Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

Vol. 9	No. 1	pp. 93-96	2010

Original Research Paper

Impact of Treated Sago Industry Effluent on Paddy Plants

N. Sivananda
Pasteur Institute of India, Coonoor-643 103, Nilgiris, Tamil Nadu, India

Nat. Env. Poll. Tech.
ISSN: 0972-6268
www.neptjournal.com

Key Words:
Sago industry effluent
Paddy plants
Wastewater irrigation
Seed germination
Biochemical parameters

ABSTRACT

The effluents collected from Sago industry before and after treatment were analysed for the physicochemical characteristics. The effect of treated sago industry effluent in different concentrations (10%, 25%, 50% and 100%) on seed germination and biochemical changes during germination of paddy were studied and compared with the control. In the treated effluent pH, TSS, TDS, BOD and COD were found to be within the tolerance limit and it can be used for irrigation purposes. The seed germination percentage declined with the increasing concentration of the treated effluent. Generally, in paddy the protein, starch and chlorophyll contents were increased from 6th day to 12th day and then declined. It was observed that when the treated effluent is diluted particularly at 10 %, it influences the biochemical parameters and at the same time the increased concentration of the effluent reduces the protein, starch and chlorophyll contents in experimental leaves when compared to control.

INTRODUCTION

Environmental pollution is a global problem both in developed as well as developing countries. The rapid economic growth, sharp rise in agricultural production, rapid urbanization and industrialization are affecting the natural environment. Industrial and domestic wastes are the main cause of water pollution. Many studies have proved that the effluents can be used for beneficial activities (Manonmani et al. 1992). Recycling of wastewater is the only solution to get rid of pollution problems (Tewari et al. 1996).

Sago industry is an agro-based industry. The raw material used in the sago industry is tapioca (*Manihot esculanta*), which belongs to the family Euphorbiaceae. In view of the highly pollutional nature of the effluent, sago units have to necessarily treat the effluent before disposal on land or into water bodies. The utilization of wastewater for irrigation of crop plants has two-fold benefits. The first and foremost is the safer disposal of the effluents which may otherwise have adverse effects on the environment and human health. The other is to reuse it as irrigation water and also for its possible fertilizer value. Hence, the present investigation is an attempt to study the impact of treated sago industry effluent on crop plant, paddy.

MATERIALS AND METHODS

The treated effluent that comes out of the sago factory was analysed for its physicochemical characteristics. The treated effluent at different concentrations (10%, 25%, 50%, and 100%) was used for seed germination and for irrigation of paddy plants.

The effluent was noted for its colour and temperature immediately after collection. Total suspended solids (TSS), total dissolved solids (TDS), biochemical oxygen demand (BOD) and chemical oxygen demand (COD) were measured according to the methods of APHA (1989).

Seed germination: Seeds of paddy were soaked in 10%, 25%, 50% and 100% concentrations of the treated sago industrial effluent and also in control water for 24 hours. Fifty each of presoaked seeds were kept for germination in Petri dishes between double layers of filter paper which were kept moistened with the respective concentrations of the effluent and the control water throughout the period of the experiment. The emergence of the radicle through the seed coat was taken as the criterion for germination. The germination percentage was recorded each day on a statistical basis for the period of 10 days.

Assay of biochemical parameters: Biochemical parameters such as protein (Lowry et al. 1951), starch (Sadasivam & Manickam 1996a) and chlorophyll (Sadasivam & Manickam 1996b) were analysed. The third leaf of the paddy was used for the analysis of starch, protein and chlorophyll contents present in one gramme of leaves within time intervals of 6 days, i.e., after 6 days, after 12 days and after 18 days.

RESULTS AND DISCUSSION

Water is a precious natural resource that must be safeguarded for the benefit of present and future generations. The present study shows the impact of treated sago industry effluent on paddy.

The physical characteristics (colour, temperature, pH, TSS and TDS) of sago industry effluent are shown in Table 1, and chemical characteristics (BOD and COD) in Table 2. Table 3 shows the percentage of germination of paddy when treated with different concentrations (10%, 25%, 50%, 100%) of treated sago industry effluent. The biochemical changes in paddy was studied during the germination under the treatment of sago industry effluent in different concentrations and are shown in Tables 4, 5 and 6.

In paddy, the protein, starch and chlorophyll contents were increased gradually from 6^{th} day to 12^{th} day and then declined. But the quantity of protein, starch and chlorophyll contents were less in the treated plants when compared with the control.

The treated sago industry effluent was colourless. It might be due to settling down of suspended particles during the treatment processes. The pH of the treated effluent was within the standard limit of water used for irrigation (IS 1981). The reduction in the TSS in treated sago industry effluent is due to oxidation in the aerated lagoon during the treatment. It is clear that the TDS of treated sago

Table 1: Physical characteristics of sago industry effluent before and after treatment.

