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Research Article

Impact of Thermal Power Plant Effluent on Changes of Growth and Pigment Content in *Raphanus sativus* L.

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Abstract

The physicochemical characteristics of the content of the effluent from thermal power plant Ukai have been explored and its effects on the growth patterns as well pigment content of *Raphanus sativus* L. have been studied. Different concentrations of effluent were used (0%, 20%, 50%, 80% & 100%) for irrigation. Tape water served as 0% (control). Studies were conducted up to 20 days. Results were noted at every 5th day. The experiments were carried out in triplicates. The results concluded that higher concentrations of effluent were affecting plant growth and chlorophyll content but lower concentration favoured it. From experimental analysis it can be said that if dilutions of the effluent is carried out it can be used for agriculture purpose.

INTRODUCTION

With the increasing industrialisation pollution also increased. Based on type of industries, various levels of pollutants can be discharged into the environment. Coal based thermal power plant is a part of industrialisation because it is the major source of electricity (Nawaz, 2013). Fly ash, bottom ash, effluent etc. are the by product of the thermal power plant. Cement industries use fly ash as raw material for cement production and bottom ash is a raw material for brick production (Kumara *et al*, 2014). It is also used for road construction, block making, etc. But the effluent directly discharges in to the natural source of water. So directly or indirectly effluent shows adverse effects on water quality.

The effluent contains some organic and inorganic nutrients and which may be beneficial for various crops depending upon the concentration and thus it is gaining importance in agricultural sector (Rawat *et al.*, 2011). So, effluent can be considered as both a resource though it is a problem. So, the present study shows characteristics of thermal power plant effluent as well as affect of different concentrations of thermal power plant effluent on Since waste water is used for irrigation purpose in many countries which are suffering from water scarcity (Ansari *et al.*, 2013, Arora *et al.*, 2008). It is necessary to remediate this waste water and use it in beneficial way. Use of effluents for irrigation of crop has been a controversial proposition due to the contradictory reports obtained on the effects of effluents on crop plant responses (Mandoli *et al.*, 2016; Sutton *et al*, 1978; Ajmal *et al.*, 1984, Shahin, 1987). This alternative use of waste water will not only prevent the waste from becoming an environment hazard but also will serve as a potential source of fertilizer if used rationally and at appropriate concentration.
growth and photosynthetic pigment content of *Raphanus sativus* L.

MATERIALS AND METHODS

Seed collection

Seeds were purchased from Pahuja seeds pvt. Ltd which is an agro based company. Uniformity is maintained regarding Size, weight and colour for better interpretation.

Effluent collection

Effluent samples were collected from discharge side of Ukai thermal power plant. Effluent samples were collected in acid rinsed plastic ware. Standard method of APHA is applied for effluent collection (APHA, 2005). Effluent was stored at 4ºC in refrigerator for further use.

Physicochemical analysis

Physical parameters like pH and temperature were noted immediately at collection site with the use of pH meter and mercury bulb thermometer respectively. Physicochemical parameters were determined by standard methods given by APHA (APHA, 2005). Iron, aluminium, potassium and zinc were determined by ICP-AES (SAIF IIT Mumbai).

Growth and Pigment content

Different concentrations (like 20%, 50%, 80 % and 100%) of effluent were used for irrigation. Tape water was used as a control. Studies were conducted up to 20 days and plants were uprooted on every 5th day. Root length (RL) and shoot length (SL) were measured by meter scale. Fresh weight (FW) and Dry weight (DW) was found with the help of digital weighing balance. Pigment content was determined by MacKenney Method. (macKenney G., 1941).

Statastical analysis

Mean and Standard Deviation (SD±) were performed using Microsoft Excel 2007.

RESULTS AND DISCUSSION

Physicochemical properties of water served as an important determinant of water quality. Physicochemical properties of thermal power plant effluent are given in table 1. Thermal power plant effluent was alkaline in nature with 8.2 pH. Temperature of effluent was found to be 29.8ºC. 192 µS/cm Electric Conductivity was observed. 0.2% Salinity was found in effluent. Turbidity, Alkalinity, Total dissolve solids, Total suspended solids, Total solids, Biological oxygen demand, Chemical oxygen demand, were found to be 1.9, 28.7, 137.6, 15.0, 152.6, 21.6, 92 (mg/l) respectively. Fluoride (1.13mg/l), Chloride (126mg/l), Chlorine (0.10mg/l), Sulphate (180mg/l), Sulphide (0.13mg/l), Ammonical Nitrogen (4.8mg/l), Iodine (0.09mg/l), Bromine (0.07mg/l) were determined. Other elements like Iron, Aluminium, Potassium, and Zinc were analysed and found to be 1.161, 6.045, 3.337 and 0.016 ppm respectively.

