



Physico-chemical analysis of Combined Industrial Effluent and it's impact on seed germination of *Brassica campestris* L. var. RSPIT-I

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ABSTRACT

The current research was performed to observe the physico-chemical parameters of combined industrial effluent and its impact on seed germination of *Brassica campestris* L. var. RSPIT-I. The effluent was reported to be light brown and pungent smelling at moderate temperature of 28°C, slightly acidic with pH 6.22, TDS of 0.554 ppt, salinity of 0.6 ppt and electrical conductivity of 1.069 ms. The concentration of various cations viz. Na, K, Ca, Li and Mg was observed to be 45.190ppm, 1.786ppm, 39.091ppm, 3.056ppm and 2.432ppm respectively while concentration of various anions like chloride, nitrate, phosphate & sulphate was observed to exhibit the values as 9.318ppm, 0.259ppm, 0.213ppm & 12.066ppm respectively. Over all inhibitory impact was exhibited on seed germination at the taken concentrations of the effluent viz. 25%, 50%, 75% & 100% with gradual decrease in seed germination index and percentage seed germination with the increase in concentration of effluent.

Keywords: seed germination, combined industrial effluent, physico-chemical, *Brassica campestris* L.

INTRODUCTION

Industrial revolution is a great benefit to mankind but there are enormous environmental impacts created by industries. Environmental Pollution has become a havoc world-wide and is accentuated by rapid industrialization which is fast transforming the natural resources like Air, Water and Soil into big reservoirs of dangerous pollutants. India's 14 major, 55 minor and several hundred small rivers receive millions of litres of sewage, industrial and agricultural wastes. The most polluting source for rivers is industrial waste discharge. Rapid industrialization has led to enhancement in the withdrawal of fresh water quantity for production and cooling purposes and also in substantial effluent discharge into the fresh water resources that changes physico-chemical characteristics of the water body (Idris *et al* 2013; Joshi and Santani, 2012 and Lokhande *et al* 2011). This when used for irrigation on crops exhibited inhibitory effect on growth and germination specially at higher concentration (Kumar and Chopra 2013).

Seed germination being a critical stage for insuring plant population dynamics serves as an important test for tentative crop growth and yield, henceforth In the present study an evaluation was made for the analysis of physico-chemical parameters of combined industrial effluent from the main drainage (SIDCO Industrial Complex Bari Brahmna Samba, Jammu) and its impact on seed germination of *Brassica campestris L. Var RSPIT-I*

MATERIALS AND METHODS

The combined Industrial effluent was collected from the main drainage at SIDCO Industrial Complex Bari Brahmna, Samba, J&K. The seeds of *Brassica campestris L. var. RSPIT-I* were obtained from Directorate of Agriculture, Talab Tillo Jammu J&K. Four different concentrations of combined industrial effluent were made viz. 25% for Set I, 50% for Set II, 75% for Set III & 100% for Set IV for the experiment in four beakers and in one beaker only tap water was used which was taken as control set. 40 seeds were soaked in each beaker for a period of 24 hours. Percentage germination and Seed germination index was recorded in 5 sets of petri dishes,

four with different Combined Industrial Effluent concentrations and one with tap water, in each one of them 10 pre-soaked seeds were kept and observed for a period of 7 days to calculate percentage germination and seed germination index. Seed Germination Index was obtained by calculating the no. of seeds germinated each day divided by the day on which those seeds germinated. Seed germination index –

$$n_1/d_1+n_2/d_2+n_3/d_3+....n_n/d_n$$

n = no. of germinated seeds

d = day on which those seeds germinated

The physical parameters viz. pH, electrical conductivity, TDS & salinity were analysed by preparing different concentrations of Combined Industrial Effluent & were measured by means of water analysis kit, temperature was recorded by mercury bulb thermometer. The concentrations of anions and cations in the effluent were analysed by Ion Chromatography instrument (Model No. 850 I.C Professional)

Table 1: Physical parameters of different concentrations of the Combined Industrial Effluent

Concentration of Combined Industrial Effluent	Physical Parameters of Combined Industrial Effluent			
	TDS (ppm)	pH	Salinity (ppt)	Electrical conductivity (ms)
25%	0.247	6.60	0.2	0.490
50%	0.345	6.48	0.3	0.508
75%	0.438	6.27	0.5	0.829
100%	0.554	6.22	0.6	1.069

Table 2: Concentration of cations (ppm) in different concentrations of the Combined Industrial Effluent.

