

# Irrigation using Treated Pulp and Paper Mill Effluent : A Review

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The effluent generated from paper mills is normally considered to be highly polluting. But, for the mills using waste paper as a raw material the treated paper mill effluent is successfully being used for irrigation purpose, and in many cases even a gain in crop yield has been reported. This paper is an initiative towards removal of myths in this area.

## INTRODUCTION

Paper mills have been considered as a major source of pollution since long. The most sufferers are the waste paper based units, which are basically recyclers, but like to be called by the name "Paper Mill". These mills use lesser amounts of chemicals, lesser harmful ones-, create no harmful effect on environment, and even to some extent, helpful to environment. While CREP (Corporate Responsibility on Environmental Protection) emphasizes on reducing pollution levels and mark it as top priority item, it is also required that we must have a systematic approach and also indicate the benefits of treated effluent for irrigation purpose. This work is basically to present relevant information and to let readers evaluate the advantages of such units as well as of using treated effluent for irrigation.

### The Process

The papermaking in waste paper based paper mill is basically a recycling process. The process involves collection and storage of waste paper, sorting to be used as per different grades of paper produced, and slushing in a pulper, alongwith water to prepare a fibrous suspension called pulp. This pulp is passed through different equipments for further cleaning and fibre development for strength increase. Having done that, some nonhazardous chemicals are added to it which are needed for paper properties, and papermaking, and then paper is made on a paper machine. During the processing, solid waste generated might contain some

minor amounts of plastic waste, staple pins, stones etc. The effluent generated contains minor amount of fibre particles, which are biodegradable in nature and fillers used in preparation of paper from virgin fibre. In case better brightness is required, mild bleaching is done to pulp, with the help of hypo. It is interesting to note that the quantity of bleaching chemicals needed for bleaching of waste paper pulp is nearly one tenth of that required in virgin fibre based pulp, i.e. a recycler is generating at least 90% less pollution than its counterpart.

### Chemicals

Before proceeding further, we must have a look on the chemicals used in processing of waste paper for papermaking, and other applications where these are used as crude or with minor treatment.

### Applications

- |         |                                                                                                                               |
|---------|-------------------------------------------------------------------------------------------------------------------------------|
| Rosin   | Known as Gond, it is used for several sweets and namkeen preparation etc.                                                     |
| Alum    | Known as Fitkari, it is used as aftershave.                                                                                   |
| Tal/°C  | Known as Talcum powder it is used as a cosmetic on face.                                                                      |
| Calcium | This is a major constituent of most Carbonate toothpastes, most medicines for bones etc.                                      |
| Starch  | This is used for imparting stiffness to cotton clothes and it is major constituent for preparation of vegetable soups used as |

apitizer before food.

Thus, all the chemicals are non-hazardous, and the only fear that appears in the mind of a common man is just due to the word "Chemical".

### Effluent Treatment

Though the inputs are non-hazardous, the generated effluent is treated in effluent treatment plant (to maintain better environment). Here, solids, which can be removed easily by sedimentation are removed in clarifiers and the underflow-the sludge- is used for preparation of low cost items such as egg trays, grey board etc. Alternatively, it can be used as an excellent landfill material in low-lying areas. The clarified water is then sent to aeration tanks, where, air is added to effluent, and with the help of air and bacteria, biosolids floc together and appear in suspended form. To enhance this reaction, urea and DAP are added in the aeration tanks. This effluent is then sent to secondary clarifier, where these solids settle, and sludge is obtained in underflow.

This secondary sludge is an excellent manure for agricultural purposes. Research has shown that this sludge contains major nutrients e.g. nitrogen, phosphorus etc, and in several places, it has been found that the use of this sludge as well as treated mill effluent for irrigation purpose have resulted in an increase of over 20% in crop production. Some major advantages of using treated mill effluent for irrigation purpose are listed below :

### Improvement in Soil Productivity

It has been found that the soil productivity improves by using treated paper mill effluent for irrigation. This has been indicated in many of the research papers, where, an increment of even 20–30% in crop production has been reported. Some of the figures are:

The National Bank for Agricultural and Rural Development (NABARD), based on expert survey that the soil as well as the ground water were not affected, came forward to refinance the loans given earlier by

Table 1 : Crop production with treated effluent irrigation (1)

Location	Crop	Fresh Water Irrigation	Treated Effluent Irrigation (50%)
Shamli (U.P.)	Paddy, (q/ha)	44.1	50.4
Shamli (U.P.)	Maize, (q/ha)	25.8	29.8
Shamli (U.P.)	Wheat, (q/ha)	22.9	23.8
Shamli (U.P.)	Mustard (q/ha)	10.0	11.5
Paithon (Aurangabad)	Wheat (q/ha)	29.6	31.5
Paithan (Aurangabad)	Mustard (q/ha)	4.4	4.6
SPB, Erode	Sugar Cane, t/ha	33-50	40-60

Table 2 : Effect Treated Effluent (1) on Juice Quality of Sugar Cane at Shamli, (U.P.)