Root and Shoot length of radish were deferred with different concentrations of TPP effluent (figure 1&2). RL & SL was higher in lower concentration in compare to control (figure 1&2). It was inhibited at higher concentrations. In this study fresh weight and dry weight of seedling was also affected by effluent which was badly affected at higher concentrations of TPP effluent. (Figure 3&4) Fresh weight and dry weight was found to be better at lower concentrations in compare to control. Chlorosis was also noted on radish at higher concentrations. Seedlings which were affected at higher concentrations appeared pale yellow in colour as compared to control which was green in colour. At lower effluent concentration pigment content slightly increased in amount or was similar to the control.

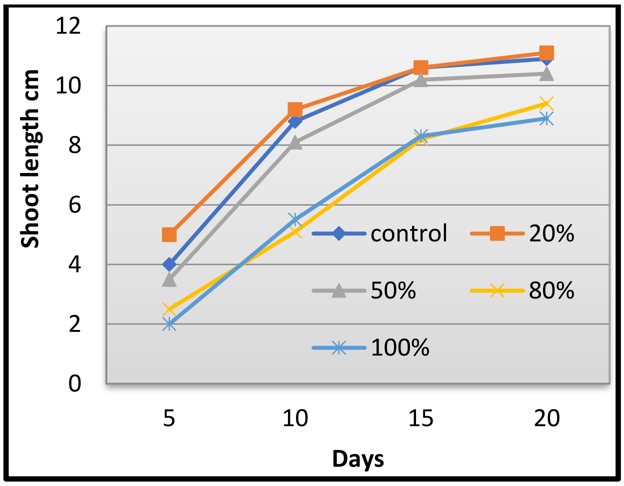

Fig. 1: Effect of TPP effluent on shoot length of *Raphanus sativus* L.

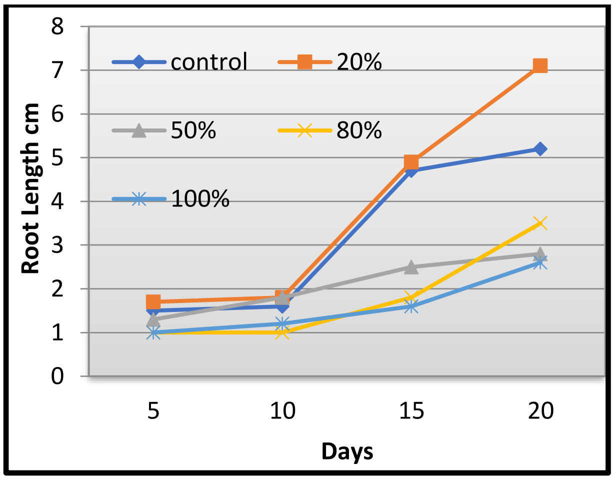

Fig. 2: Effect of TPP effluent on root length of *Raphanus sativus* L.

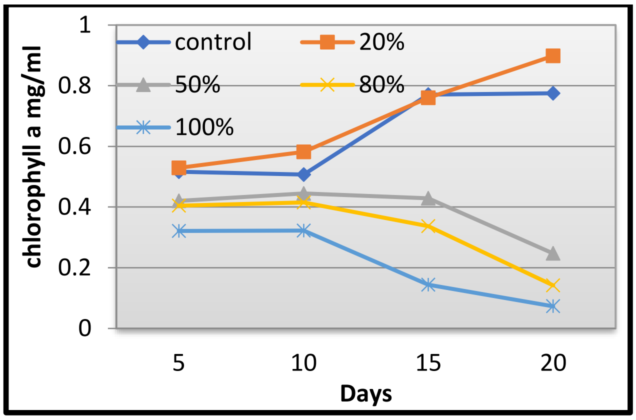

Fig. 5: Effect of TPP effluent on chlorophyll a content of *Raphanus sativus* L.