Concentration of Combined Industrial Effluent	Concentration of Cation (in ppm)				
	Na	K	Ca	Li	Mg
25%	13.423	0.966	12.085	1.066	0.955
50%	26.195	1.607	16.833	1.835	1.097
75%	32.186	1.705	28.926	2.011	1.928
100%	45.190	1.786	39.091	3.056	2.432

Table 3: Concentration of anions (ppm) in different concentrations of the Combined Industrial Effluent.

Concentration of Combined Industrial Effluent	Concentration of anion (in ppm)			
	Chloride	Nitrate	Phosphate	Sulphate
25%	2.290	0.004	0.078	0.079
50%	4.276	0.011	0.145	0.148
75%	5.857	0.034	0.211	0.214
100%	9.318	0.259	0.213	12.066

Table 4: Impact of Combined Industrial Effluent on seed germination of *Brassica campestris* L. var. RSPIT-I

Experimental Set	No. of germination on day							Percentage (%) of Seed germination	Seed germination index
	1	2	3	4	5	6	7		
Control Set	8	2	0	0	0	0	0	100%	9
Set-I	2	7	0	0	0	0	0	90%	5.5
Set-II	0	6	0	2	0	0	0	80%	3.5
Set-III	0	5	1	0	1	0	0	70%	3.033
Set-IV	0	5	1	0	0	0	0	60%	2.833
Pearson's Correlation								r=-1	r=-0.903
Significance								p=0.1460	p=0.0366

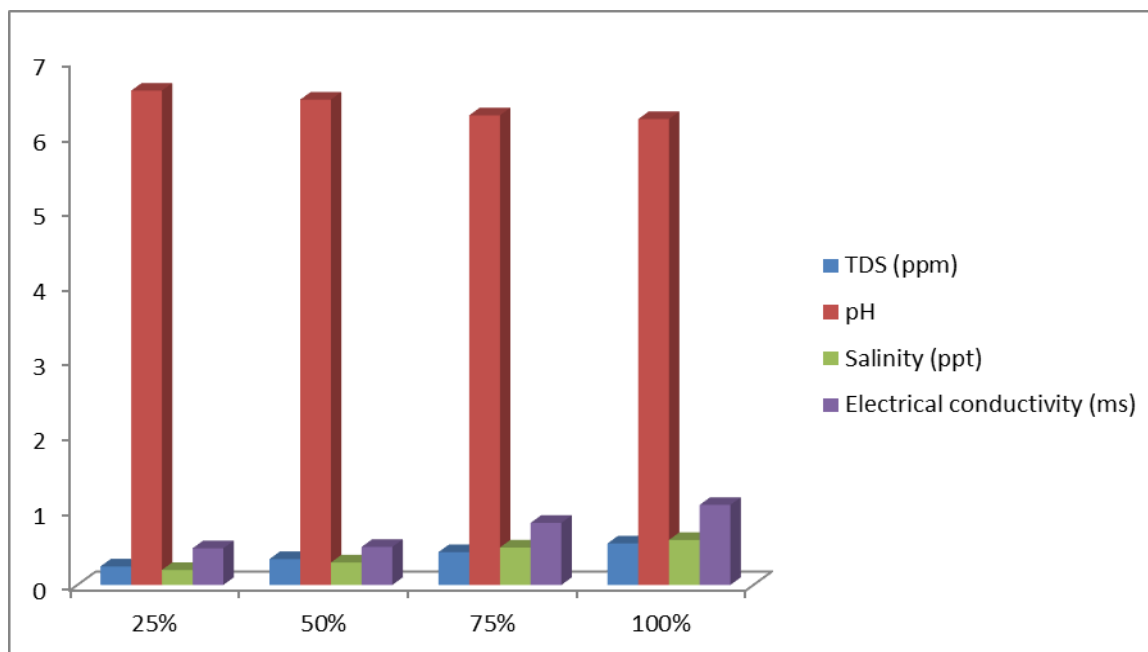


Fig. 1: Physical parameters of different concentrations of Combined Industrial Effluent

