IJERMT

International Journal of Engineering Research & Management Technology

ISSN: 2348-4039

November-2017 Volume 4, Issue-6

Email: editor@ijermt.org www.ijermt.org

DISTINCTIVENESS AND DISPOSAL PROBLEM OF INDUSTRIAL EFFLUENTS

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ABSTRACT:

Industrial disposal of effluents on land and the subsequent pollution of groundwater and soil of surrounding farmlands – is a relatively new area of research. The environmental and socioeconomic aspects of industrial effluent irrigation have not been studied as extensively as domestic sewage based irrigation practices, at least for a developing country like India. The disposal of effluents on land has become a regular practice for some industries. Industries located in Mettupalayam Taluk, Tamil Nadu, dispose their effluents on land, and the farmers of the adjacent farmlands have complained that their shallow open wells get polluted and also the salt content of the soil has started building up slowly. This study attempts to capture the environmental and socioeconomic impacts of industrial effluent irrigation in different industrial locations at Mettupalayam Taluk, Tamil Nadu, through primary surveys and secondary information.

KEY WORDS: Effluents, domestic sewage.

INTRODUCTION:

With the growing competition for water and declining freshwater resources, the utilization of marginal quality water for agriculture has posed a new challenge for environmental management. In water scarce areas there are competing demands from different sectors for the limited available water resources. Though the industrial use of water is very low when compared to agricultural use, the disposal of industrial effluents on land and/or on surface water bodies make water resources unsuitable for other uses (Buechler and Mekala 2005; Ghosh 2005; Behera and Reddy 2002; Tiwari and Mahapatra 1999).

Industry is a small user of water in terms of quantity, but has a significant impact on quality. Over three-quarter of freshwater drawn by the domestic and industrial sector, return as domestic sewage and industrial effluents which inevitably end up in surface water bodies or in the groundwater, thereby affecting water quality. The 'marginal quality water' could potentially be used for other uses like irrigation. Hence, the reuse of wastewater for irrigation using domestic sewage or treated industrial effluents has been widely advocated by experts and is practiced in many parts of India, particularly in water scarce regions. However, the environmental and socioeconomic impact of reuse is not well documented, at least for industrial effluents, particularly for a developing country like India where the irrigation requirements are large. The reuse of industrial effluents for irrigation has become more widespread in the State of Tamil Nadu after a High Court order in the early 1990s, which restricted industries from locating within 1 kilometer (km) from the embankments of a list of rivers, streams, reservoirs, etc.2 The intention of this order was to stop industries from contaminating surface water sources. Apart from the High Court order, industrial effluent discharge standards for disposal on inland surface water bodies are stringent when compared to disposal on land for irrigation, specifically for Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Residual Chlorine (TRC) and heavy metals (see CPCB 2001; and Appendix C, Table C1 for more details). Therefore, industries prefer to discharge their effluents on land. Continuous irrigation using even treated effluents may lead to groundwater and soil degradation through the accumulation of pollutants. Currently, industries are practicing effluent irrigation without giving adequate consideration to the assimilation capacity of the land. As a result the hydraulic and pollution load often exceeds the assimilative capacity of the land and pollutes groundwater and the soil. Apart from the disposal of industrial effluents on land, untreated effluents and hazardous wastes are also injected into groundwater through infiltration ditches and injection wells in some industrial locations in India to avoid pollution abatement costs (Sharma 2005; Ghosh 2005; Behera and Reddy 2002; Tiwari and Mahapatra 1999). As a result, groundwater resources of surrounding areas become unsuitable for agriculture and/or drinking purposes. Continuous application of polluted groundwater for irrigation can also increase the soil salinity or alkalinity problems in farmlands. The problem of pollution is perhaps as old as the birth of the first man on the earth, but it took long before it could be realized. Bhaskaran (1947) and Archeivala (1969) indicated excessive water pollution as a cause of water scarcity and its interference with other legitimate uses. The problem of waste disposal in its acute form in which it exists today began in nineteenth century with the advent of industrial revolution and the phenomenal population growth. The waste disposal problem however, evokes little interest from the mill owners because of additional costs involved in treatment of waste. But they failed to understand the fact that attempt made in the right direction can lead to the recovery of products, which are now being wasted and effluents may be used for irrigation purpose after treatment or using appropriate dilution. They are also not fully aware of the damage to natural environment and other natural losses due to non disposal of the waste.

Pollution is an international problem and has caused concern all over the world. Pollution of water, has only been discussed here in the concerned work. Water is the elixir of life without which no organism can sustain life. Four fifth of the earth is covered with water, most of it i.e. 97.2 percent is the ocean and 2.8 percent is the fresh water. Out of 2.8 percent fresh water, 2.2 percent is the ground water and 0.6 percent is the below ground water. Out of the ground water, 2.15 percent lies frozen in glaciers and soil polar ice caps, 0.04 percent is in the atmosphere, soil and vegetation while only 0.01 percent in the streams and lakes. Thus we have hardly .01 percent of the total water resources in the universe at our disposal. It is up to us whether to use it judiciously or to misuse it.