Quality Characteristics	Fresh Water Irrigation	Treated Effluent Irrigation (50%)
Brix, %	20.32	19.80
Pol, %	17.42	17
Purity, %	85.73	86.62
CCS, %	11.33	11.24

Bank of India for lift irrigation schemes at Seshasayee Paper & Boards Ltd. (SPB), in Tamil Nadu.

### Improved Crop Properties

It has been found that the crop obtained this way is better yielding, e.g. not only the per hectare sugarcane production is increased, but also, the recovery of sugar is improved with sugarcane grew.

### Improved Farmer Economics

As no or very little fertilizers are required, the use of treated mill effluent reduces the financial burden on farmers, and thus improves their profitability. Furthermore, as the farmers are less dependent on groundwater if irrigation is met by treated mill effluent, it reduces their electricity bills and requires less fuel consumption for running the pump sets.

### Reduced Electricity Consumption

It is interesting to note that the pump sets used by most farmers are less energy efficient. This is because of using rewind motors, using off grade pumps, unmetered supply for most of the farmers etc. As the effluent is discharged by the mills from a level above ground level, no pump set is required by the farmers, in the nearby

Sectorwise Average Realization of Power	
Category	Rs. Per unit
Agriculture	0.21
Domestic	1.52
Industry	3.54
Commercial	4.30
Average	2.10 (Reference 2)

### Published Results

A lot of work has already been done in this regard, a brief summery of which is given hereunder –

### Results Obtained

The effluent treatment plant installed in a typical mill consists of a stabilization tank, a primary clarifier, aeration tanks with two aerators, and finally a secondary clarifier. Properties of the effluent treated are as under –

All of these properties are within local pollution control norms, and the clean treated water leaves factory premises to a nearby rain nallahs or other similar

Table 4

Study Title	By	Source	Brief Results
Waste Paper Sludge to Agriculture Land	Bridgewater Paper Company UK	UK environmental Technologies & Services Report`	Paper mill sludge is rich in Nitrogen, Phosphorus, Potassium etc.
Utilization of ...Crop Production	IARPMA, New Delhi	Paper India 3(4):14 (August 2000)	At different places, it was observed that when irrigated with mill effluent also, the growth of paddy, maize, wheat, mustard increased by 20%

areas to paper mills. Electricity given to farmer is highly subsidized (Table - 3) the following figures :

This indicates clearly, if the farmers can use treated mill effluent for irrigation, their electricity requirement and hence subsidy on this saved electricity will be reduced, which is in national benefit.

Table 5 : Effluent Characteristics

PH	7.1
Suspended Solids	68 ppm
BOD (5 Days, 20 C)	26 ppm
COD (Reflux Method)	78 ppm
Oil & Grease	0.6 ppm

			mustard increased by 20%
Irrigation with treated ...Experience	Dr. N. Gopalratnam, SPB Ltd., Erode	Paper India 2(6):8-9 (Dec. 99)	Increase in sugar cane yield by 20% when irrigated with treated paper mill effluent.
Composting of Effluent Treatment Sludge	CPPRI	IPPTA convention Issue, 1993-94 Page 141 - 149	Sludge contains micronutrients N,P,K of the same quantity as in case of sheep dung & cowdung.
Pollution Abatement...Bio methanation Process	CPPRI	Training Programme, Ahmedabad, April 12 - 16, 2003	The effluent generated during the processing of waste paper contain easily biodegradable organic matter.
Guidelines for the Utilization of Pulp & Paper Mill Biosolids on Agricultural Land	Water & Earth Science Associates Ltd.	Final Report File. No. B1333 Feb. 2002	Use of pulp & paper mill biosolids results in improved soil characteristics and is very useful for land.

drainage facility. Soon after a plant came into operation, the farmers come to know that the effluent coming out of factory is very useful to them. Within a short span of time they find that the sugar cane production in the fields was increasing and the height of sugarcane increased by approx. 20%. They became eager to use treated mill effluent, and sometimes in the weather of summer, when the fresh water irrigation is very difficult, due to acute shortage of grid power, they start coming to factory demanding more effluent to be discharged to cater their need.

#### CONCLUSION

The recycled fibre based paper mill treated effluent is beneficial to farmers. In some cases it has been found that the farmers prefer to use treated mill effluent for irrigation over the fresh water.

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