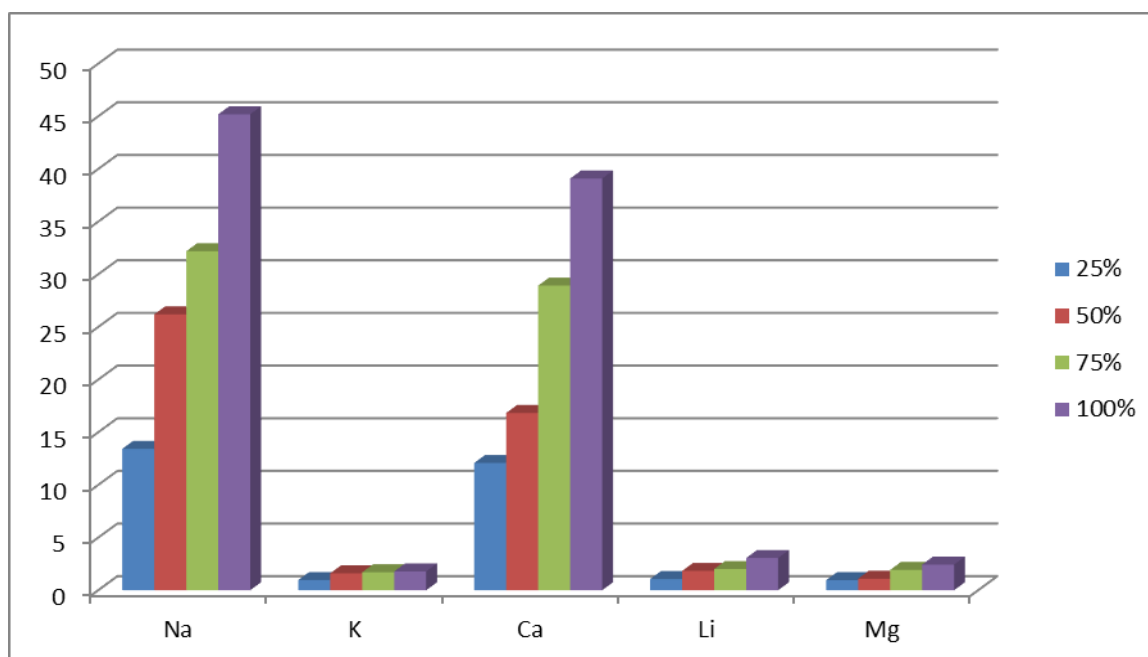


Fig. 2: Concentration of cations in different concentrations of Combined Industrial Effluent

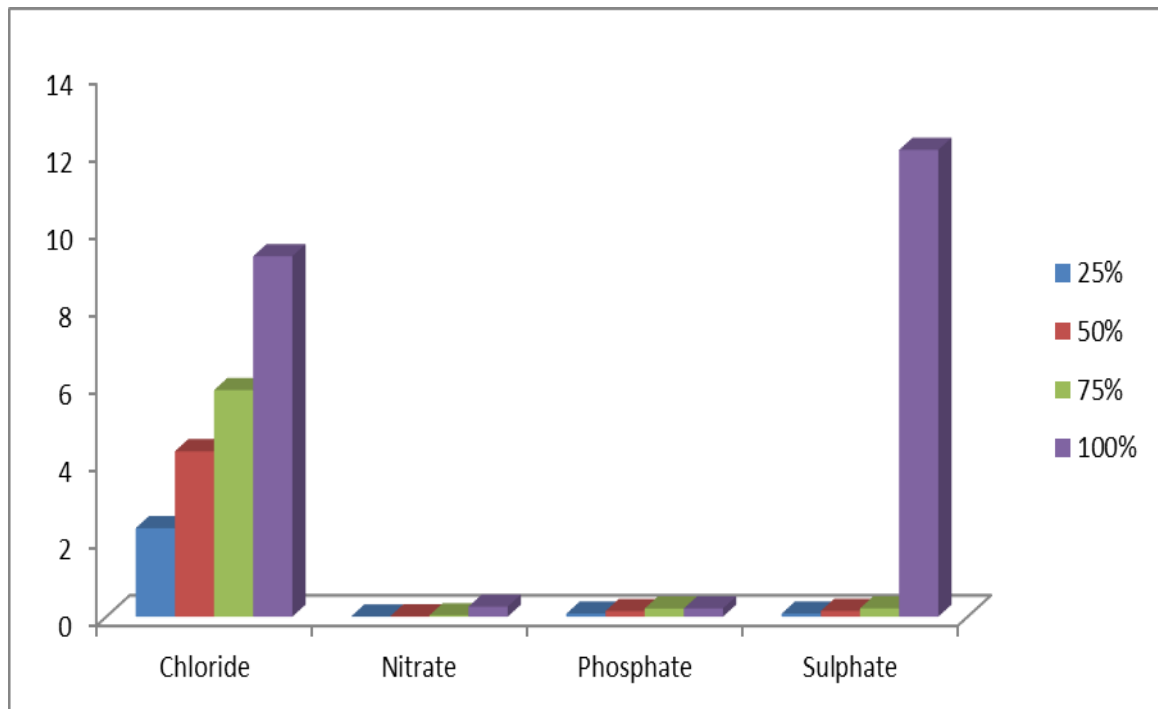


Fig. 3: Concentration of anions in different concentrations of Combined Industrial Effluent

