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RESEARCH ARTICLE

STUDIES ON THE EFFECT OF SPENT ENGINE OIL ON PLANT GROWTH IN TRIFOLIUM ALEXANDRENUM (BARSEEM).

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Abstract

Pot Experiment was conducted in controlled laboratory conditions to examine the effect of spent engine effluent on growth of Barseem for six months. Mixed effluent was collected from the oil refining industry, Gurgaon. The spent engine wash contaminated soil was taken from auto market, Hisar (Hr). The Farm soil was taken from university's energy park. For germination tests of seeds, fifteen seeds of *Trifolium alexandrenum* (Barseem) were sown in pots (duplicates) with different conc.(0, 20, 40, 60 & 80%) of effluent. It was interesting to observe that the diluted effluent (at 20% and 40% concentrations) were more beneficial for the germination of the *Trifolium* (Barseem) seeds which showed 90% and 85% germination, in comparison to 60% and 80% concentration which showed 68% and 58.8% germination of seeds in comparison to other concentrations. Diluted effluent (20 and 40%) favored less radical growth (1.0 – 0.9cm) than control (1.5 cm). The higher concentrations 60% and 80% favored very less radical growth of (0.7 - 0.5 cm) in comparison to control and other concentration. In regards to effect of effluent, it was noticed that less diluted effluent had negative effect on plant growth as compared to more diluted effluent.

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Introduction:-

India supports more than 16% of the world's population with only 4% of the world's fresh water resources (Singh, 2003). Although agriculture sector in this country has been major user of water, share of water allocated to irrigation is likely to be decreased by 10–15% in next two decades (CWC, 2000). In this changing scenario, reuse of domestic and industrial waste water in agriculture for irrigating crops appears to be a lucrative option. In India, total waste water generated per annum from 200 cities is about 2600 Mm³ (Kaul *et al.*, 1989) and also the use of sewage effluents for irrigating agricultural lands is on the rise especially in the peri-urban area. These waste waters carry appreciable amounts of trace toxic metals (Feign *et al.*, 1991; Pescod, 1992; Som *et al.*, 1994; Gupta *et al.*, 1998; Brar *et al.*, 2000; Yadav *et al.*, 2002) and concentrations of trace metals in sewage effluents vary from city to city (Rattan *et al.*, 2002). Although the concentration of heavy metals in sewage effluents are low, long-term use of these waste waters on agricultural lands often results in the build-up of the elevated levels of these metals in soils (Rattan *et al.*, 2002). Extent of build-up of metals in waste water-irrigated soils depends on the period of its application (Bansal *et al.*, 1992; Palaniswami and Sree Ramulu, 1994).. Hydrocarbons are the most common category of environmental contaminants reported in industrialized waste (Shahsavari *et al.* 2013). As a consequence, the requirement for effective, low-cost, and sustainable technologies for the cleanup of petrogenically impacted environments is increasing (Gaskin and Bentham 2010). In recent years, studies have shown that a broad range of environmental contaminants including organic compounds

such as petrogenic hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), organic solvents (trichloroethylene), metals, and pesticides can be successfully remediated using phytoremediation (Olette *et. al.* 2008; Brigmon *et. al.* 1998; Meng *et. al.* 2011; Phillips *et. al.* 2006; Cofield *et. al.* 2007). Barseem, *Trifolium alexandrum* (L.) belongs to the family Leguminosae. In India, it is a major fodder crop and it is grown at the same time as potatoes. In the present study we examine how spent engine effluent affects the growth of Barseem.

Materials and Methods:-

Effluent Sample:-

Mixed effluent was collected from the oil refining industry, Gurgaon. The spent wash contaminated soil was taken from an auto market, Hisar (Hr). The Farm soil was taken from university's energy park.

Crop Seeds: Barseem :-

Variety of Barseem seed used for the study were obtained from the local grain market.

