Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 7(C), pp. 27857-27860, July, 2018

ISSN: 0976-3031

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

GROWTH OF SOLANUM MELONGENA IN EFFLUENT OF OKHLA INDUSTRIAL AREA

Sajid Ali and Masood Alam

Department of Applied Sciences & Humanities, Faculty of Engineering & Technology, Jamia Millia Islamia, New Delhi, India

DOI: http://dx.doi.org/10.24327/ijrsr.2018.0907.2347

ARTICLE INFO

Article History:

Received 12th April, 2018
Received in revised form 23rd May, 2018
Accepted 7th June, 2018
Published online 28th July, 2018

Key Words:

Effluent; Pollutant; Seed germination; Solanum *melongena*; Effluent Tolerance Index (ETI).

ABSTRACT

The objective of the present work was to observe the effects of the effluents on one of the crop plants. The physico-chemical parameters of the effluent sample show that the pollution level is high in the effluent which was collected from Okhla Industrial Area Phase-I, New Delhi. In this study we have found that, the growth of Solanum *melongena* was good at 25% concentration of the effluent for 15, 30,45 and 60 days in the soil without any treatment, soil with cow dung treatment and soil with the Neem treatment. In this study ETI (Effluent Tolerance Index) showing the continuous decrease with the increase in concentration of effluents reduces the growth of Solanum *melongena*. The study suggests that the effluent may be used for agricultural purposes after taking the suitable dilution of the effluents.

INTRODUCTION

Industrial effluents can be considered as a potential source of irrigation water and nutrients for the growth of agricultural crops in areas where industrial effluents are being discharged. However, proper treatment and removal of toxic substances are necessary before using industrial effluents for irrigation purpose (Ivy *et. al*. 2015). Rapid growth of industries in par with the threatening population lasted to the high discharge of industrial wastewater spoiling ground water quality, soil and vegetation in that area (Babyshakila *et. al*. 2009). The most important effluent discharging industries are thermal power plants, paper mills, textiles, distilleries, fertilizer unit, electroplating plants, tannery industries, sugar mills, sago factories, oil refineries, pesticide and herbicide industries. Industrial effluents containing heavy metals pose a threat to the ecosystem (Amathussalam *et al*. 2002). The environmental pollution due to toxic metals has begun to cause concern now in most major cities. The toxic metals entering the ecosystem may lead to geoaccumulation, bioaccumulation and biomagnifications (Lokeshwari *et.al*. 2006). Normally wastewater is used for irrigation purposes in many countries which are suffering from low availability of water (Al-Ansari *et. al*. 2013., Arora *et. al*. 2008). Pollution is a matter of great concern because of its adverse effects on human health, animals, plants and various exposed materials (Nawaz *et. al*. 2006). Industrialization play an important role in the development process but the wastewater disposal has become a global dilemma for the industries because of generation of high volume of effluents, limited space for land based treatment & disposal and high cost of treatment technologies (Kumar & Chopra). Effluents affect the time of flowering and fruiting number of fruits, weight of fruits and effect on vascular bundles (Uaboi-Egbenni *et. al*. 2009). The utilization of industrial effluents for irrigation of crop plants is a highly beneficial solution to control the pollution (Medhi *et. al*. 2008). Industrial waste water contains very poisonous salts, alkalis, acids, odour, gases, heavy metals, insecticides etc. These polluted wastes are thrown into the canals, streams or rivers affecting the quality of water, making the water unfit for irrigation purposes and for other uses (Malik *et. al*. 2003). Seed germination is a fascinating process. The industrial effluents possess various organic and inorganic chemical compounds. The presence of these chemicals will show detrimental effects on the development of plant, germination process and growth of seedlings (Wins and Murugam. 2010, Vijaakumari and Kumudha. 1990, Vijayarengan and Lakshyamanachary. 1993). Treated industrial effluents can be used for irrigation purposes but when the effluent is used without any treatment, toxic substances present in the effluent reduces crop growth and

Corresponding author:* **Sajid Ali
Department of Applied Sciences & Humanities, Faculty of Engineering & Technology, JamiaMilliaIslamia, New Delhi, India

gives severe adverse effect on soil properties (Medhi *et. al*. 2008). Effluent released with high temperature can raise the temperature of water bodies, reducing the solubility of oxygen in the water and increasing the pH value of the receiving body (Ara begum *et. al*. 2010, Rao *et. al*. 1983). Irrigation water quality not only affect the growth of crops, but also has long term effects on soil health, grain quality, fodder quality and health of consumers (Garg & Kaushik. 2007).