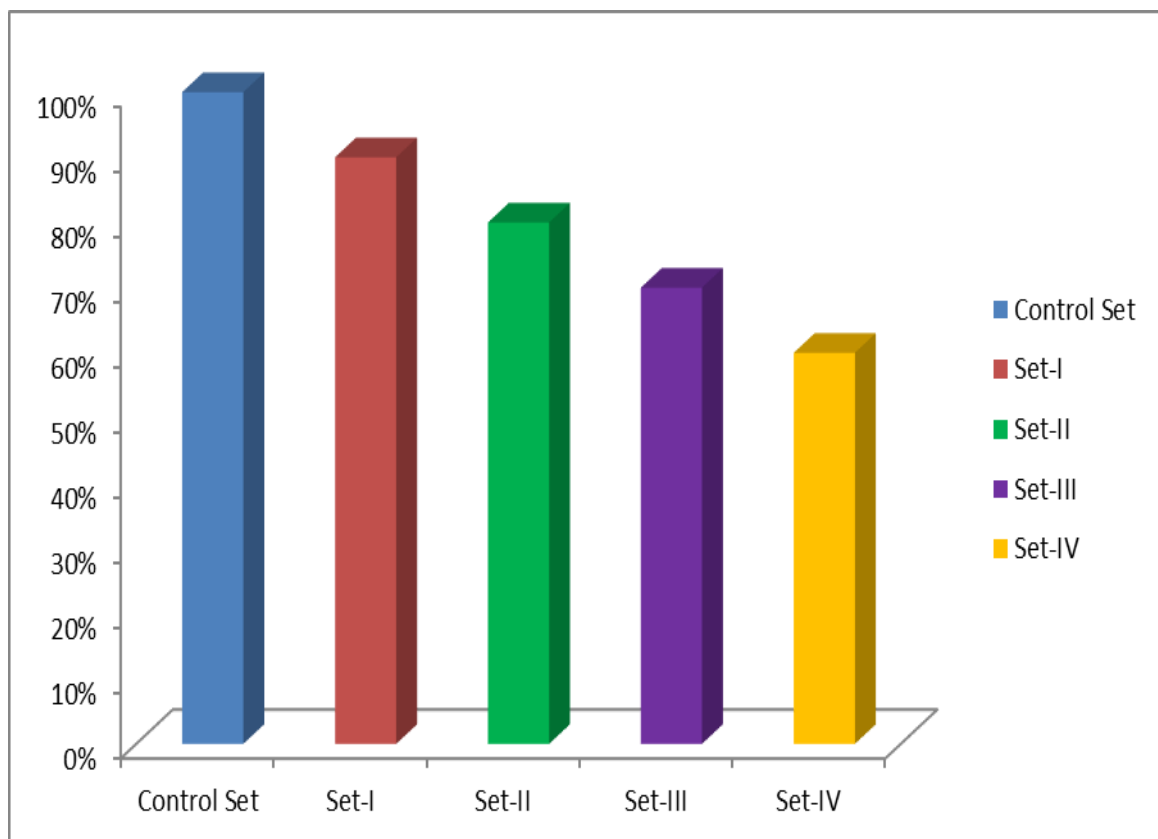


Fig. 4: Impact of Combined Industrial Effluent on percentage seed germination of *Brassica camprestis L. var. RSPIT-I*