Germination Studies:

For germination tests, fifteen seeds of *Trifolium alexandrenum* (Barseem) were kept in clean, sterilized petridishes. 10 ml of effluent with different conc.(0, 20, 40, 60 & 80%) were added to duplicate petridishes. Different conc. were prepared by mixing different volumes of the effluent in distilled water. In the control set 10 ml of distilled water was used instead of effluent. Each of the sets had two replicates.

Germination was recorded for 5 days. Emergence of radical from the seed was taken as an index of germination. Radical length, fresh weight and dry weight of the seedlings were recorded after 10 days.

Chemical analysis:-

Physico-chemical analysis of agricultural and contaminated soil like pH, Electrical conductivity (EC), Cation exchange capacity (CEC), Calcium (Ca), Sodium (Na), Potassium (K), Total organic carbon (TOC) has been done using (Hesse, 1971) methods. Physico-chemical analysis of effluent water like pH, Electrical conductivity (EC), Total Hardness (TH), Total alkalinity, Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Phosphate etc. has been done using (APHA, 1998) methods.

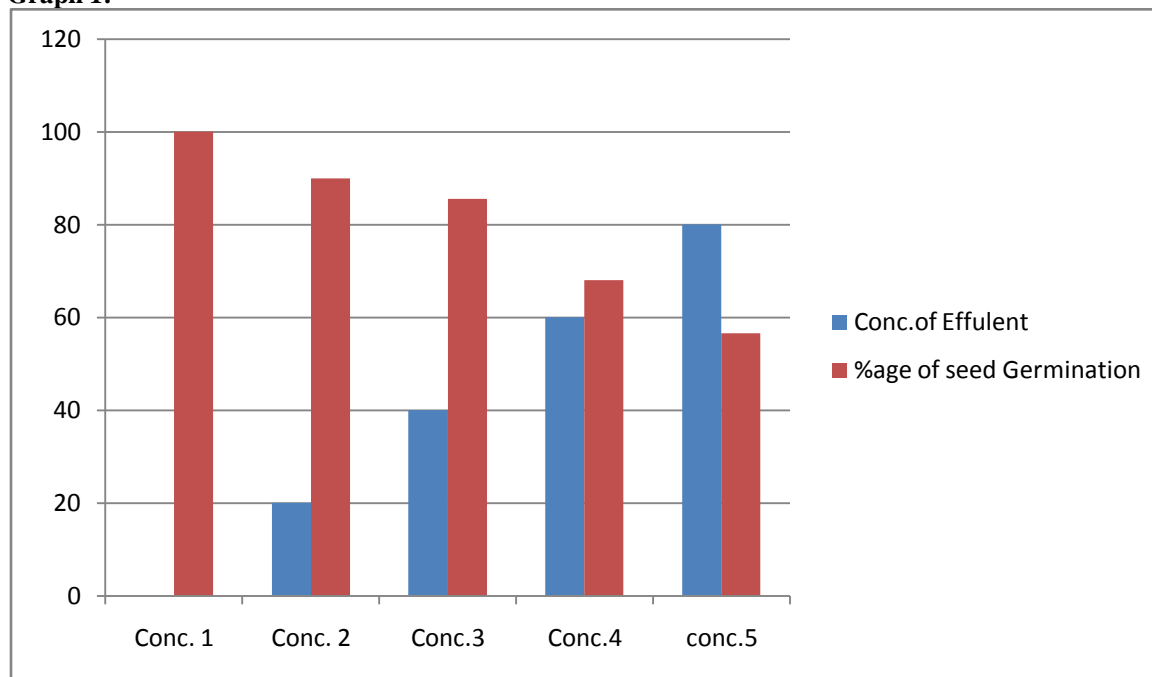
Results and Discussions:-

Effluent Characterization:-

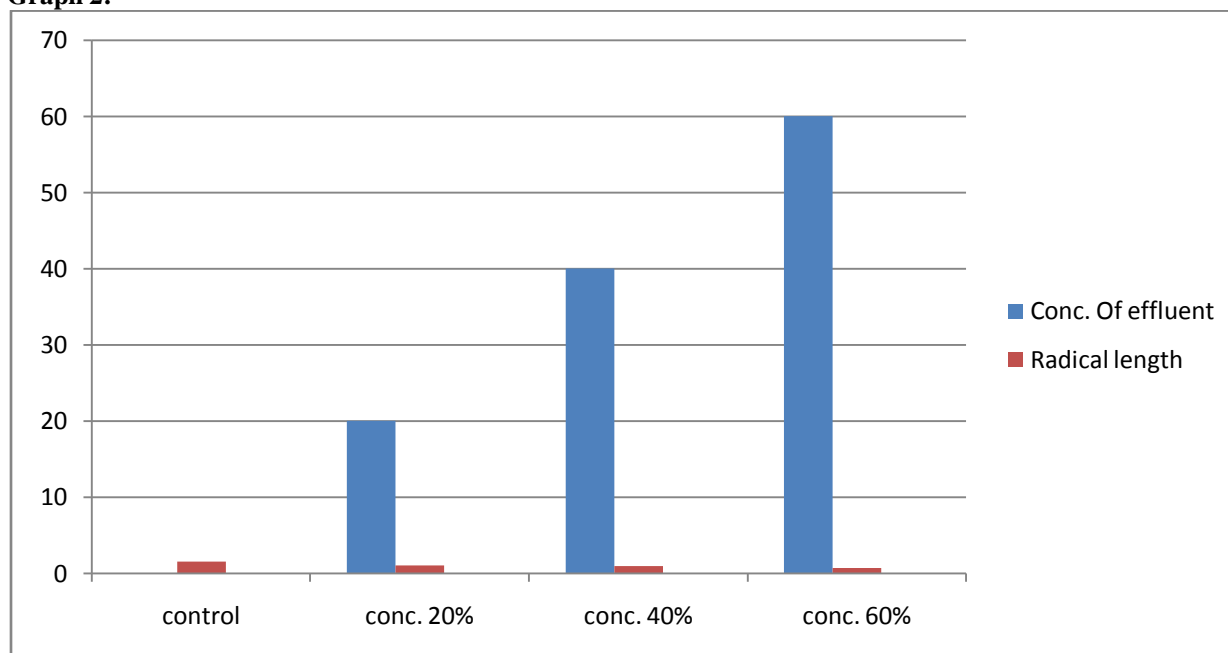
The effluent was found to be acidic (pH 2.24) and saline (E.C. 9.05ds/m) in nature. The Total Dissolved Solid (TDS) were 4.41 ppm. Among cations, Na^+ and K^+ concentrations were very high. K^+ is required by plants as one of the major nutrients. Hence irrigating crop plants with such effluent is likely to be useful for the crop. But Na^+ in high concentration can pose a problem for plant growth. Thus, it becomes important to study the effects of using the effluent for irrigation of the crop plants at germination stage and later growth stages.

Effect of effluent on seed germination and seedling growth:-

Graph 1 shows germination of Barseem at different concentrations of effluent application. It is interesting to observe that the diluted effluent (at 20% and 40% concentrations) were more beneficial for the germination of the *Trifolium* (Barseem) seeds which showed 90% and 85% germination, in comparison to 60% and 80%. Conc. which showed 68% and 58.8% germination of seeds in comparison to other concentrations.