MATERIALS AND METHOD

In the present study attempts have been made to investigate pollutants of wastewater effluents of Okhla Industrial Area Phase-I, New Delhi and their effects on growth of Solanum *melongena*. The present study was conducted with five different concentrations of effluent sample collected from industrial area phase-I New Delhi situated at 28.5223^{o} N Latitude and 77.2849^{0} S Longitude. The physico-chemical properties of the effluent were analyzed by the procedure of APHA (1992) in the Environmental Science Laboratory, Department of Applied Sciences and Humanities, Faculty of Engineering and Technology, Jamia Millia Islamia, New Delhi, India from 02 May 2017 to 02 August 2017. The sets were made by dissolving calculated amount of effluents in tap water i.e. Tc, T_{25}, T_{50}, T_{75}, T_{100} and by maintaining the ratio of effluent and tap water as-0:100, 25:75, 50:50, 75:25, 100:0 respectively as shows in table -1.

Table 1 Different dilution levels of the industrial effluent with different ratios.

S.N	Volume of effluent %	Volume of tap water %	Concentration V/V Effluent:Water	Final Concentration of the effluent	Symbol
1	0	100	0:100	0	Tc
2	25	75	25:75	25	T_{25}
3	50	50	50:50	50	T_{50}
4	75	25	75:25	75	T_{75}
5	100	100	0:100	100	T_{100}

Industrial effluent of different concentrations was used to investigate the effect of industrialeffluent and to observe growth of Solanum *melongena*-Variety PK-123) which was bought from Indian Agriculture research Institute (IARI), PUSA, New Delhi. During experiment, seeds of Solanum *melongena* were collected and sterilized by 0.1 % of mercuric chloride solution which helped to remove the microbes. Pot culture experiment was carried out to study the effect of industrial effluent on the growth of Solanum *melongena* (Fig-01*)*. Earthen pots were filled with air dry soil. The collected effluent was considered as 100 percent concentration. Different dilutions of effluent viz 0, 25, 50 75 percent were prepared from 100 percent concentration of effluent by adding tap water. Earthen pots filled with dry soil were prepared for separate treatment with Neem and cow dung. Three replications were maintained for each level of concentration of effluent. One set of earthen pot was arranged without applying any effluent (as control). Tap water was used in control. The pots were irrigated with respective concentrations of effluent and kept for 60 days. After a gap of 15, 30, 45 and 60 days, the root length, shoot length, fresh weight and dry weight were recorded.

Effluent Tolerance Index (ETI)

The effluent tolerance index was calculated using the formula determined by Turner & Marshal. 1972, Bhale.*et al*.2011.

$$ETI = \frac{Mean\ length\ of\ root\ \&\ shoot\ in\ effluent}{Mean\ lenght\ of\ largest\ root\ \&\ shoot\ in\ the\ control}$$

Fig 1 Pot culture for the growth of Solanum *melongena.*

RESULTS AND DISCUSSION

The physicochemical characteristics of the effluent are presented in Table-2.

Table 2 Physico-Chemical characteristics of the effluents.

S.N	Parameters	value
1.	Colour	Dark brown
2.	Temperature(Celsius)	30
3.	pH	8.0
4.	EC(µS)	1.54
5.	TDS(mg/l)	670
6.	BOD(mg/l)	244
7.	COD(mg/l)	432
8.	Alkalinity(mg/l)	50
9.	Chloride(mg/l)	2223
10.	Sulphate(mg/l)	72
11.	Phosphate(mg/l)	0.928

The effluent had dark brown color and was found alkaline in nature (pH 8.0). The electrical conductivity (EC) value and temperature were recorded as 1.54 µS/ cm and 30^{o}C. The values of BOD, COD, TDS, Alkalinity, chloride, Sulphate and phosphate of the collected effluent were determined as 244, 432, 670, 50, 2223, 72and 0.928 mg/L respectively. The values of BOD, COD and Chloride ions exceeded the ISI tolerance limit, which affect the water quality of receiving bodies and thus were found unfit for irrigation purpose. The results for root length of Solanum melongena with sets of soil treatments using different effluent concentrations are shows in table-3.

