



Impact of Amalai paper mill effluent on vegetables seed germination

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Abstract

In the present study an attempt has been made to access the effect of Amalai Paper Mill effluent treated as well as untreated on germination of various crops, to ensure the safe landing of such effluent for irrigational purpose. The effluent treatment plant of Amalai Paper Mill consists of Semi treated effluent, Full treated effluent, Untreated effluent. The germination of various seed was determined on the basis of growth with respect to different effluent, keeping all other factors constant. Maximum rate of germination occur in Untreated effluent. Level of germination in different effluent was determined on the basis of simple pot experiment and basis of measurement of growth was only apical shoot growth. The Semi treated water showed the reduced growth due to addition of various chemical added during pulping. The previous research reveals that physicochemical properties of paper mill waste water don't permit its disposal directly into land for irrigation however after using the treatment methodologies the treated effluent can be used safely and good for crops in coming future. The result obtained supports the beneficial effect of Amalai Paper mill effluent on the growth behaviour of crops.

Keywords: amalai paper mill effluent, treated, untreated, germination of crops, effluent treatment plant

1. Introduction

India has an average of 700 pulp and paper mills. It is one of the highest polluting industries in India and is highly water intensive. The most important problem which the pulp and paper industry is facing today is the disposal of tremendous volumes of waste water. This waste water is rich in dissolved solids such as chlorides and sulphates of Na, Ca and varying amounts of suspended organic materials. In addition to these constituents, effluents also contain some trace metals like Hg, Pb, and Cr etc. The dark colour of waste water exhibits the toxic effects on the biota and inhibits the photosynthetic activity by reducing the sunlight (Evans, 1996) [1]. Reports have suggested that the effluent have an inhibitory effect on seed germination and growth performance of wheat cultivars, pulses like green gram, red gram and other crops like onion and tomato (Rohit *et al.* 2013) [2]. In regions of water scarcity, effluent is the single permanent water source for irrigation.

The paper industry uses a variety of effluent treatment systems. The preferred process combination for each individual case depends on the grade -specific quality of the effluent that is going to be treated.

Polluted water, in addition to other effects, directly affects soil not only in industrial areas but also in agricultural fields and river beds, thereby creating secondary source of pollution. Various industries have been continuously adding lot of waste water containing high level of nutrients, heavy metals and hazardous substances to the cultivable land. These effluents not only increase the nutrient level, but also excess tolerance limits and cause toxicity (Nath *et al.*, 2007) [3].

Water pollution due to discharge of untreated industrial effluents into water bodies is a major problem in the global context (Mathuthu *et al.*, 1997) [4]. The problem of water pollution is being experienced by both developing and

developed countries. Human activities give rise to water pollution by introducing various categories of substances or waste into a water body. The more common types of polluting substances include pathogenic organisms, oxygen demanding organic substances, plant nutrients that stimulate algal blooms, inorganic and organic toxic substances (Cornish and Mensahh, 1999) [5]. Baruah and Das (1997) [6] reported that there is delay, retardation and decline of germination of rice seeds and seedling growth with paper mill effluent in comparison to control.

2. Material and Methods

Effluent collection

The samples for the studying the effect of different effluents were collected from the Effluent Treatment Plant of recycled Paper industry. The wastewater samples were collected from the Semi treated, Full treated and Untreated. Normal tap water was taken as control water. These effluent samples of the paper mill were used without dilution for the experimental purpose. Germination and shoot length was measured by simple scale method on apical parts.

Selection of seed/shoot

The seed and shoot bud of fast germinating crops were selected randomly. The major selected crops which were used for simple pot experiments.

1. *Brassica campestris* (Yellow and Black Mustard)
2. *Beta vulgaricus* (Chukandar)
3. *Allium cepa* (Onion)
4. *Allium sativum* (Lahsun)
5. *Raphanus sativus* (Muli)
6. *Brassica rapa rapa* (Shalgam)
7. *Coriandrum sativum* (Dhaniya)

Soil selection

All factors were kept constant except for type of water for irrigation. Two types of soil was selected one from secondary sludge bed, other from ETP garden for 1st set expt. and 2nd set expt. respectively.