Graph 1:-

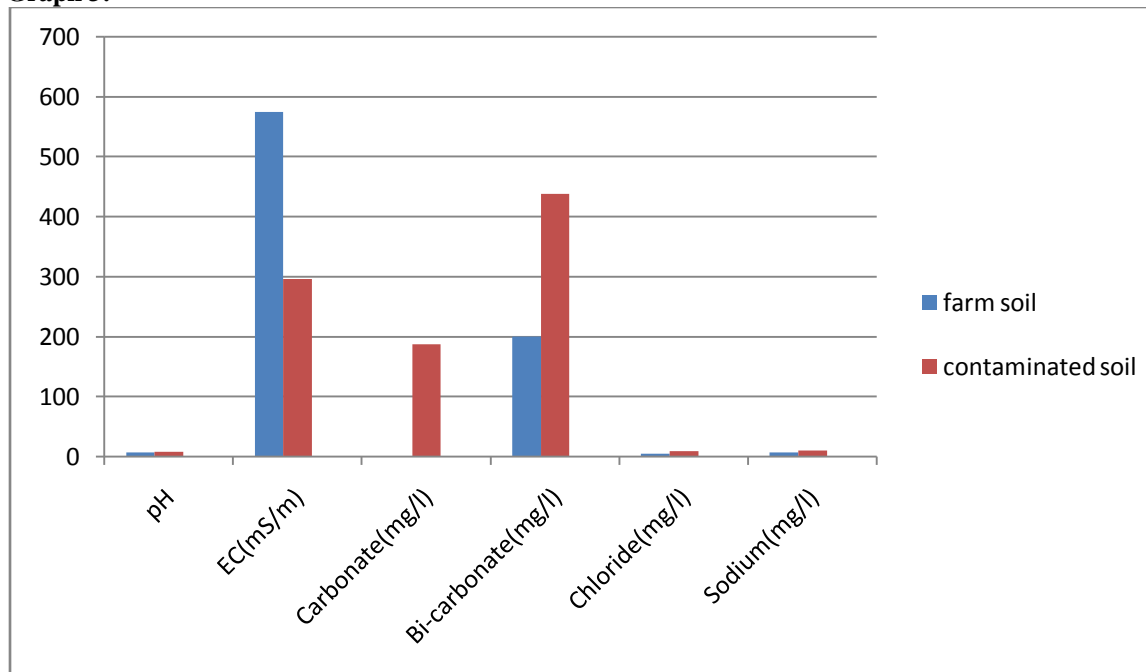
Seedling growth was also favored by the effluent application as evident from Graph 2. Diluted effluent (20 and 40%) favored less radical growth (1.0 – 0.9cm) than control (1.5 cm). The higher concentrations 60% and 80% favoured very less radical growth of (0.7 -0.5 cm) in comparison to control and other concentration .Thus, it was observed that the effluent can be used for seed germination in very low concentration during early seedling growth stage. Germination is generally considered to be a crucial and sensitive stage for successful establishment of a crop. Particularly in areas of water scarcity we can use the effluent for such crops.

Graph 2:-

Characteristics of farm soil and contaminated soil:-

Graph 3 shows different concentrations of parameters of farm soil. Farm soil has pH (6.2) indicates less acidic nature which was most suitable for germination of seeds. EC of farm soil was 574.4ms which supported the seeds germination. Carbonate was totally absent in farm soil. Sodium and potassium presence in farm soil made soil nutrient rich for seed germination but phosphate was present in very less amount. Contaminated soil was alkaline in nature due to pH 8.0. It also had very high EC 295.4ms. Carbonate and bicarbonate concentration also very high, it seems to be useful for the growth of seeds. Phosphate concentration was very low so it no longer supports the plant growth as nitrogen; phosphorus and potassium are major components of fertilizers required by plants for growth.

Graph 3:-



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References:-

1. American Public Health Association (APHA). 1998. Standards methods for examination of water and waste water. American Public Health Association Inc, Washington DC 20th Edition.
2. Brar, M.S., Mahli, S.S., Singh, A.P., Arora, C.L. and Gill, K.S. (2000): Sewer water irrigation effects on some potentially toxic trace elements in soil and potato plants in northwestern India. Canadian Journal of Soil Science. 80:465–471.
3. Brigmon, R. L., Bell, N., Freedman, D. and Berry, C. (1998): Natural attenuation of trichloroethylene in rhizosphere soils at the Savannah River Site. Journal of Soil Contamination. 7:433–453.
4. Cofield, N., Schwab, A. P. and Banks, M. K. (2007): Phytoremediation of polycyclic aromatic hydrocarbons in soil: Part I. Dissipation of target contaminants. International Journal of Phytoremediation. 9, 355–370.
5. CWC. (2000): Water and related statistics. Information Systems Organization, Water Planning and Organization Wing, Central Water Commission, RK Puram, New Delhi. 66, 451p.