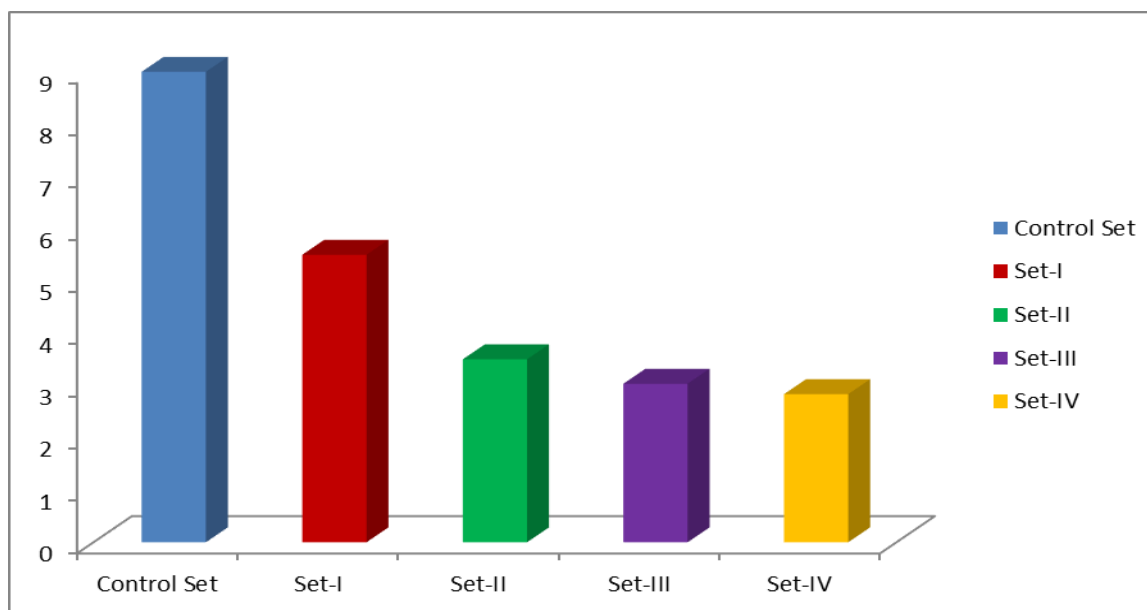


Fig. 5: Impact of Combined Industrial Effluent on seed germination index of *Brassica camprestis L. var. RSPIT-I*

RESULT AND DISCUSSION

The analysis of the physical parameters of the Combined Industrial Effluent revealed that it was light brown in colour having pungent odour and a moderate temperature of 28°C at the place of its collection in the main drainage and it was slightly acidic in nature with pH of 6.22 and TDS of 0.554 ppm, Salinity of 0.6 ppt and electrical conductivity of 1.069 ms. The concentration of various cations viz. sodium, potassium, calcium, lithium and magnesium was observed to be 45.190 ppm, 1.786 ppm, 39.091 ppm, 3.056 ppm and 2.432 ppm respectively while the concentration of various anions like chloride, nitrate, phosphate and sulphate was observed to exhibit the values as 9.318 ppm, 0.259 ppm, 0.213 ppm and 12.066 ppm respectively. (Table I, II, III & Fig. 1,2,3). Lokhande *et al* (2011) while working on the physico-chemical parameters of industrial wastewater effluents collected from Taloja industrial belt of Mumbai also reported higher values of chloride BOD, COD, TDS and TSS. Doke *et al* (2011) reported low values of pH and high values of TDS, COD and high inorganic and organic content in sugar industry effluent. Begum *et al* (2010) also observed high values of electrical conductivity TSS, TDS, DO, COD, turbidity and temperature in natural gas fertilizer factory effluent. The analysis of the data of impact of Combined Industrial Effluent on seed germination revealed that seed treatment with Combined Industrial Effluent for 24 hours exhibited an inhibitory effect on seed germination index and percentage seed germination as compared with that of the Control Set. The seed germination index

was observed to be 9 in case of Control Set whereas the values decreased to 5.5, 3.5, 3.033 and 2.838 at increasing concentrations of Combined Industrial Effluent i.e. Set I, Set II, Set III and Set IV respectively, thereby exhibiting significant ($p < 0.05$) negative correlation ($r = -0.903$). The percentage of seed germination was observed to be 100% in case of Control Set where as it decreased to 90%, 80%, 70% and 60% with increase in concentration of Combined Industrial Effluent i.e. 25%, 50%, 75% and 100% respectively (Table IV, Fig. 4 & 5) exhibiting insignificant ($p > 0.05$) negative correlation ($r = -1$). Shanmugavel (1993) while studying the impact of sewage, paper and dye industry effluents on green gram and maize seeds also observed that with the increase in concentration of effluent the germination percentage decreased. Sahai and Neelam (1988) while working on fertilizer factory effluent observed decline in seed germination index and percentage seed germination of *Sesamum indicum Linn.* at higher effluent concentration. The present observation supported the work of other workers like Panaskar and Pawar (2011), Pandey *et al* (2008), Goel and Kulkarni (1994), Rehman *et al* (2009) and Siddique and Waseem (2012) while working on different plants using different effluents.

CONCLUSION

Environmental pollution always had disastrous implications on plants, humans and animals. Industrial effluents discharged from industries have wide range of contaminants including organic, inorganic and heavy

metals load which when used for irrigation may cause huge damage to the crop depending upon the crop and effluent type. Seed being a fragile and important stage for probable qualitative and quantitative growth of the crop requires utmost care and nourishment, An observation from the work of other authors has described that seed germination had an inverse relationship with the concentration of the applied industrial effluent and the present study has distinctly revealed inhibitory effect of combined industrial effluent on seed germination of *Brassica campestris* L. Var RSPIT-I at the taken concentrations of the effluent.

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