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SUGAR INDUSTRY EFFLUENT FOR THE GROWTH OF *CYAMOPSIS TETRAGONOLOBA* (L.) TAUB.

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Abstract

Sugar industry effluent was analyzed for its physico-chemical parameters and to know its Water quality index for usage of the effluent for irrigation purpose. The calculated WQI of the study effluent was severe; direct use of the effluent is not good for agricultural practice. So, different concentrations of effluent were prepared and growth study was made to know its effect. Maximum growth performance was at Low concentration and it was decreased with increasing concentration. Study makes clear that effluent should be diluted or treated before it is used for irrigation.

Key words : Effluent, Growth, Irrigation, Water Quality Index.

Introduction

Agriculture is facing a challenge because of water crisis problem. Utilization of industrial effluents for irrigating agricultural land has become a frequent practice in India. Water scarcity problem for irrigation can be solved to some extent by using an effluent as an alternative source of water. But before using the effluent for irrigation it should be checked for its quality. Usage of effluent having hazardous chemicals may disturb the agricultural field because industrial effluent has been considered as causes for pollution. Effluent can be checked for its quality by evaluating the Water Quality Index of an effluent for irrigation. Water Quality Index is a best and easiest method to know the quality of water. The aim of water quality index is to express water quality data into information that is understandable and used by the public. In the industries, Sugar industry is the most important agro based industries contributing significantly to rural and national economy. It generates huge amount of waste during the manufacture of sugar (Saranraj and Stella, 2014). Sugar industries play a major role in creating a polluted environment (Kumar and Chopra, 2010). The sugar mill operates for 3 to 6 months per year. A considerable amount of wastewater is released during crushing of sugar cane. These waste waters are disposed into its nearby surroundings. Discharge of this effluent into water bodies or on soil is causing a serious problem of water pollution resulting in severe damage to the flora and fauna and environmental degradation (Pande, 2005). Purpose of the current study is to analyze the sugar mill effluent to evaluate its WQI for irrigation and aimed to study the effect of sugar industry effluent on the growth of *Cyamopsis tetragonoloba* (L.) Taub.

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Materials and Methods

Collection of Sugar effluent

Pre sterilized 25 liter plastic container was used for effluent collection from the sugar industry. After proper collection, the sample was immediately brought to the laboratory and preserved for future analyses.

Sample Preservation and Analysis

The collected samples were preserved as per the standard preservation technique. The effluent samples were always kept in a suitable container in a refrigerator at 15 – 20° C. The effluent samples were taken out from the refrigerator only at the time of analyses. The Physico-chemical parameters of the effluent were determined (APHA, 2012).

Water Quality Index (WQI)

Water Quality index was measured by taking six

important parameters with the standards of discharge of trade effluent on land for irrigation by TNPCB (Tamil Nadu Pollution Control Board) P. MS. No. 30 Dated 21.02.1984, with the allotted weights (Punmia, 1977) and calculation was made as per the modified method (Harton, 1965 and Tiwari and Mishra, 1985) followed by Mathan and Venkatesan (2020).

Impact of Sugar Effluent on the growth of Chosen Plant

Healthy and viable seeds of *Cyamopsis tetragonoloba* (L.) Taub. were selected and used for plant growth study. Various concentrations of Sugar effluent, such as 10%, 25%, 50%, 75%, and 100% (v/v) were made with tap water. The tap water was used as the control. The selected seeds were sown in different pots each with 10 seeds and irrigated with equal amount of prepared concentration accordingly. After 15th day the plants were taken for analysis like germination of seeds, shoots length, root length, fresh weight, dry weight (Arts and Marks, 1971) and the plant vigour index was calculated by multiplying germination percentage with total length of seedlings (Abdul baki and Anderson, 1973).

Results and Discussion

The Physico-chemical characterization of the study effluent is represented in table 1. In the analyzed effluent pH and sulphate value were only within the limit of TNPCB standard for irrigation. The WQI of sugar industry effluent is represented in table 2. Water Quality Index was calculated based on the measurement of the analyses of some important physico-chemical parameters for irrigation and the calculated WQI of sugar industry effluent was 9.25, which was severe. The WQI of electroplating effluent was between slight to moderate and not suitable for irrigation (Periyasamy and Rajan, 2009) and the WQI of surface water around the steel plant industry was very poor and recommended it should not be used for human activities (Vinod *et al.*, 2013). Since, the WQI of the study effluent was severe; it is not advisable to use the effluents directly for irrigation because the property of effluent may disturb the agricultural land properties. So, it should be properly treated or diluted before it is used for irrigation. In order to find out the impact of sugar effluent on plant growth, a study was undertaken to observe the effect of various concentrations of sugar effluent on the growth characteristics of the chosen plant.