7. Feign, A., Ravina, I. and Shalhevet, J. (1991): Irrigation with Treated Sewage Effluents: Management for Environmental Protection. Springer, Berlin.
8. Gaskin, S. E. and Bentham, R. H. (2010): Rhizoremediation of hydrocarbon contaminated soil using Australian native grasses. *Science of the Total Environment*.408, 3683– 3688.
9. Gupta, A.P., Narwal, R.P. and Antil, R.S.(1998): Sewer water composition and its effect on soil properties. *Bioresource Technology*. 65, 171–173.
10. Hesse, P.R.(1971): A textbook of soil chemical analysis. John Murray, London, pp 35–88.
11. Kaul, S.N., Badrinath, S.D., Juwarkar, A.S. and Satyanarayanan, S.(1989): *Asian Environment*.11, 33.
12. Meng, L., Qiao, M. and Arp, H. P. H. (2011): Phytoremediation efficiency of a PAH-contaminated industrial soil using ryegrass, white clover, and celery as mono- and mixedcultures. *Journal of Soils and Sediments*.11, 482–490.
13. Olette, R., Couderchet, M., Biagianti, S. and Eullaffroy, P. (2008): Toxicity and removal of pesticides by selected aquatic plants. *Chemosphere*.70, 1414–1421.
14. Palaniswami, C. and Sree Ramulu, U.S.(1994): Effects of continuous irrigation with paper factory effluent on soil properties. *Journal of the Indian Society and Soil Science*. 42, 139–140.
15. Phillips, L. A., Greer, C. W. and Germida, J. J. (2006): Culturebased and culture-independent assessment of the impact of mixed and single plant treatments on rhizosphere microbial communities in hydrocarbon contaminated flare-pit soil. *Soil Biology and Biochemistry*. 38, 2823–2833.
17. Rattan, R.K., Datta, S.P., Chandra, S. and Saharan, N.(2002): Heavy metals and environmental quality: Indian scenario of Fertilizer News: 47 (11), 21–40.
18. Rattan,R.K., Datta,S.P., Chhonkar,P.K., Suribabu,K. and Singh,A.K. (2005): Long-term impact of irrigation with sewage effluents on heavy metal content in soils, crops and groundwater—a case study. 109: 310-322.
19. Shahsavan,E., Adetutu, E.M., Andereson,P.A. and Ball,A.S.(2003): Tolerance of Selected Plant Species to Petrogenic Hydrocarbons and Effect of Plant
20. Rhizosphere on the Microbial Removal of Hydrocarbons in Contaminated Soil. 224:1495.
21. Shahsavari, E., Adetutu, E. M., Anderson, P. A. and Ball, A. S. (2013).:Plant residues—A low cost, effective bioremediation treatment for petrogenic hydrocarbon-contaminated soil. *Science of the Total Environment*.443, 766–774.
22. Singh, A.K. (2003): Water resources and their availability. In: *Souvenir, National Symposium on Emerging Trends in Agricultural Physics*, Indian Society of Agrophysics, New Delhi. 22– 24 April 2003, pp. 18–29.
23. Som, S., Gupta, S.K. and Banerjee, S.K.(1994): Assessment of quality of sewage effluents from Howrah sewage treatment plant. *Journal of the Indian Society of Soil Science*. 42, 571–575.
24. Yadav, R.K., Goyal, B., Sharma, R.K., Dubey, S.K. and Minhas, P.S.(2002): Post-irrigation impact of domestic sewage effluent on composition of soils, crops and ground water—a case study. *Environment International*. 28, 481–486.