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REGULAR ARTICLE

IMPACT OF JUICE FACTORY SPENT WASH ON THE GROWTH AND PIGMENT CONTENT OF *LABLAB PURPURES* SWEET. (L.)

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SUMMARY

Juice factory spent wash effluent discharged as wastewater, contains various toxic chemicals that contaminate water and soil. It may affect the common crops if it is used for agricultural irrigation. Toxic nature of juice factory effluent is due to the presence of high amounts of organic and inorganic chemical loads and its high acidic in nature. The paper deals with the effects of untreated juice factory spent wash, on growth and pigments content of *Lablab purpures* Sweet. (L.). The *Lablab purpures* Sweet. (L.) is a commonly used legume crop in Tamil Nadu. Seeds were selected and surface-sterilized with 0.1% HgCl2 for 2 minutes and washed with distilled water thoroughly. They were treated with different concentrations (5-100%) of effluent. The germination percentage growth (shoot and root length), fresh weight, dry weight and pigment content of the plants were investigated. The results revealed that the germination characters, root and shoot length, fresh and dry weight and pigment content increased upto 5% concentration and there after decline in higher concentrations of spent wash effluent.

Keywords: Juice factory, *Lablab purpures*, germination, pigments.

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1. Introduction

Water is the most precious thing in the world. The most vital fascinating of all god creation. In recent years increasing of industrialization, urbanization and development activities to cope up with the population explosion have brought inevitable waste crisis (1). In India there are about 7500 medium to large industrial units, which generate lot of waste water as effluent (2). These effluents are well known to cause pollution in the natural streams by lowering of pH value, increase inorganic load, depletion of oxygen content, discoloration (3, 4, 5). It can create serious threats on the welfare and health of the adjoining aquatic and terrestrial habitats.

Juice factory effluent contain many constituents in the form of organic and inorganic chemicals, which are phytotoxic in nature at higher concentration. However, some of the constituents at lower concentrations are also beneficial for growth and development of plants (6). The different concentrations of juice factory effluent used to enhance the germination, root length, shoot length, fresh weight, dry weight and pigment content of

Lablab purpures. However, higher concentrations (>15%) were found to inhibit the among the parameters (7). Deleterions effects on the growth of *Lablab purpures* have been assessed with higher concentrations of effluent. The some effluent concentration dependent decrease in germination of steel factory effluent (8) sugar mill effluent, (9) and paper mill effluent (10) have also been reported. The present study focused on physicochemical analysis of juice factory spent wash effluent and its effects on the seed germination, growth characteristics and pigment content of *Lablab purpures* Sweet. (L).

2. MATERIALS AND METHODS

Collection of juice factory effluent

The effluent sample was collected in plastic container from the outlet of the Thaeenamuthu food product factory in Kaveripattinam, Kirshnagiri district, Tamil Nadu, India. The physico-chemical properties were analysed by standard methods of APHA (11). Raw effluent were freshly diluted viz., 5, 15, 25, 50 and 100% v/v with distilled water for experimental studies.

Germination character studies

Lablab purpures Sweet. (L.) seeds were procured from Agricultural Department, Dharmapuri (Dt.), Tamil Nadu. Fifty healthy, uniform size seeds were selected and surface sterilized with 0.1% HgCl2 for two minutes. They were thoroughly washed with tape water to avoid surface contamination. Ten seeds were placed equidistantly in plastic trays, filled with sterilized soil. The seeds were treated with equal quantity of different concentrations of effluent an the seeds treated with distilled water were maintained as control. The number of seeds germination and the length of seedlings were observed and measured on the 7 days old seedlings. The fresh weight of seedlings were taken by using an electrical single pan balance. The dry weight was taken after drying the seedlings in hot air oven at 80°C for 24 hours. The number of leaves were counted at 15 and 30th days. The chlorophyll and carotene contents of seedlings were estimated by following the methods of (12) and (13) respectively.

Statistical analysis

The results were expressed as mean ± SD comparisons were made with appropriate controls.

3. Results and discussion

The physicochemical properties of raw juice factory spent wash effluents are shown in Table 1. The raw effluent was Blakish yellow in colour. The pH of raw effluent was acidic in nature. It contained high amounts of suspended and dissolved solids it showed a high value of biological oxygen demand (BOD) and chemical oxygen demand (COD). The presence of considerable amounts of calcium, magnesium, chloride, sulphate, fluoride, nitrate, silica and total hardness were also noticed in the effluent. This is in conformity with the earlier findings in various effluent (14, 15, 16, 6, 17, 4). The pollution load of the effluent depends upon the nature of raw materials, chemicals used, at the time of juice extraction. The presents of higher amount of organic and inorganic chemicals due to the presents of fermentation enzymes in fruit itself.

