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Impact of Sewage and Industrial Effluent on Soil Plant Health Act on Environment

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ABSTRACT
Effect of continuous irrigation with sewage effluent on soil properties and status of nutrients and pollutant elements in soils and plants in the adjoining areas of Agra and Mathura cities of Uttar Pradesh was ascertained. The physical properties of soils improved due to sewage water irrigation. An appreciable increase in organic carbon, available N, P, K contents was recorded in the sewage water irrigated soils. Electrical conductivity of sewage water irrigated soils was much below the threshold limit of salinity.

Application of sewage water resulted in the accumulation of heavy metals in surface soil. The mean contents of total Cd, Cr, Pb in the soils irrigated with sewage water were 2.85, 75.40 and 40.26 mg kg- 1, respectively. The mean values of available Cd, Cr and Pb in soils were 0.21, 0.33 and 1.27 mg kg-1, respectively. The concentration of Cr in lettuce, cabbage and be seem plants grown on sewage water was higher as compared to its tolerance level indicating their accumulation in plants. In general, Cd was relatively higher in lettuce (0.88 mg kg-1). On the other hand, be seemed contained relatively higher amount of Cr and Pb.
KEYWORDS: Impact, Sewage, Industrial Effluent, Soil Plant Health, Environment.

I. INTRODUCTION

It provides farmers with a nutrient enriched water supply and society with a reliable and inexpensive system for wastewater treatment and disposal. Some of these effluents are a rich source of plant nutrients, therefore soil provides the logical sink for their disposal. But many untreated and contaminated sewage and industrial effluents may have high concentration of several heavy metals such Cd, Ni, Pb and Cr. Field study was conducted in Salem area, to evaluate the effects of using sewage water to irrigate the fields near ground water wells in this region. Many quality parameters like pH, EC, total alkalinity, total hardness, Ca+2, Mg+2, Cl-1, So4-2, Na+1 and Potassium.

The analysis of samples showed alkaline nature of the water in research area. Also the results refer to high salt water levels compared with classifications of WHO. The two most common treatments prior to sludge applications to agriculture seem to be anaerobic digestion and lime stabilization. In some of the old Member States (EU15), land application of raw and/or limited treated sludge is diminishing and composting and other treated products are increasingly used. There is also an increase of advanced treated sludge to be used in non-agricultural applications. Sludge is also used as a soil improver on degraded soils at mine sites, construction sites, and other disturbed areas such as in Portugal (Duarte) where sludge has been used for stabilizing soils after forest fires. However, use of sludge in forests is relatively uncommon or even prohibited in some Member States.

Most Member States are, in general, moving away from land filling to recycling sludge to land and/or – to a lesser extent – incineration with some recovery of energy.

II. EFFECTS ON BIOLOGICAL, PHYSICAL, SOCIAL AND ECONOMICAL ENVIRON Nuisance (Odor, Noise, Vermin and Fire)

2.1 Impacts

There will not be odor, noise and vermin problems at the plant that can affect the residents. Even the worker(s) will not be affected by the odor. However, there is the possibility of mosquito breeding in the open aeration tank of the plant and also in the water pond, where the effluent will be discharged, which can cause nuisance to the people during the summer months. The plant will not attract

flies, rodents and other animals. Occurrence of fire is not possible unless the biogas release valves do not function properly and create explosive situations.

2.2 Water Impacts

In general, the existence of the WWTP will have a positive impact on the surface and ground water quality of the area because it will eliminate the existing septic tanks in the western part of the village, which cause pollution and create health problems. However, the discharge of treated effluents from the plant to the runoff channel will have some slight impacts, particularly during the wet season, extending from November to April. In addition, the water stream located in the vicinity of the plant may be contaminated if effluents do not meet the standards. During the dry season the discharged water can be used for irrigation of forest trees, or used by farmers. If the removed grease from the grease trap is dumped haphazardly at the plant site it will impact the surface waters, particularly during the wet season when the rains carry them down into the valley.

