Enzymatic Deinking

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Abstract- ***Using enzyme Xylanase deinking could be carried out. Recycled waste paper has become an important and environmentally harmless source for new papermaking. Office waste papers with laser prints is considerable available waste for recycling due to increased utilization of these papers. However, the reuses of these waste papers are limited. Inks are fixed by fusion with combination of pressure and heat (Carr, 1991). Moreover most of the conventional deinking techniques require usage of large amount of chemical agents such as sodium carbonate, sodium hydroxide, sodium silicate, hydrogen peroxide and surfactants (Prasad et al., 1993) which results in a costly wastewater treatment (Jeffries et al., 1994). Furthermore, enzymatic deinking is free from alkaline environments required in traditional deinking process, which consequently reduce chemical and waste treatment cost. Therefore, commercial available enzymes such as cellulase, and xylanase were attempted in present study for their efficacy. In addition the enzymatic treatment improves brightness of paper.***

Index Terms – Enzyme, Enzyme Deinking

I. INTRODUCTION

Recycling of printed waste paper has been an important requirement of the time and this can be achieved by environmentally safe bioprocesses. (Prasad *et al.*, 1993). The reuse of laser-printed waste papers is limited because the ink formulations used in these papers are difficult to be removed by conventional techniques such as washing and flotation they also lead to the serious pollution hazard to the environment (Carr, 1991, Jeffries *et al.*, 1994).Enzymatic deinking is eco-friendly in terms of pollution against Chemical deinking processes. Therefore the enzymatic deinking of laser printed waste paper or photocopy paper and the effects of enzymatic activity on waste papers was performed for deinking process which can provide better paper quality.

II. MATERIAL

0.1 M Acetate buffer (pH = 5.6)

Enzyme , Xylanase(S.R.L.)

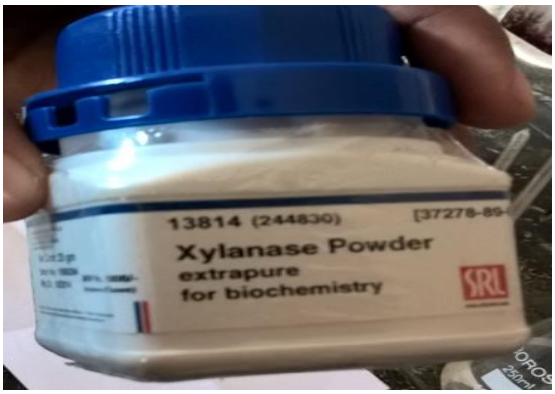


Figure:1 Xylanase Powder

Laser printed papers 2×2cm. pieces

Abrasive (plastic beads)

Figure: 2 plastic beads

5 conical flasks (100ml).

Rotary shaker

Incubator

III. PROCEDURE

Printed papers of 2×2cm size, with complete dark laser printed were placed in 50ml, 0.1M acetate buffer (pH 5.6) containing conical flask-no.1; 200mg xylanase (1200 units) enzyme and 5 plastic beads were placed as abrasives.

In the second flask, printed paper(2×2cm.) which had two parts ;dark black and white, were placed in 50ml, 0.1M acetate buffer(pH 5.6) containing conical flask; 200mg xylanase (1200 units) enzyme and 5 plastic beads.

(2×2cm.) White (paper without laser print) were placed in 50ml, 0.1M acetate buffer (pH 5.6) in conical flask no.3 with 200mg xylanase (1200 units) enzyme and 5 plastic beads.

Forth flask was prepared using laser Printed papers 2×2cm. pieces which had whole dark laser print, were placed in 50ml ,0.1M acetate buffer(pH 5.6) containing conical flask no. 4 with plastic beads.

Fifth flask was prepared with 2×2 cm, paper which had two parts; dark black and white, were added to 50ml, 0.1M acetate buffer (pH 5.6) containing conical flask– 5 and added with 5 plastic beads.

Figure:3 Five flasks containing respective material.

Incubate all conical flasks with material at 37ºC for 24 hours.

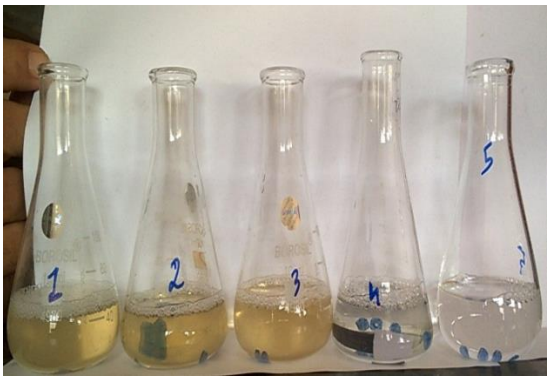


Figure:4 Results after incubation.