Germination percentage decreased with increase in effluent concentrations. In contrast effluent treatment has no effect on germination of seeds upto 10% effluent concentration (Fig. 1). In the raw effluent (100%) some seeds germinated, but the seedlings did not survive beyond seven days. Our results are consistent with the findings of other workers (18, 9). The germination reduction due to the osmotic pressure of the effluent is higher in high concentrations of effluent (19, 3). Inhibition of

seed germination may be due to high level of dissolved solids which enrich salinity and conductivity of the observed source by seed before germination (7). The higher concentration of effluent decrease enzyme dehydrogenase activity that is considered as one of the biochemical change which have inhibit the germination and seedling growth.

Table 1. Physico-chemical analysis of juice factory effluent

S. No.	Parameters	
1.	Appearance	Turbid, slight yellow color liquid
2.	pH	6.37
3.	Colour	Blakish yellow
4.	Turbidity	12 NTU
5.	Odour	Bad odour
6.	Total suspended solids	1608 mg/l
7.	Total dissolved solids	1200 mg/l
8.	Conductivity	1845 Micromho's/cm
9.	Total hardness as CaCO3	2286 mg/l
10.	Permanent hardness as CaCO3	918 mg/l
11.	Temporary hardness as CaCO3	1368 mg/l
12.	Calcium hardness as CaCO3	376 mg/l
13.	Magnesium hardness as CaCO3	1910 mg/l
14.	Carbonate hardness as CaCO3	597 mg/l
15.	Non-Carbonate hardness as CaCO3	1689 mg/l
16.	Total Alkalinity as CaCO3	597 mg/l
17.	Phenolphthalein Alkalinity as CaCO3	Nil
18.	Carbonate Alkalinity as CaCO3	Nil
19.	Bi-Carbonate Alkalinity as CaCO3	597 mg/l
20.	Calcium as Ca+	150.70 mg/l
21.	Magnesium as Mg+	30.13 mg/l`
22.	Chlorides as Cl-	310 mg/l
23.	Sulphates as SO4	319 mg/l
24.	Silica as SiO2	21.8 mg/l
25.	Iron as Fe	0.1 mg/l
26.	Hydroxide Alkalinity as CaCO3	Nil
27.	Free CO2	Nil
28.	Free Chlorine as Cl	Nil
29.	Fluoride as F	1.0 mg/l
30.	Sodium as Na	198 mg/l
31.	Potassium as K	94 mg/l
32.	Nitrate as NO3	11.27 mg/l
33.	Oil and grease	8.5 mg/l
34.	COD	550 mg/l
35.	BOD at 20°C for 5 days incubation	308 mg/l

The stimulation of germination percentage at lower concentrations due to the reduction in level of toxic metabolites by dilution and better utilization of nutrients present in the effluent (20). The same trend findings observed in *Lablab purpures* (21). The reduction in seed germination percentage at higher

concentrations of effluent may be due to the higher amounts of solid present in the effluent (22).

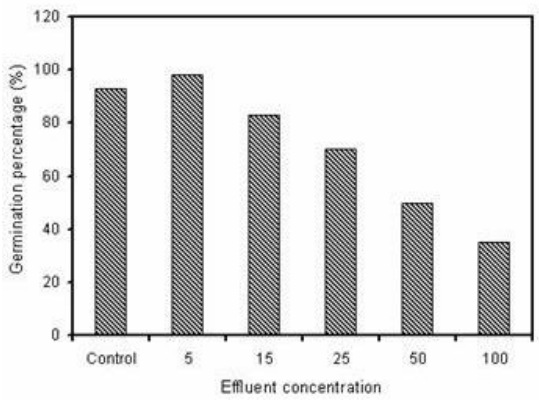

Fig. 1. Effect of juice factory effluent on germination percentage of *Lablab purpures* Sweet (L.)

The greatest effect on shoot and root length, shoot fresh and dry weight was observed with effluent followed by 100, 50, 25, 15, 5% v/v (Figs. 2-7). There was an increase in root and shoot length, fresh and dry weight at 5 and 10% effluent concentration when compared to control. The increasing trend in germination and growth behaviour at lower concentrations of effluent is due to the optimum level of nutrients present in the diluted effluent. The higher concentration (15% and above of effluent) have an inhibitory effect on seed germination, growth and fresh and dry weight of *Lablab purpures* seedlings. Decrease in seedling growth and fresh and dry weight, was observed with increase in concentration of effluent when compared to control. The lower concentration of effluent increased the dry weight of seedling the higher concentrates were reduced the dry weight the variation of fresh and dry weight due to the presence of salt and minerals at lower concentration at optimum level (23). The presence of excessive amount of the elements, major elements as well as other pollutants could possibly reduce the seedling growth and subsequently the weight of the seedling. The higher concentrates of the effluent contained especially excessive quantities of chlorides acted as retardants to plant growth and for the dry matter production of plants (24, 25). The same trend was reported while studying the effect of different industrial effluents on various crops (26, 9) and also the adverse effect on the plant growth may also be due to the presence of higher amount of organic matter and BOD which leads to the depletion of oxygen and accumulation of CO2 (27).