Planting Procedure

4 to 5 seeds of respective plant were planted 3cm apart and 2cm deep in each of 8 planting pot containing 2 kg of soil. The experiment was divided in to two set planted in 1 day gap. Irrigation was done on the basis of moisture in soil.

Growth analysis

Morphological parameters of planted seed were recorded in

situ condition. The seed germination was recorded after 5 to 6 days from planting. The growth was analysed only on the basis of shoot length.

3. Results and Discussion

The seeds were sowed in pots and the effluent of Semi treated, Full treated, Untreated and control water were added equally in to the respective pots and the day of germination was noted and the height of plant after germination was evaluated on day to day basis and observation. The germination starts after 2nd day of sowing in most of the cases. The results of germination date show difference in case of *Allium cepa* and *Brassica campestris*. Coriander seeds did not show any germination by control or test samples.

Table 1: Day of germination after sowing seed and irrigation with treated and untreated waste water

S. No.	Crops	Day of germination after sowing			
		Control	Semi treated	Full treated	Untreated
1.	<i>Allium sativum</i>	2	2	2	2
2.	<i>Brassica raparapa</i>	3	2	3	3
3.	<i>Raphanus sativus</i>	2	2	2	2
4.	<i>Brassica campestris</i>	9	9	6	6
5.	<i>Coriander</i>	-	-	-	-
6.	<i>Allium cepa</i>	1	1	2	1
7.	<i>Beta vulgaricus</i>	6	9	6	6

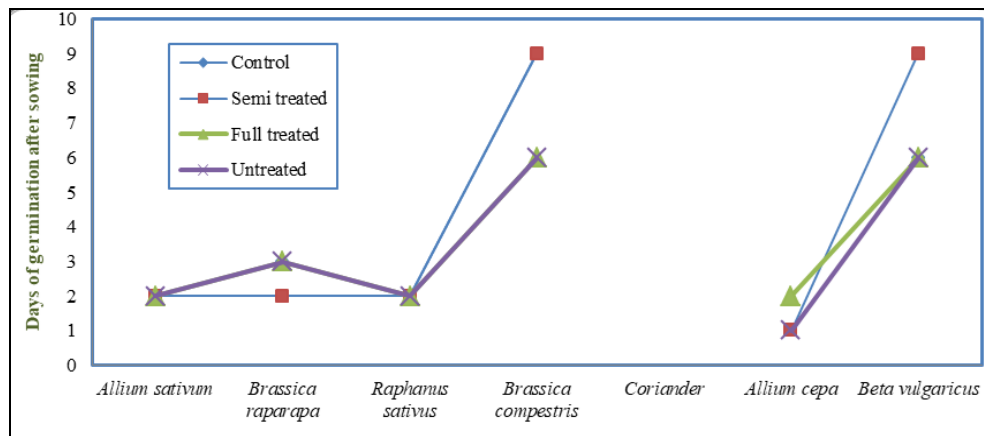


Fig 1: Graphics analysis of Day of germination after sowing seed and irrigation with treated and untreated waste water.

Table 2: Length of seedling after germination and irrigation with treated and untreated waste water.