2.3 Air Impacts

Air pollution will result during the excavation and construction phase. Dusty conditions will occur. Also vehicular emissions will take place. But this will occur for a period of 2 to 3 months. During the operational phase of the plant no such conditions will result. Gaseous and particulate emissions will have their impacts on the natural vegetation. If flaring of biogas does not take place, methane gas will be released into the atmosphere, which is a powerful greenhouse gas and it will have negative impact on the global climate.

2.4 Climate Impacts

The existence of the WWTP will not have any negative effect on the microclimate of the area. This will be improved against the climate extremities (wind and storms), by planting trees in the neighborhood of the plant. Greenhouse gases, such as methane gas, will be produced in the bio-digesters of the plant and if released, this will have negative impact on the climate.

2. 5 Soil Impacts

Sandy soil and rocks will be excavated during the construction phase of the treatment plant. If it coincides with the rainy season, this will cause soil erosion at the site. However, since the site is already dug, minimal excavation work is required. The use of treated wastewater for irrigation will improve the fertility of agricultural lands of the area. But when unsatisfactorily treated effluents are released, these might contaminate the soils. If the grease and sludge (once in 20 years) are not properly handled and managed they can contaminate the nearby soils and create unsighty conditions.

2.6 Landscape Impact

The bio-digesters of the WWTP/2 will be constructed underground at a distance of at least 1000m far from the nearest house. The WWTP will be the only structure in the area. But since the digesters are going to be partially buried inside the abandoned quarry, they will be hidden by the surrounding natural fence of trees, which will surround it. Therefore, the visual impact on the project would be positive.

2.7 Fauna Impacts

The fauna in the project area is very limited. It consists of some birds, rodents, snakes and turtles. During the construction phase of the plant these animals will be disturbed and their habitat affected. The physical existence of the plant might scare the birds. Effluents of the WWTP will have some minor impact on the soil microorganisms, particularly in the immediate vicinity of the water pond, where it will be discharged. In dry season the plant effluents can become a water source for the wild animals and birds.

2.8 Impacts of sewage effluents

Sewage effluents have historically been discharged through outfall in shallow coastal and waters (Young-Jin Suh and Rousseaux P., 2001, Mclntyre 1995, Klaus Koop and Pat Hutchings 1996) and is one of the major stresses impacting coastal ecosystems. There are usually significant effects on water quality and on marine life arising from sewage disposal. Water quality deterioration is one of the most important water resource issues of the 21st century. Therefore the quality status of coastal surface water is very important and would always be under public scrutiny because of health risk associated with sewage contamination.

The potential deleterious effects of pollutants from sewage effluents on the receiving water quality of the coastal environment are manifold and depend on volume of the discharge, the chemical composition and concentrations in the effluent. It also depends on type of the discharge for example whether it is amount of suspended solids or organic matter or hazardous pollutants like heavy metals and organo chlorines, and the characteristics of the receiving waters (NAP, 1984, Canter W., 1996: Nemerow and Dasgupta, 1991). High levels of soluble organics may cause oxygen depletion (Peter and Robin, 2002) with a negative effect on aquatic biota. Contamination of the coastal water may result in changes in nutrient levels, abundance, biomass and diversity of organisms, bioaccumulation of organic

and inorganic compounds and alteration of trophic interaction among species.

III. SEWAGE WATER

Raw sewage water available from cities is a mixture of domestic, commercial and industrial activities. Currently more than 450 cities in India generate more than 17 million cubic meters of raw sewage water per day Since the raw sewage water is rich in organic matter and essential nutrients, sewage farming is quite common in all urban areas. In the country as a whole, about 200 sewage farms, covering as area of about 50,000 ha, are utilizing sewage waters to supplement the nutrients and water supply. Some city sewage waters where industrial effluent is discharged in to sewer system may contain toxic metals in high amounts. Thus the composition of domestic sewage may be changed with the type of industries discharging their effluents**.**

3.1 Composition of Sewage Water

The composition of sewage water is quite variable depending upon the contributing source, mode of collection and treatment provided. Although a large proportions of these sewage waters is organic in nature and contains essential plant nutrients but sometimes toxic metals are also present in appreciable amounts. The sewage water generated in India contains more than 90% water. The solid portion contains 40-50% organics, 30-40% inert materials, 10-15% bio-resistant organics and 5-8% miscellaneous substances.