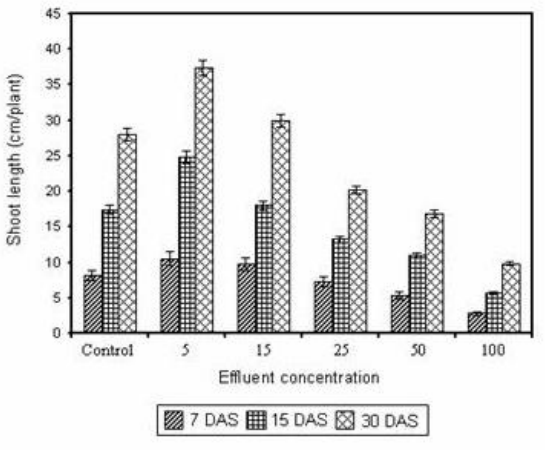

Fig. 2.Effect of juice factory effluent on shoot length (cm/plant) of *Lablab purpures* Sweet. (L.)

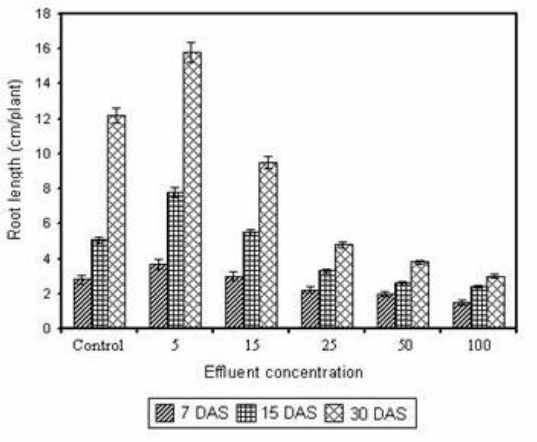

Fig. 3.Effect of juice factory effluent on root length (cm/plant) of *Lablab purpures* Sweet. (L.)

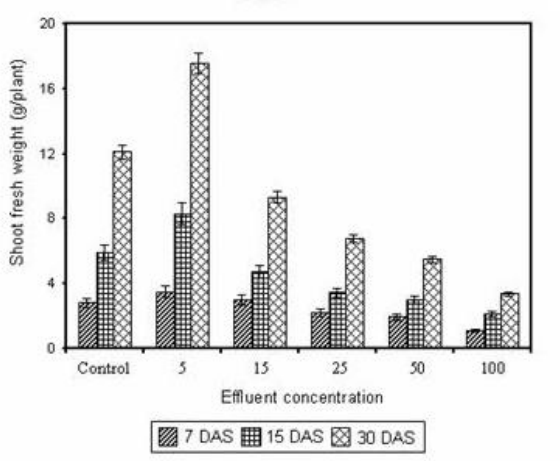

Fig. 4.Effect of juice factory effluent on shoot fresh weight (g/plant) of *Lablab purpures* Sweet. (L.)

Chlorophyll

The chlorophyll is one of the important biochemical content which is used as an capacity of the plant growth. The pigments content of chlorophyll 'a', 'b', total chlorophyll and carotenoid contents of seedlings showed an increasing trends at lower concentrations of effluent irrigation (Figs. 8-11). It is due to the presents of favourable amount of nutrients. It has been reported that the presence of excess amount of minerals in the higher concentration of effluent (6, 10, 28). The increase in carotenoid content might due to enhanced influence of nitrogen and other organic elements present in the effluent (29, 30).