After the incubation put all conical flasks on rotary shaker at 5000 rpm for 2 hours.

Figure:5 Results after shaking

Enzymatic treatment System table:

System no.	Buffer solution (ml)	Enzyme (mg)	Type of paper
1	50	200	Totally dark
2	50	200	Totally white
3	50	200	Mixture of dark & white
4 (control)	50	0	Totally dark
5 (control)	50	0	Totally white

Table no.:1 Enzymatic treatment system table

IV. RESULTS

Results of untreated (control) (flask – 4,5) :-

In these flasks with buffer only, did not show any turbidity after incubation and shaking (Flask no. 4 and 5). The system without enzyme did not indicate deinking (in terms of turbidity and black color).

Figure:6 Control flasks

Figure:7 Flasks showing Deinking treatment.

Flask:-1 with enzyme showed black color and turbidity and whole printed paper was found less dark than control.

Figure:8 Laser printed paper treated with enzyme.

Figure:9 Laser printed paper treated without enzyme(control).

Results of enzyme treated paper.

These flasks exhibited turbidity with black color, after incubation and agitation like so it is indict deinking is take place because buffer is having enzyme.

Figure:10 Control flasks after treatment

Figure:11 Flasks showing Enzyme treated paper.

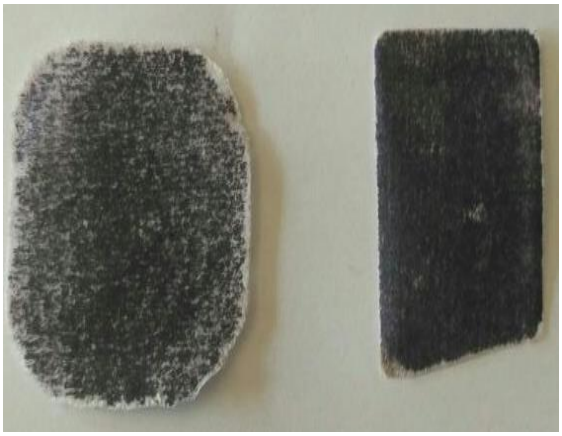


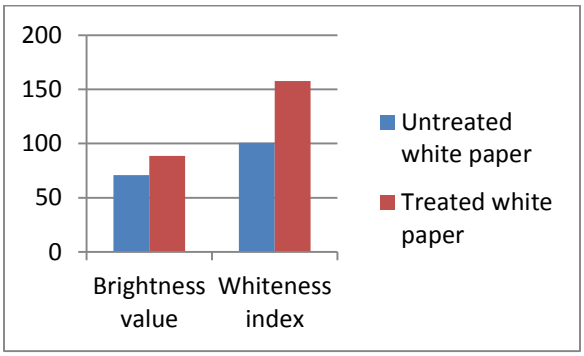
Figure:12 Comparison between treated(left)and untreated(right)

All above visual criteria were confirmed by ATIRA laboratory report attached here with.

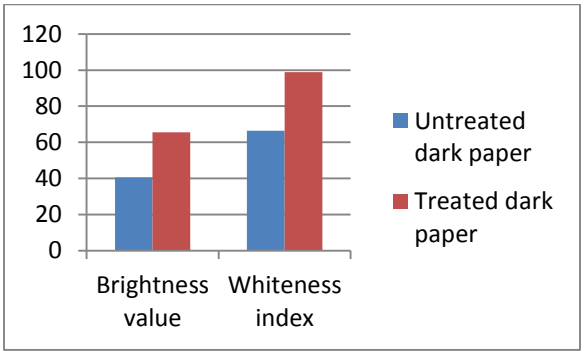
ATIRA laboratory report table

sample no.	Type of paper	Brightness value	Whiteness index
1	Untreated white paper	70.81	100.64
2	Treated white paper	88.63	157.61
3	Untreated dark paper	40.54	66.39
4	Treated dark paper	65.58	98.89

Table no.:2 Test report table



Graph no. 1: Brightness evaluation of enzymatic bleaching treatment.



Graph no. 2: Brightness evaluation of enzymatic deinking treatment.

V. CONCLUSION

Enzyme Xylanase is effectively removing ink from the laser printed paper visually. The ATIRA report of the experiment further confirms the efficacy of the treatment. According to the authentic laboratory reports, brightness is increased as a result of treatment by 62% and it also increases the whiteness of the printed paper by 67%. All above results were achieved by two hours of treatment only.

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