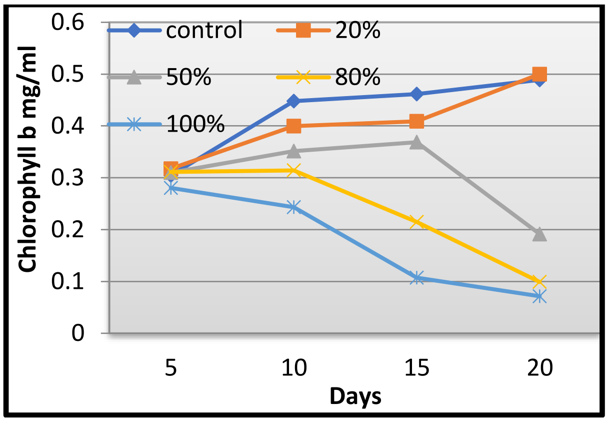

Fig. 6: Effect of TPP effluent on chlorophyll b content of *Raphanus sativus* L.

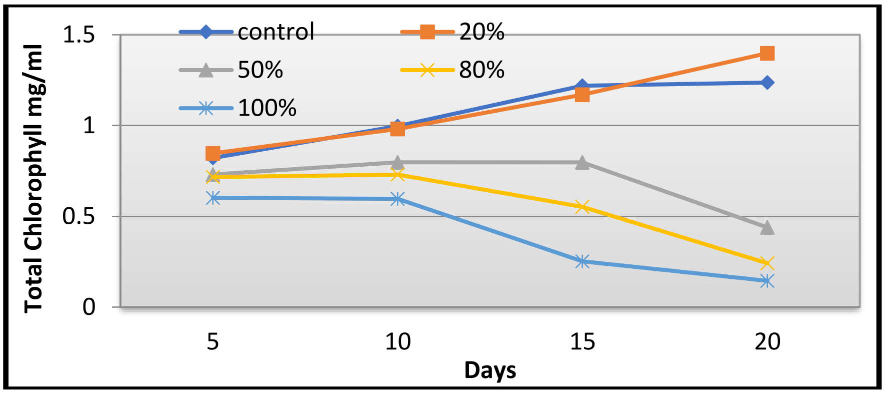

Fig 7: Effect of TPP effluent on total chlorophyll content of *Raphanus sativus* L.

Table 1 physicochemical Parameters of Thermal Power Effluent

Sr. no.	Physicochemical parameters	Unit	Effluent	CPCB Limits
1	pH		8.2	5.5-9
2	Temperature	°C	29.8	45
3	Turbidity	NTU	1.9	-
4	Alkalinity	mg/l	28.7	-
5	Salinity	%	0.2	-
6	Electric Conductivity	µS/cm	192	-
7	Total dissolve solids	mg/l	137.6	2100
8	Total Suspended Solids	mg/l	15.0	100
9	Total Solids	mg/l	152.6	-
10	Fluoride	mg/l	1.13	15
11	Chloride	mg/l	126	1000
12	Chlorine	mg/l	0.10	1.0
13	Sulphide	mg/l	0.13	2.8
14	Sulphate	mg/l	180	1000
15	Ammonical nitrogen	mg/l	4.8	-
16	Bromine	mg/l	0.07	-
17	Iodine	mg/l	0.09	-
18	Biological Oxygen Demand	mg/l	21.6	100
19	Chemical Oxygen Demand	mg/l	92	250
20	Aluminium	ppm	6.045	-
21	Iron	ppm	1.161	-
22	Potassium	ppm	3.337	-

It showed that lower concentration was beneficial for pigment content and higher dosage of effluent gradually reduce pigmentation of radish seedlings. Changes in pigment content such as chlorophyll a, b and total chlorophyll are shown in figure 5, 6 & 7.

The results thus obtained indicate that, at a proper dilution TPP effluent shows beneficial effect on crop and it shows adverse effect at higher concentrations. The promotional influence on seedling growth at the lower concentration of effluent might be due to the presences of optimum level of plant nutrient (Panda *et al*, 2016). By gradual increase of effluent dosage, growth of plant is decreased, may be because of high total dissolve solids present in textile & dairy effluent (Verma and Sharma, 2012). The presences of large number of elements in effluent may be suppressing the growth and pigment content of plant (Ravi Mycin and Lenin, 2012). The same results were found on growth and development of mustard, pea and rice plant according to (Medhi *et al.* 2008). Iqbal *et al.* (2013) found that maize seedling SL, RL, FW and DW increased with decreasing sugar mill effluent concentration.