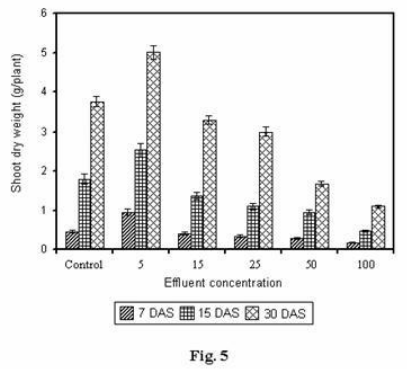

Fig. 5

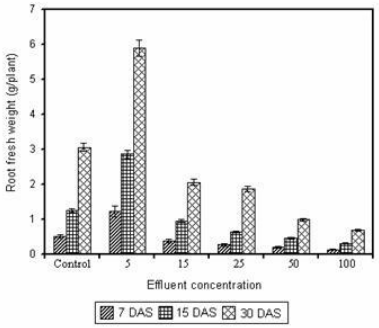

Fig. 6

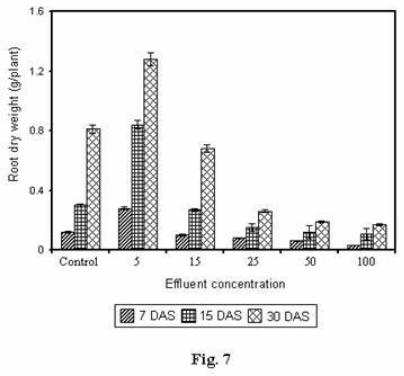

Fig. 7

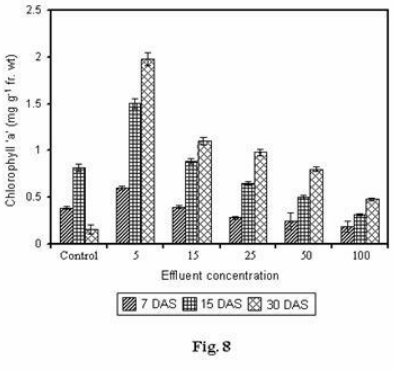

Fig. 8

Fig. 5.Effect of juice factory effluent on shoot dry weight (g/plant) of *Lablab purpures* Sweet. (L.), Fig. 6.Effect of juice factory effluent on root fresh weight of *Lablab purpures* Sweet. (L.), Fig. 7.Effect of juice factory effluent on root dry weight (g/plant) of *Lablab purpures* Sweet. (L.), Fig. 8.Effect of juice factory effluent on chlorophyll 'a' content of *Lablab purpures* Sweet. (L.)

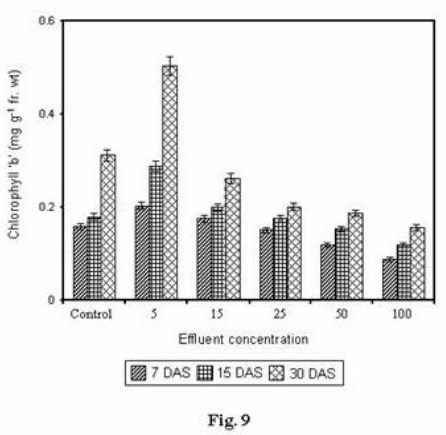

Fig. 9

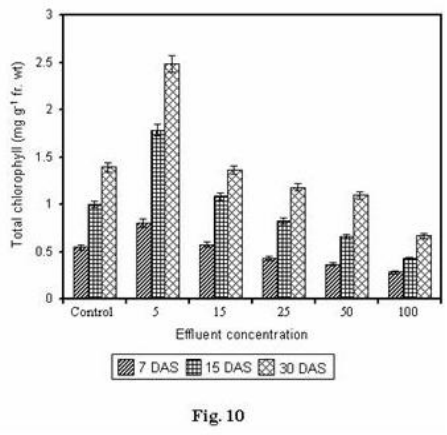

Fig. 10

Fig. 9.Effect of juice factory effluent on chlorophyll 'b' content of *Lablab purpures* Sweet. (L.)Fig. 10.Effect of juice factory effluent on total chlorophyll content of *Lablab purpures* Sweet. (L.)

Reduction of pigment contents induced by higher concentration of effluent may be associated with mineral ions. Some of the possible reasons for the decrease in pigment content may be the formation of enzyme such as chlorophyllase which is responsible for chlorophyll degradation (31, 32).

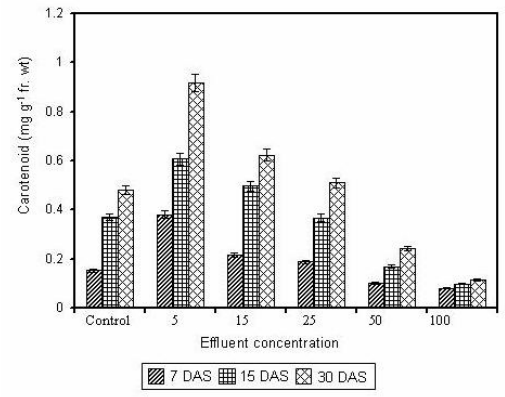

Fig. 11.Effect of juice factory effluent on carotenoid content of *Lablab purpures* Sweet. (L.)

CONCLUSION

The present study concludes that the untreated juice factory spent wash effluent is highly toxic for *Lablab purpures*, at the same time. Seed germination seeding growth and pigment contents were increased at low concentration of effluent. It is suggested that the effluent diluted upto 5% serve as a liquid fertilizer for the crop plants.

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