

EFFECT OF STEEL PLANT EFFLUENT ON SEED GERMINATION AND SEEDLING CHARACTERISTICS OF SESAMUM INDICUM L.

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Abstract Attempts were made to study the influence of steel plant effluent on seed germination and seedling characteristics of *Sesamum indicum*. Germination of the seeds, germination value and germination relative index were decreased by about 9%, 10% and 13% respectively, as compared to their values under control condition. Fresh weight and moisture percentage of effluent germinated seedlings were significantly higher than the respective values for tap water germinated seedlings.

Most significantly effects of steel plant effluent were observed with respect to nutrient contents of the seedlings. Calcium, Iron, Total nitrogen and Protein concentration decreased in effluent germinated seedlings while magnesium & Phosphate concentration increased in effluent germinated seedlings as compared to their values under control condition.

Key Words: steel plant, seed germination, seedling growth, nutrients.

Introduction-

Industry contributes various kinds of pollutants to the environment. The pollutants are mainly in gas, water and solid forms that can cause serious damage to the biosystem. Industrial pollution has attracted a lot of attention. Great efforts have been made to solve the problems. In recent years, the sustainable development concept has been widely recognized, which has promoted the implementation of integrated management of industrial production.

Germination of seeds being a very delicate phase in the life of a plant is affected much by the changes in the external environment. The industrial effluents affect the germination of seeds even at very low concentration.

The present study has been made to investigate the physico-chemical characteristics of Bhilai steel plant effluent and its effect on *sesamum indicum*.

Materials and Methods

The waste water from BSP was collected at about at 10 km downstream to the points of its origin. Seeds treated with tap water were taken as control while effluent treated seeds were taken as treated. Methods followed for analyse were :-

Germination value (Boojh Ram and Ramakrishnan 1981), speed of germination index (Kamal and Sinha 1974), germination relative index (zur 1966), protein (lowry et al 1951), inorganic nutrients (Jackson 1973), while physico-chemical characteristics of water sample were determined following (Apha-1976).

Results and Discussion

The physico-chemical properties of tap water and steel plant effluent are given in Table 1.

The temperature, pH, electrical conductivity of the effluent with mean value of 29.5 °C, 7.49 and 0.710 m. mhos/cm respectively (Table 1) were slightly higher as compared to the values obtained for tap water. Oxidation reduction potential and dissolved oxygen were

significantly higher in tap water with mean value of 184 mv and 5.73 mg/l respectively as compared to the value obtained for BSP effluent. The TDS, Sulphate, Ammonia, Iron and Total hardness with mean values of 358 mg/l, 1286 mg/l, 255 mg/l, 353 mg/l and 381 mg/l respectively, were present in higher concentration in BSP effluent.

Similar observations were reported in some industries like electroplating (Ajmal and Khan 1985), fertilizer factory (Muthu Kumar and Subramanyam 1987). Temperature, pH and Electrical conductivity within the normal range as is also observed for sugar factory effluent (Saxena et al 1988). The presently observed value for total dissolved solid and total hardness are also very low as compared to the values for tannery effluent (Usha and Kalaiselvi 2009). The presently observed concentrations of sulphate, ammonia and iron are higher as compared to the values obtained in textile industry (Kannan et al 2003) and bicycle manufacturing industry (Sastry et al 2003).

THE EFFECT OF STEEL PLANT EFFLUENT ON SEED GERMINATION AND SEEDLING CHARACTERISTICS ARE SHOWN IN TABLE - 2.

The effluents have generally inhibitory effect on seed germination as well as on investigated seedling characters (Table 2). The germination percentage, germination values, speed of germination index and germination relative index all decreased significantly in effluent germinated seeds by about 9.41%, 9.59%, 9.05% and 12.90% respectively as compared to values found under control

condition, while fresh weight as well as moisture percentage of effluent germinated seedlings increased about 2.52% and 1.51% respectively.

Concentration of calcium, iron, total nitrogen and protein were decreased in effluent germinated seedlings by about 9.90%, 29.51%, 0.18% and 0.17% respectively, while magnesium and phosphate concentration increased in effluent germinated seedlings by about 12.84% and 3.99% respectively.

Effluents from different types of industries, as experimented on several plant species have exhibited differential effects on their seed germination and seedling characteristics. Effluents from some of the industries have been reported to show very significant effects even in diluted form. These include the effluent from the industries like fertilizer factory (Jerath and Sahai 1982), distilleries (Singh-1982), sugar factories (Shinde et al 1988), while effluents from some industries shown very insignificant effects. These include the effluent from brewery (Ajmal and Khan 1984), and electroplating (Ajmal and Khan 1985).

The present observations showing even promontory effects on fresh weight, moisture %, magnesium and phosphate indicates that the integrated steel plant effluent as compared to the other industrial effluents in considerably less harmful to the plants and it can safely be used for irrigation.

Table 1: Physico-chemical characteristics of Tap water & BSP effluent (All values are in mg/l. Except Temperature, ORP & Electrical conductivity)

SN	Parameters	Tap water	BSP Effluent
1	Temperature °C	22.5	29.5
2	pH	7.21	7.49
3	ORP mv	184	28
4	Electrical conductivity m.mhos/cm	0.365	0.710
5	TDS	181.0	358.0
6	Sulphate	16.621	1286.0
7	Nitrite	0.062	2.23
8	Ammonia	0.005	255.0
9	Iron	2.841	353.0
10	Total Hardness	148.0	381.0
11	Dissolved Oxygen	5.73	0.92

(Data represents the mean of three replicates).

Table 2 -Effect of steel plant effluent on seed germination and seedling characteristic of sesamum indicum

SN	Parameters	Control mean	Treated mean	% change in treated over control
1	Germination%	85	77	-9.41
2	Germination value	73	66	-9.59
3	Speed of germination index	409	372	-9.05
4	Germination relative index	62	54	-12.9
5	Fresh weight of seedling/ g seed	2.659	2.726	2.52
6	Dry weight of seedling/ g seed	0.988	0.987	-0.10
7	Moisture % of seedling	62.838	63.789	1.51
8	Calcium mg/ 100gms	32.590	29.363	-9.90
9	Magnesium mg/ 100gms	1.301	1.468	12.84
10	Phosphate mg/ g	6.411	6.667	3.99
11	Iron mg/ g	1.576	1.111	-29.51
12	Total nitrogen %	0.553	0.552	-0.8
13	Protein%	3.456	3.450	-0.17

(Values are arithmetic mean of three replicates)

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