Parameters	Raw Effluent	Treated Effluent
Colour	Yellowish brown	Colourless
Temperature (°C)	37	25
pH	5.3	7.5
TSS (mg/L)	468	75
TDS (mg/L)	6864	1750

Table 2: Chemical characteristics of Sago industry effluent before and after treatment.

Parameters	Raw Effluent	Treated Effluent
BOD (mg/L)	1260	30
COD (mg/L)	2400	200

Table 3: Paddy germination values (percent) in control and different dilutions of the waste in 10 days study period.

Concentration of treated effluent	Percentage of germination in paddy
Distilled water (control)	100
10% waste	100
25% waste	90
50% waste	90
100% waste	80

Table 4: Protein content of paddy leaves irrigated with treated sago industry effluent in different concentrations.

Treated effluent Concentration	Protein content mg/g		
	6^{th} day	12^{th} day	18^{th} day
Control	50.12	60.00	46.40
10% waste	49.08	58.00	37.00
25% waste	43.88	53.00	36.40
50% waste	41.00	51.00	36.40
100% waste	36.60	46.00	35.20

Table 5: Starch content of paddy leaves irrigated with treated sago industry effluent in different concentrations.

Treated effluent Concentration	Starch content mg/g		
	6^{th} day	12^{th} day	18^{th} day
Control	48.40	67.50	30.00
10% waste	38.70	50.40	24.30
25% waste	30.00	38.70	23.00
50% waste	24.30	36.00	16.20
100% waste	24.30	26.30	16.20

Table 6: Total chlorophyll content of paddy leaves irrigated with treated sago industry effluent in different concentrations.

Treated effluent Concentration	Total chlorophyll content g/g		
	6^{th} day	12^{th} day	18^{th} day
Control	0.00015173	0.00017180	0.00013718
10% waste	0.00014365	0.00016130	0.00010896
25% waste	0.00013795	0.00016050	0.00011626
50% waste	0.00012506	0.00014680	0.00009363
100% waste	0.00008312	0.00010650	0.00008363

industry effluent was lower than the tolerance limit, which reveals that treated effluent can be well used for irrigation purposes. The high TDS of industrial effluent may affect the seed germination and also the soil fertility. The effluent from the sago industry after treatment recorded a low BOD of 30mg/L, which is within tolerable limits (400mg/L) accepted for irrigation. The treatment adopted by the sago industry effluent is effective in reducing the COD of the effluent.

The present study showed that the seed germination percentages was decreased in undiluted treated effluent. Mishra & Behera (1991) studied the seed germination of rice in soil polluted with paper mill effluents, and it was observed that the polluted soil caused delay in seed germination and reduction in final germination by 12.5% compared with seeds in unpolluted soil.

Generally, the protein, starch and chlorophyll contents have increased gradually in paddy up to 12 days and then declined. The trend was similar both in treated and control plants. But the quantity of the above biochemical parameters were less in treated plants when compared to control. Hence, the toxic level of the treated sago industrial effluent was reduced by dilutions.

ACKNOWLEDGEMENT

The author is deeply indebted to Dr. S. Saravana Babu, Dept. of Plant Biotechnology, C.N. College, Erode, Tamilnadu for valuable guidance. Sincere thanks are also due to Dr. B. Sekar, Director, Dr. K.N. Venkataramana and Mr. B. Sundaran, Asst. Directors of Pasteur Institute of India, Coonoor, for their encouragement.

REFERENCES

APHA 1989. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington DC.

IS 1981. Bureau of Indian Standards: Drinking water specifications, pp. 1920-1995.

Lowry, O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J. 1951. The estimation of protein. J. Biol. Chem., 193: 265.

Manonmani, K., Murugeshwaran, R. and Swaminathan, K. 1992. Effect of photofilm factory effluent on seed germination and seedling development of some crop plants. J. Ecobiol., 4(2): 99-105.

Mishra, R.N. and Behera, P.K. 1991. The effect of paper industry effluent on growth, pigments, carbohydrates and proteins of rice seedlings. Environ. Poll., 72: 159-167.

Sadhasivam, S. and Manickam, A. 1996a. Biochemical Methods, 2nd edn., New Age International (P) Ltd., Publishers, New Delhi, pp. 11-12.

Sadhasivam, S. and Manickam, A. 1996b. Biochemical Methods, 2nd edn., New Age International (P) Ltd., Publishers, New Delhi, pp. 190-192.

Tewari, A.K., Shukla, D.N. and De, S.K. 1996. Waste recycling- A way to sustainability. Indian J. Agri. Chem., 29(3): 113-115.