Table 3 Root Length (mm/plant) of Solanum *melongena* grown under different concentrations with different soil treatments. (n=3. Mean ± SD)

Soil Treatment	Effluents concentration	Age of the plants (days after sowing)			
		15	30	45	60
Soil without any Treatment	0%	60.0±1.802	92.3±0.288	98.5±0	110.5±0.5
	25%	66.3±1.040	98.3±0.288	100.5±0	111.5±0.5
	50%	67.8±2.254	97.1±0.288	98.5±0.866	110.3±0.577
	75%	65.1±0.577	95.8±0.577	98.5±0	109.6±0.577
	100%	60.1±0.763	96.0±0.886	98.1±0.288	109.6±0.763
Soil with cow dung treatment	0%	61.0±1	94.1±0.577	99.0±0.866	112.0±0
	25%	67.0±0.5	100.5±0	104.5±0	113.1±0.288
	50%	68.1±2.362	97.8±0.577	104.0±0	112.1±0.577
	75%	64.0±0	97.6±0.288	101.1±0.288	111.8±0.577
	100%	62.0±1	96.1±0.288	100.3±0.288	110.5±0.5
Soil with Neem Treatment	0%	60.6±0.577	94.8±0.577	99.1±0.577	111.6±0.577
	25%	66.3±0.577	98.8±0.288	100.8±0.288	112.3±0.288
	50%	68.6±2.516	97.6±0.577	99.8±0.763	110.5±0.5
	75%	65.0±0.5	96.8±0.288	99.1±0.763	108.6±1.154
	100%	61.0±2.0	95.6±0.763	98.6±0.577	108.5±0.866

In this study it was found that the root length in soil without any treatment was highest at 50% for 15 days but for 30, 45, 60 days 25 % concentration showing highest growth. Same results were observed in Soil with cow dung treatment and soil with Neem treatment, as in soil without any treatment. The results for shoot length of Solanum *melongena* with different sets of soil and effluent concentrations are shown in Table-4

Table 4 Shoot Length (mm/plant) of Solanum *melongena* grown under different concentrations with different soil treatments. (n=3. Mean ± SD)

Soil Treatment	Effluents' concentration	Age of the plants (days after sowing)			
		15	30	45	60
Soil without any Treatment	0%	57.6±1.892	115.1±0.288	181.0±0.866	298.1±0.288
	25%	69.3±0.577	119.3±1.154	183.3±0.288	305.0±0
	50%	68.3±0.577	115.6±1.154	182.1±0.288	303.0±1.732
	75%	60.8±2.753	114.3±0.577	181.5±0.5	301.6±2.08
	100%	60.0±1.732	114.3±0.577	180.3±0.577	300.0±1
Soil with cow dung treatment	0%	58.6±0.577	117.3±0.577	185.3±1.154	302.3±1.154
	25%	70.6±1.527	119.6±0.577	187.1±0.577	309.6±0.577
	50%	69.6±0.577	118.0±0	186.8±0.288	308.3±0.577
	75%	63.0±1	116.6±0.577	185.3±0.577	307.3±0.577
	100%	60.0±1	116.3±0.577	184.5±0.866	306.3±0.577
Soil with Neem Treatment	0%	58.6±0.288	118.0±1	182.0±0	300.6±0.577
	25%	70±1.732	118.3±0.288	184.1±0.288	307.3±0.577
	50%	68.3±1.527	116.6±0.577	183.5±0.5	306.3±0.577
	75%	65.3±2.516	116.3±1.15	182.3±0.577	305.0±1
	100%	61.0±1	115.3±0.577	181.0±0	304.0±0

The results show that the shoot length is highest in 25 % concentration of the effluents in all sets of soil samples. The reduction in the shoot length was also observed with the increasein the concentration of the effluents. The Effluent tolerance index (ETI) values for root and shoot are shown in Table-5.

Table 5 Effluent Tolerance Index (ETI)

Soil Treatment	Effluents' concentration		Age of the plants (days after sowing)			
			15	30	45	60
Soil without any Treatment	25%	Root	1.105	1.065	1.020	1.009
		Shoot	1.203	1.036	1.012	1.023
	50%	Root	1.130	1.052	1.000	0.998
		Shoot	1.185	1.004	1.006	1.016
	75%	Root	1.085	1.037	1.000	0.991
		Shoot	1.055	0.993	1.002	1.011
	100%	Root	1.001	1.040	0.995	0.991
		Shoot	1.041	0.993	0.996	1.006
Soil with cow dung treatment	25%	Root	1.098	1.068	1.055	1.009
		Shoot	1.204	1.019	1.009	1.024
	50%	Root	1.116	1.039	1.050	1.000
		Shoot	1.187	1.005	1.008	1.019
		Root	1.049	1.037	1.021	0.998
	75%	Shoot	1.075	0.994	1.000	1.016
		Root	1.016	1.021	1.013	0.986
	100%	Shoot	1.023	0.991	0.995	1.013
		Root	1.094	1.042	1.017	1.006
Soil with Neem Treatment	25%	Shoot	1.194	1.002	1.011	1.022
		Root	1.132	1.029	1.007	0.990
	50%	Shoot	1.165	0.998	1.008	1.018
		Root	1.072	1.021	1.000	0.973
	75%	Shoot	1.114	0.983	1.001	1.014
		Root	1.006	1.008	0.994	0.972
	100%	Shoot	1.040	0.974	0.994	1.011