Percentage of seed germination was high at low concentration and it was gradually decreased with increasing concentration of effluent as

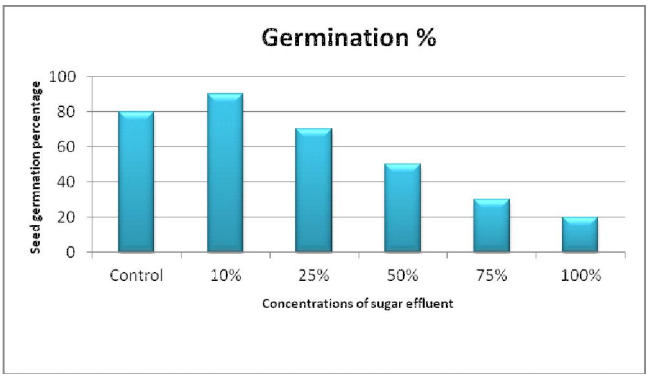

Fig. 1: Graphical representation of seed germination on different concentration of sugar effluent.

represented in fig. 1. Suppression of germination at higher concentrations of effluent may be due to high levels of total dissolved solids which enhance the salinity and conductivity of the solute absorbed by the seeds before germination (Piyush Malaviya and Anuradha Sharma, 2011).

Growth performances of the study plant were represented in table 3. Shoot and root growths were recorded to be high at low concentration. It had a negative effect with increasing concentration of the effluent. It

Table 1: Physico-chemical characterization of Sugar industry effluent.

S.No.	Parameters	Values *	Standard value (TNPCB)
1	pH	6.8	5.5 to 9
2	Total dissolved solids	11176	200
3	Total suspended solids	701	2100
4	Sodium	680	-
5	Potassium	251	-
6	Calcium	359	-
7	Magnesium	51	-
8	Sulphate	843	1000
9	Chloride	1640	600
10	Percent Sodium (%)	62	60

*All the values are expressed in mg LÉ¹except pH and Percent sodium.

Table 2: Water Quality Index of Sugar industry effluent.

S.No.	Parameters	Standard Value (TNPCB)	Rating (qi)	Unit weight (wi)	Product (qiwi)
1	pH	5.5 to 9	75	0.06	4.5
2	TSS	200	0	0.13	0
3	TDS	2100	0	0.13	0
4	Chloride	600	0	0.25	0
5	Sulphate	1000	25	0.19	4.75
6	Percent Sodium %	60	0	0.25	0
Water Quality Index =					9.25

Table 3: Impact of sugar effluent on growth characters of *Cyamopsis tetragonoloba.*

S.No.	Parameters*	Control	Concentration of Sugar effluent				
			10%	25%	50%	75%	100%
1	Shoot length (cm/seedlings)	8.2±0.70^{b}	9.2±0.13^{a}	7.9±0.68^{b}	6.2±0.90^{c}	5.3±0.13^{d}	2.8±0.06^{e}
2	Root length (cm/seedlings)	7.4±0.75^{a}	7.6±0.10^{a}	7.0±0.11^{b}	5.3±0.09^{c}	2.9±0.12^{d}	1.2±0.06^{e}
3	Fresh weight (gm/seedlings)	0.85±0.07^{b}	0.91±0.10^{a}	0.77±0.11^{c}	5.4±0.10^{d}	0.40±0.12^{e}	0.23±0.09^{f}
4	Dry weight (gm/seedling)	0.39±0.09^{b}	0.43±0.11^{a}	0.37±0.07^{c}	0.30±0.07^{d}	0.24±0.11^{e}	0.08±0.05^{f}
5	Vigour Index	1248±50.2^{b}	1512±51.4^{a}	1043±52.0^{c}	575±67.3^{d}	246±49.0^{e}	80±26.0^{f}

Mean values within rows followed by a same letter are not significant at *P=0.05* according to DMRT.

was clear from the report that higher concentration of the effluent was toxic to the plant which suppresses the growth of the plant and may be due the presence of large amount of dissolved solids and suspended solids. Low concentration of paper mill effluent increased the growth and high concentration inhibited the seedling growth of Black gram (Gupta *et al.,* 2016).

The fresh weight, dry weight and vigor index were also high at low concentration than the control but they were reduced with increasing concentration of the effluent which shows the deleterious effect of the effluent. Similar report was recorded at low concentration of sugar mill effluent on finger millet (Pravina Mary *et al.,* 2017). From this study it is clearly understood that direct use of sugar industry effluent is not good for agricultural practice, it can be used after dilution or treatment.

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