at alkaline conditions using surfactant, bleaching, de-inking and chelating agents.

In this work, attempt is made to utilize the spent liquor of CSRMP (cold soda refined mechanical pulp) which is a waste liquor containing residual alkali and was used for the de-inking of waste news paper. The de-inked pulp is then compared with de-inked pulp prepared using caustic soda, sodium silicate and other bleaching chemicals. It is observed that both de-inked attain similar mechanical and optical properties. The DIP effluent has however high BOD and COD, which is improving the potential of further bio-methanation in UASB (Up-flow anaerobic sludge blanket) reactor.

INTRODUCTION

Conserve resources like material, money, energy, water and reduction in consumption of chemicals. To meet the demand in the coming years Indian industry will be faced to use more and more waste paper by recycling as well as by imports.

Indian consumption of paper is 5 kg per capita, with an expected growth rate of 6-7% per annum over the next five years. By using paper carelessly, we contribute to the depleting forest cover, drastic climate change and water pollution. For every ton of paper, the paper industry guzzles up 2.8 tons of dry timber and 100-150 M³ per tonne of water besides electricity and other resources. With the ecological concern about conservation raw materials, recycle, reutilize and reduce of industrial waste and end products have become order of the day. Recycling of waste and old news paper (ONP) not only save trees and minimize pollution, but also reduce the bio-mass waste. The de-inking process (DIP) saves 75% water 60-70% energy and reduces pollution by 75% per tonne by pulp production. It can create more jobs for young generation while collecting the waste paper from various areas.

Recycling of old news print (ONP) has been a high profile with an increasing commitment towards the use of secondary fiber. Improved de-inking and fiber processing have aided their
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procedure. De-inking of waste paper is normally carried out at alkaline pH value in the presence of alkali metal hydroxides, alkali metal silicates, oxidative/reductive bleaches and surfactants at a temperature in the range of 30-50°C anionic and/or non-ionic surfactants are recommended.

The Mysore Paper Mills Ltd. is of 300 TPD capacity of Newsprint and have chemical and heat recovery units to prevent pollution. Newsprint mills use mechanical pulps which forms a major constituent of the newsprint furnish. The use of mechanical pulp for the newsprint production economically viable apart from imparting necessary properties like opacity to the newsprint, because of its high yield and lower brightness. Chemi-mechanical pulping process i.e. CSRMP (Cold Soda Refined Mechanical Pulp) discharge about 2500 M³ BSW (Brown stock washer) Filtrate per day. The BSW Filtrate contains about 120-1500 PPM of lignin and about 4 to 5% residual active alkali. Exploration work at our R&D laboratory is done so as to utilize this spent liquor for de-inking ONP improving organics in spent liquor to make it more suitable for its end of pipe treatment in UASB reactor. The de-inked pulp is then compared with the de-inked pulp prepared by using caustic and silicate of sodium and other bleaching chemicals like H₂O₂ or sodium hydro sulphite. It is observed that both pulps attain similar mechanical and optical properties.

EXPERIMENTAL

DE-INKING PROCESS

De-inking is the process of removing ink particles from waste paper fiber by a combination of mechanical and chemical action in a pulper. There are several types of chemicals used for de-inking, each one operating on a different chemical principal. The types and amounts of these chemicals depend on the types of waste paper, the types of printing ink and its degree of adherence to the paper, the intended end use of the recycled pulp, and the nature of the de-inking process.

De-inking process classified into 3 types namely.

- Washing process
- The floatation process
- The hybrid process (combination of washing and floatation)

Now a days the hybrid process are in progress, the specialty de-inking chemicals used in this hybrid process are termed as "Displectors" instead of dispersants or collector, Most of the "displectors" are believed to be combinations of organic acids and non-ionic surfactants.

HYBRD DE-INKING PROCESS

The sheets of ONP were torn in to pieces by hand and disintegrated for 45 minutes with hot water and hot BSW

spent liquor separately. The above stock of 0.9% to 1.2% consistency and freeness of 300 CSF was subject to de-inking in laboratory by froth floatation.

Chemicals used for de-inking are the following;

- 0.5% by wt of sodium hydroxide.
- 0.5% to 1.0% by wt. of H₂O₂ or sodium hydro sulphite.
- 0.1-0.2% by wt. of ammonia
- 1-2% by wt. of sodium bicarbonate
- 0.25% by wt. of Magnesium sulphate or sodium silicate
- 0.01-0.02% by wt. of surfactant chemical

The floatation cell consists of 2 liter capacity beaker with stirrer and aerator, the whole unit is kept in a plastic tub for collection of froth along with ink particles. During continuous stirring

TABLE NO. 1

EXPT	PH	COLOUR	BOD	COD	% ALKALI
1.	10.5	22000	2000	4000	4.5
2.	11.0	23000	2200	4600	5.5

CHARACTERISATION OF EFFLUENTS WITH AND WITHOUT USE OF CSRMP (BSW) SPENT LIQUOR

TABLE NO. 2

EXPT	PH	COLOUR (HU)/pt. co	BOD (PPM)	COD (PPM)
DIP WITH 100% water	9.5	T	466	1811
DIP (1:1) water+BSW	10.5	1100	700	3040

PROPERTIES OF DE-INKED PULP-WITH AND WITHOUT USE OF CSRMP BSW FILTRATE

TABLE NO. 3

EXPT	DIRT	BRIGHT ISO%	BF	BL(Km)	TF
DIP 100% WATER	+450	56-56.0	28-29	2560-2870	55-58
DIP 1:1 H ₂ O:BSW	+460	55.5-56.0	27-29	2500-2860	56-57

and aerating the stock by using sodium hydrosulphite as bleaching and fiber swelling agent. Ammonium hydroxide used as de-inking aids, like surfactants, dispersants and chelating agents. Liquid detergents used as frothing agents. After completion of the frothing the stock was subjected to washing with water, the above stock was made into pulp sheets as per TAPPI standards for measuring dirt count, brightness, and strength properties. The results are

given in the table no. 3.

The discharge effluent from DIP were subjected to analysis for the determination of colour, pH BOD & COD. The results are shown in the table No. 2.

The analysis and results of CSRMP spent liquor are shown in the table No.1.

RESULTS AND DISCUSSION

1. 60-80% colour reduction of CSRMP BSW spent liquor while using in DIP.
2. There is no effect on DIP pulp brightness by using BSW spent liquor.
3. Observe Slight yellowness of the pulp before deinking causes

4. reduction of bleaching chemicals. By using BSW spent liquor it saves the use of water and chemicals like NaOH, NaHCO₃ to fiber swelling and to maintain pH.
5. High BOD and COD may favors the UASB reactor for bio-methanogenation.
6. BSW spent liquor is used not only to adjust the pH to the alkaline region but also saponify or hydrolyze the ink resins. The

alkaline environment is often reported to swell the fibers, as well as to reduce the water intake. The fibers would take up some water and become more flexible.

7. In alkaline conditions H₂O₂ ionises in to

$$H_2O_2 + OH^- \rightleftharpoons OOH^- + H_2O$$

Perhydroxyl ions are supposed to be active bleaching agents. This can be prevented by addition of sodium silicate.

CONCLUSIONS

1. With the use of recycling of waste paper by rigorous screening de-inking and dispersing we can derive the following benefits in the present industrial scenario.
2. It substitutes forests based raw materials requirement.
3. The equipment requires low capital investment.
4. It uses low energy, water etc.,
5. Reuse of CSRMP spent liquor instead of water may cut down per tonne of paper to 50-60 M³.

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