It was within normal range and irrigation with these waters in not going to cause any significant change in the soil pH due to high buffering capacity of the soils.

Table 3.1

Location	pH	EC(dSm^{-1})	Organic C (mgL^{-1})	SAR (m mol^{-1} $^{1/2}$L$^{-1/2}$)	N (mg L^{-1})	P (mg L^{-1})	K (mg L^{-1})
Haryana							
Faridabad	7.5	3.8	180	10.0	35	20	110
Gurgaon	7.4	3.8	480	10.1	50	35	275
Bahadurgarh	7.2	3.6	90	4.6	8	53	388
Hisar	7.4	2.1	105	10.4	106	25	294
Panipat	8.2	1.6	15	0.8	61	18	2500
Sonepat	7.7	2.6	30	0.9	71	17	2125
Punjab							
Abohar	8.3	1.4	200	ND	29	4.2	46
Bhatinda	7.8	3.0	59	ND	17	5.6	60
Jalandhar	7.9	1.1	117	ND	38	7.6	35
Amritsar	7.2	1.7	108	ND	34	8.4	42
West Bengal							
Calcutta	8.0	2.0	ND	2.9	ND	7.0	20
Dhapa	7.8	1.2	ND	2.9	ND	ND	19

ND - Not determined

IV. RECOMMENDED MAXIMUM CONCENTRATION (MG L-1) OF HEAVY METALS FOR USE OF EFFLUENTS IN AGRICULTURE

The Central Pollution Control Board (CPCB) formulated a Ganga project in 1984 to clean the water of Ganga river. This project aimed at the installation of sewage treatment plants at various sites along Ganga river in the important cities and towns. Cities selected for the installation of sewage treatment plants include 26 cities in Uttar Pradesh, 15 in Bihar and 59 in West Bengal have been identified as the worst polluting cities because they contribute 84% of the total pollutants of the Ganga. Physical properties of sewage and well -irrigated soils table 4.1 given below.

Soil depth (cm)	Soil physical property			
	Bulk density (Mg m^{-3})	Hydraulic conductivity (cm hr^{-1})	Water retention (%)	
			33 kPa	1500 kPa
	Sewage-irrigated soils			
0-30	1.28 (1.20-1.36)	1.22 (1.12-1.33)	43.2 (40.0-46.4)	15.4 (13.2-17.2)
30-60	1.30 (1.22-1.39)	1.19 (1.10-1.28)	45.5 (42.0-49.4)	18.5 (17.3-19.8)
	Well-irrigated soils			
0-30	1.40 (1.39-1.41)	1.12 (1.10-1.15)	38.0 (38.0-38.0)	13.4 (12.8-14.0)
30-60	1.38 (1.34-1.41)	0.94 (0.90-0.98	42.6 (40.8-44.4)	15.7 (14.6-16.8)

V. POSSIBLE SOLUTIONS OF PROBLEMS ASSOCIATED WITH THE SEWAGE AND INDUSTRIAL EFFLUENTS

- To exploit the sewage waters as a potential source of irrigation and maintain environment, the sewage waters must be diluted either with canal or underground waters to avoid the excessive accumulation of soluble salts in the soils. It will help in maintaining the productivity of agricultural crops without any harmful effect on soil properties. Entry of heavy metals into food chain can be reduced by adopting soil and crop management practices, which immobilize these metals in soils and reduce their uptake by plants.

- Heavy phosphate application and also the application of kaolin/zeolite to soils can reduce the availability of heavy metals.

- Raising hyper accumulator plants (mustard/trees) in toxic metals contaminated soils is recommended to avoid the entry of toxic metals in the food chain.

VI. CONCLUSION

The major environmental concern is an urbanizing India relate to high levels of water

pollution due to poor waste disposal, inadequate sewerage and drainage, and improper disposal of industrial effluents. The sewage and industrial effluents contain essential nutrients or possess properties which can easily be utilized for irrigating the field crops. But the sewage water of many cities where industrial effluent is mixed in the sewage system contained toxic metals. Continuous use of sewage and industrial effluents irrigation recorded improvement in water retention, hydraulic conductivity, organic C and build-up of available N, P, K and micronutrient status and soil microbial count.

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