LITERATURE REVIEW:

Environmental pollution is one of the major problems of the world and it is increasing day by day due to urbanization and industrialization. Over the last few decades large scale usage of chemicals in various human activities has grown very fast, particularly in a country like India which has to go for rapid industrialization in order to sustain over growing large problem of population (Mustafa et al., 2010). The current pattern of industrial activity alters the natural flow of materials and introduces novel chemicals into the environment. The released organic compounds and heavy metals are one of the key factors that exert negative influences on man and environment causing toxicity to plants and other forms of biotics and abiotics that are continually exposed to potentially toxic heavy metals (Chandra et al., 2010).

The various sources of pollutants industrial effluents containing heavy metals pose a threat to the ecosystem. These metals are present in the waste water of different industries such as metal cleaning, plating baths, refineries, mining, electroplating, paper and pulp, paint, textile and tanneries (Mistry et al., 2010). Water used in these industries creates a waste that has potential hazards for our environment because of the introduction of various contaminants such as heavy metals into soil and water resources (Prabavathy and De, 2010). Presence of pollutants in effluent is a common environmental hazard since the toxic metal ions dissolved can ultimately reach the top of the food chain and becomes a risk factor for human beings (Devi and Sasikala, 2010). Ground water is of major importance for potable water supply and also serves for the agricultural irrigation and industrial production. Ground water resources are experiencing an increasing threat of pollution coming from urbanization, industrial development, agricultural activities and mining enterprises (Hema et al., 2010). The global water pollution due to the increase in number of industries is a serious problem faced by the modern world (Ganesh and Baskaran, 2009). Release of the effluents in the receiving water is the major reason for water pollution. These pollutants find their way to aquatic ecosystem such as rivers and ponds and lakes which pose a risk to the health of human and ecosystem (Rehman and Anjum, 2010).

RESULT:

Different effluents showed inhibitory effects on seed germination. Reduction in seed germination percentage was observed as 7.29, 14.5 and 20.83 percent in cultivar Swarna treated with 50, 75 and 100 percent distillery + sugar effluents. Reduction in seed germination percentage was noticed as 24.26 percent in cultivar Pusa bold as 32.96 percent in Varuna and as 34.40 percent in Kranti at 100 percent concentration of distillery + sugar effluent, whereas in organic effluent, germination with 5.62 and 22.91 percent reduction was observed in 10 and 100 percent effluent concentration respectively, in Swarna. 27.90, 35.40 and 41.40 percent reduction was observed in cultivar Pusa bold, Varuna and Kranti at 100 per cent concentration. Lowest (10%) concentration of distillery + sugar effluent had little or no effect on seed germination, though this concentration increased the growth.

Table 1

Bio-accumulation of heavy metals (ppm) in different parts of *Brassica juncea* cv. Swarna treated with different concentration of organic industry effluent.

Attribute	**Effluent concentration (%)**				
	0	**10**	**50**	**75**	**100**
Cadmium	0.94	2.64	7.91	8.22	8.91
Arsenic	–	3.14	5.02	5.52	6.11
Nickel	0.55	4.11	5.16	5.81	6.02
Manganese	14.84	15.14	16.28	17.02	18.12
Zinc	22.11	22.68	29.12	31.56	32.81
Mercury	2.21	2.39	4.18	5.82	6.17
Lead	2.25	2.91	3.17	4.89	5.09

<u>Plant Part – Leaf</u>

Attribute	**Effluent concentration (%)**				
	0	**10**	**50**	**75**	**100**
Cadmium	0.87	4.17	6.21	6.81	7.62
Arsenic	–	5.12	5.93	6.23	6.58
Nickel	0.51	2.87	3.62	4.02	4.21
Manganese	19.51	20.18	24.17	25.11	26.84
Zinc	28.30	29.21	33.28	34.20	35.11
Mercury	1.62	1.87	2.91	3.20	3.59
Lead	1.08	2.17	3.82	3.97	4.24

Plant Part – Ear

Attribute	Effluent concentration (%)				
	0	**10**	**50**	**75**	**100**
Cadmium	0.83	3.82	4.17	4.62	4.91
Arsenic	–	2.10	3.87	4.11	4.54
Nickel	0.63	2.67	3.54	3.98	4.31
Manganese	7.54	9.62	11.52	11.97	12.81
Zinc	21.32	23.10	25.28	26.28	27.11
Mercury	0.92	1.12	2.09	2.62	2.91
Lead	1.06	1.71	3.11	3.54	3.87

DISCUSSION:

Reduction in seed germination may be due to that effluent contains certain heavy metals which affect protein metabolism also by enhancing the mobilization of reserve protein and accumulation of structural and catalytic proteins in germinating seeds. In this respect the present findings coincide with the studies of Valsyuk et al. (1970) and Gupta (1991) showing that heavy metals cause inhibition of nucleic acid and protein synthesis.

The observations of promotion of seed germination at 10 percent concentration of distillery + sugar effluent may be due to presence of adequate amount of mineral nutrients in the effluent which probably enhanced the seed germination by promoting germination enzymes acting as their cofactors or else. In this regard present results support the studies of Manoharan and Lakshmanan (1988).

CONCLUSIONS:

The present work clearly establishes the hazardous nature of the micro- and macro-elements and heavy metals in the distillery + sugar and organic industry effluent, when given in higher levels. Control of micro- and macro-nutrients and heavy metals not only difficult but also non-economical. However, one can check it at the industrial source of nutrient and heavy metals flow.

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