		<i>Allium sativum</i>	<i>Brassica raparapa</i>	<i>Raphanus sativus</i>	<i>Brassica campestris</i>	<i>Coriander</i>	<i>Allium cepa</i>	<i>Beta vulgaricus</i>
Control	3 day	3.5	1.5	1.5	-	-	4.3	-
	6 day	5.7	3.5	3.5	-	-	5.1	1.7
	9th day	7.3	4.5	4.5	1.4	-	6.9	2.2
	12th day	8.2	6	5.7	4.4	-	9.9	3
Semi treated	3 day	3	1.7	1.7	-	-	4	-
	6 day	5.2	2.5	4	-	-	5.6	-
	9th day	7.5	3.1	4.5	1.0	-	9.2	1.4
	12th day	8.9	4.8	6.7	2.5	-	11.5	2.2
Full treated	3 day	3.1	2	1.3	-	-	1	-
	6 day	6.3	3.7	3.7	0.5	-	4.5	1.6
	9th day	6.4	4.2	5.4	3.2	-	7.5	2.9
	12th day	8	5.8	7.4	4.2	-	10	3.9
Untreated	3 day	3.1	2.5	1.2	-	-	2.8	-
	6 day	6	3.7	4	1.0	-	6.3	1.4
	9th day	7.4	5.6	5	4.1	-	9.5	2.4
	12th day	9.8	6.9	6.1	5.9	-	12.4	3.3

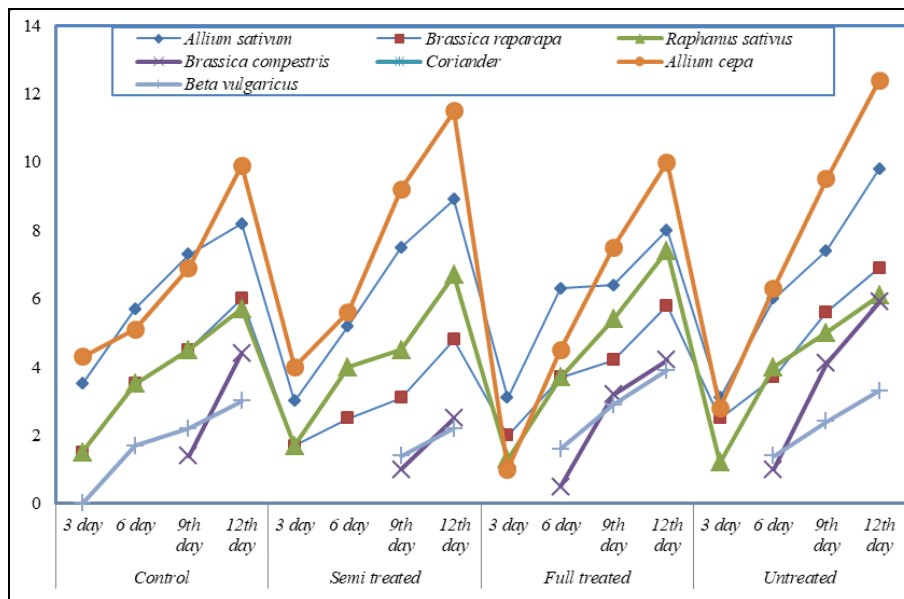


Fig 2: Graphics analysis of Length of seedling after germination and irrigation with treated and untreated waste water.

The results reveal that when untreated effluent water or Semi treated waste water is used it shows decrease in both the days taken for germination as well as length of seedling after germination with respect to treated effluent. *i.e.* Untreated water. The rate of germination of different crops were analyzed on the basis of 1st day, 3rd day, 6th day 9th day and 12th day after germination. The plants *Allium cepa* and *Allium sativum* shows maximum rate of germination, in the pot having Untreated effluent with respect to other plants on 12th day. Coriander shows no germination in any set of the experiment. The germination of different 7 crops against different Paper Mill effluent treated and untreated was found to be in decreasing order as, *Allium cepa* > *Allium sativum* > *Brassica raparapa* > *Raphanus sativus* > *Beta vulgaricus* (When analysed on the basis of last day of result on 12th day after sowing germination). The decrease in the untreated effluent might be due to high amount of dissolved solid which cause high osmotic pressure in soil solution. From the above result it can be concluded that the crops and vegetable can be irrigated with treated effluent. The treated Paper Mill Effluent can be used for irrigation purpose instead of throwing in to river or canal. Most of the Effluent Treatment Plants of Indian paper industry are having similar type of treated effluent and they are not reusing the treated water. Thus, in the scenario of water scarcity, usage of treated waste water would be highly useful to agriculturist and farmers for irrigation of the crops and agricultural fields.

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