In this study highest effluent tolerance index values are recorded at 25 percent of effluent concentration and the effluent tolerance index generally decreased for root and shoot with the increase in effluent concentration. This decrease in effluent tolerance index shows that, the growth reduces if the concentration of the effluent increases. The fresh weight (Gram/Plant) of Solanum *melongena* is shown in table-6.

Table 6 Fresh weight (Gram/Plant) of Solanum *melongena* grown under different concentrations of effluent with different soil treatments. (n=3. Mean ± SD).

Soil Treatment	Effluents concentration	Age of the plants (days after sowing)			
		15	30	45	60
Soil without any Treatment	0%	1.730±0.173	3.680±0.322	19.597±0.501	34.516±0.358
	25%	1.757±0.105	3.982±0.057	20.310±0.261	36.628±0.309
	50%	1.741±0.093	3.650±0.058	20.062±0.075	35.893±0.372
	75%	1.643±0.063	3.482±0.057	19.704±0.397	34.500±0.578
	100%	1.588±0.029	3.388±0.083	20.148±0.299	33.977±0.241
Soil with cow dung treatment	0%	1.784±0.155	4.217±0.046	21.337±0.320	35.862±0.136
	25%	1.938±0.043	4.481±0.153	22.613±0.529	37.244±0.153
	50%	1.761±0.070	4.184±0.063	22.156±0.220	36.716±0.557
	75%	1.703±0.081	4.095±0.064	21.279±0.393	35.929±0.073
	100%	1.597±0.059	4.082±0.113	20.094±0.787	35.313±0.436
Soil with Neem Treatment	0%	1.796±0.074	4.251±0.228	20.130±0.243	35.280±0.287
	25%	1.797±0.182	4.258±0.069	21.008±0.013	36.380±0.055
	50%	1.799±0.074	4.207±0.267	20.130±0.131	35.540±0.444
	75%	1.683±0.075	3.997±0.064	19.812±0.737	35.125±0.031
	100%	1.667±0.049	3.974±0.152	19.690±0.064	34.401±0.582

In this study results shows that the fresh weight is highest at 25 % concentration of the effluents in all soil sets of the experiment at 15,30,45 and 60 days. There is low growth in control as compared to the concentration of the 25% of the effluents but growth is also lesser when the concentrations of the effluents increases. The dry weight (Gram/Plant) of Solanum *melongena* is also shown in Table-7.

Table 7 Dry weight (Gram/Plant) of Solanum *melongena* grown under different concentrations of effluent with different soil treatments. (n=3. Mean ± SD).

Soil Treatment	Effluents concentration	Age of the plants (days after sowing)			
		15	30	45	60
Soil without any Treatment	0%	0.529±0.013	1.413±0.097	3.890±0.054	7.677±0.280
	25%	0.603±0.011	1.504±0.073	4.389±0.258	7.774±0.240
	50%	0.600±0.016	1.308±0.085	4.386±0.324	7.435±0.329
	75%	0.590±0.008	1.290±0.096	4.052±0.059	7.006±0.106
	100%	0.581±0.149	1.269±0.059	4.067±0.126	6.943±0.158
Soil with cow dung treatment	0%	0.557±0.003	1.452±0.036	4.247±0.489	7.963±0.043
	25%	0.622±0.009	1.500±0.026	4.595±0.278	8.684±0.395
	50%	0.596±0.006	1.315±0.096	4.163±0.051	8.089±0.080
	75%	0.584±0.003	1.397±0.018	4.078±0.065	8.032±0.077
	100%	0.579±0.029	1.335±0.029	4.155±0.162	7.776±0.260
Soil with Neem Treatment	0%	0.547±0.006	1.442±0.056	3.990±0.019	7.897±0.076
	25%	0.617±0.013	1.465±0.050	4.515±0.355	7.972±0.184
	50%	0.596±0.008	1.364±0.049	4.354±0.465	7.474±0.599
	75%	0.594±0.003	1.301±0.036	4.071±0.125	7.216±0.343
	100%	0.576±0.006	1.265±0.026	4.224±0.335	7.184±0.208

In this study we have observed that the dry weight is highest with concentration of 25 % of the effluents for all sets of soil for 15, 30, 45, 60 days. In all sets results show the reduction in dry weight with the increase the effluent concentrations.