The chlorophyll is one of the important pigment content which is used as a capacity of plant growth. Photosynthetic pigments like chlorophyll a, chlorophyll b and total chlorophyll decreased at higher concentration of TPP effluent and it increased at lower concentration. Abida Raheman *et al.* (2009) reports similar results when radish was treated with textile effluent. The lower concentration of tannery effluent shows promoting effect while higher concentration of effluent cause reduction in seedling growth and chlorophyll content in some crops (Mishra *et al.* 1996). In the above experiment maximum growth of radish seedlings was observed at lower concentration of thermal power plant effluent, so appropriate dilutions is necessary for crop productivity.

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REFERENCES

Abida Rehman, Haq Nawaz Bhatti, Habib-ur-Rehman, 2008. Textile effluents affected seed germination and early growth of some winter vegetable crops: a case study. *Water air soil pollut,* **198:**155-163.

Ansari, Nadhir, Aldardor, Wafa, Siergieiev, Dmytro and Knutsson, 2013. Effect of treated wastewater irrigation on vegitables. *Journal of environmental hydrology,* **21**(5):1-12.

APHA, 2005. Standard methods for the examination of water and wastewater, 21st edition. *American public health association, Washington, DC, USA.*

Arnon DI, 1949. Copper enzymes in isolated chloroplasts Polyphenol oxidase in *Beta vujgaris. Plant physiology,* **24:**1-15.

Arora M, Kiran B, Shweta R, Rani A, Kaur B and Mittal N, 2008. Heavy metal accumulation in vegetables irrigated with water from different sources. *Food chemistry,* **111:**811-815.

Iqbal Hussain, Muhammad Iqbal, Muhammad Nawaz, Rizwan Rasheed, Abida Perveen, Saqib Mahaboob, 2013. Effect of sugar mill effluent on growth and antioxidative potential of maize seedling. *International journal of agriculture & biology,* **15**(6):1227-1235.

Kumar Dilip A, Gupta ashish, Sri Ram A, 2014. Uses of bottom ash in the replacement to fine aggregate for making concrete. *International journal of current engineering and technology,* **4**(6):3891-3895.

MacKinney G, 1941. Absorption of light of chlorophyll solution. *Journal of biochemistry.* **140:**315-322.

Mandoli Mohan Singh, Nargave Tulsiram, Prasad Shatrughan, 2016. Impact of Amalai paper mill effluent on agronomic characteristics of *Vigina mungo* T-9. *International journal for research in applied science & engineering technology,* **4**(4): 267-273.

Medhi UJ, Talukdar AB and Deka S, 2008. Effect of pulp and paper mill effluent on seed germination and seedling growth of mustard (*Brassica campestris*), pea (*Pisum sativum*) and rice (*Oryza sativa* L.) seed. *Poll res.*, **27**(3):437-442.

Mishra P and AK Bera, 1996. Effect of tannary effluent on seed germination and seedling growth in maize (*zea mays* L.). *environ. Ecol.* **14:**752-754.

Nawaz I, 2013. Disposal and utilization of fly ash to protect the environment. *International Journal of Innovative Research in Science, Engineering and Technology,* **2**(10):5259-5266. **Panda Debabrata, Sukanya Bagh and Sharat K Palita, 2016.** Impact of industrial effluents on seed germination, early seedling vigor of rice (*Oryza* *sativa* L.) its sustainable use in agriculture. *Environment & ecology*, **34**(1):115-159.

Ravi Mycin M. and Lenin T, 2012. Morphological changes on sunflower under sago factory effluent. *International journal of environmental biology*, **2**(3): 115-120.

Rawat I, Ranjith Kumar Mutanda, Bux F, 2011. Dual role of domestic wastewater and biomass production for sustainable biofules production. *Applied energy*, **88**(10) 3411-3424.

Sutton AL, Nelson DW, Mayrose VB and Nye JC, 1978. Effects of liquid swine waste applications on corn yield and soil chemical composition. *Journal of environ.qual.*, **7**(3) 325-333.

Varma Lav and Sharma jyoti, 2012. Effect of dairy and textile waste water on growth of plant weat. *Rsayan J. Chem.*, **5**(3) 351-355

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