CONCLUSION

Results show that the mixed effluent which was collected from Okhla industrial area phase-I has considerable amount of pollutants which come from various plastic-moulding, textile, dye, printing press, electroplating, paper, chemical industries. In this study results indicate that the pollutants' concentration causes reduction in the growth of the Solanum *melongena.* The study suggests that the lower concentration of the effluents up to 25% is good for growth of plants but increase in the concentration of the effluents is harmful for proper growth of the crop plants. Appropriate dilution of the effluent should therefore be made to reduce harmful effects at the time of growth of the Solanum *melongena.*

Acknowledgement

Authors would like to acknowledge the motivation and facilities provided by Jamia Millia Islamia, New Delhi to carry out the present work.

References

Al-Ansari, Nadhir., Aldardor, Wafa., Siergieiev, Dmytro. And Knutsson. (2013). Effect of treated wastewater irrigation on vegetables. *Journal of Environmental Hydrology*, 21, 5.

Lokeshwari, H and Chandrappa, G.T. (2006). Impact of heavy metals contamination of Bellandurlake on soil and cultivated vegetation. Current Science, 91, 5.

Nawaz, Sofia, Ali, Maria, Syeda. And Yasmin, Azra. (2006). Effect of Industrial Effluents on Seed germination and Early Growth of Cicerarientum. *Journal Biological Sciences*, 6 (1): 49-54.

Kumar, Vinod and Chopra, A.K. (2012). Effects of paper mill effluents irrigation on agronomical characteristics of Vigna radiate (L.) in two different seasons. Communications in Soil Science and Plant Analysis, 43: 2142-2166.

Uaboi-Egbenni, P.O., Okolie, P.N., Adejuyitan, O.E., Sobande, A.O. and Akinyemi, O. A. (2009). Effect of industrial effluents on the growth and anatomical structures of Abelmoschusesculentus (okra). *African Journal of Biotechnology*, 8(14), 3251-3260.

Medhi, U.J., Talukdar, A.K and Deka, S. (2008). Effect of pulp and paper mill effluent on seed germination and seedling growth of mustard (Brassica campastris), Pea (Pisumsativum) and rice (Oryza sativa) seeds. Pollution Research, 27(3): 437- 442.

Malik, A. Saeed., Bokhari, T.Z., Dasti, A.A. and AbidiZaib-Un-Nisa.S.(2003). Effect of waste effluents from a tannery on the growth of some crop plants. *Asian Journal of Plant Sciences*, 2(8): 623- 626.

Wins, Albino.J and Murugan.M. (2010), Effect of textile mill effluents on growth and germination of black gram. *International Journal of Pharma and Bio Sciences*, 1 (1).1-7.

Ara, Begum, Shameem., Alam, Jahangir.M., Rahman, Shyafur, Syed and Rahman, Mizanur. M. (2010).Effect of industrial effluents on the germination and seedling growth of three leafy vegetables. *Bangladesh J. Sci. Ind. Res*., 45(2), 101-104.

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.

APHA.(1992). Standard Methods for the Examination of water and wastewater.19th ed. Washington D.C., U.S.A.

Lokeshwari, H and Chandrappa, G.T.(2006). Impact of heavy metals contamination of Bellandurlake on soil and cultivated vegetation. *Current Science*, 91, 5.

Ivy.N., Hossain, M.K. and Hossain, L. Md. (2015). Effects of Industrial Effluents on Germination and Early Growth of Selected Agricultural Crops. *Journal of Agronomy*, 14, 1, 43-48.

Babyshakila, P. and Usha, K. (2009). Effect of Diluted Effluent on Soil Properties and Plant Growth. Advances studies in Biology, 1, 8, 391-398.

Amathussalam, A., Abusbacker, M.N. and Jayabal, N.J. (2002). Physico-chemical parameters and concentration of heavy metals in sugar industry. *Ind. Poll. Con.*, 13: 118- 119.

Garg, V.K & Kaushik, P. (2007). Influence of textile mill wastewater irrigation on the growth of sorghum cultivars. *Applied Ecology and Environmental Research*, 6(2): 1-12.

How to cite this article:

Sajid Ali and Masood Alam.2018, Growth of Solanum Melongena In Effluent of Okhla Industrialarea. *Int J Recent Sci Res.* 9(7), pp. 27857-27860. DOI: http://dx.doi.org/10.24327/ijrsr.2018.0907.2347

****