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Influence of Industrial Waste Water on Soil and Plants: A Review

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ABSTRACT

Industrial wastewater has many effects on physical as well as physiological properties of soil and plants. The wastewater encloses the extraordinary levels of PO_4^{3-}, NH_4^+, SO_4^{2-}, and NO_3^- and Magnesium, Calcium, Potassium, Sodium, Copper, Zinc, Nickle and Iron. To some extent, the application of industrial wastewater in term of sewage irrigation has been observed as a suitable way to solve the agricultural water shortage problem. Waste water used for irrigation is valued by growers, generally due to its nutrients, consistency of supply and positive influences on agriculture. This review article illustrates both constructive and destructive properties of wastewater used in agriculture. Furthermore, it also highlights the effects of industrial wastewater on the soil environment as well as plant physiological system.

Keywords: *Irrigation, Industrial Discharging, Soil Environment, Agriculture.*

INTRODUCTION

Soil provides base for crop production (Toor & Adnan, 2020; Rehman et al., 2020a; & Rehman et al., 2020b). So, it is a necessary component which provides us shelter, food and fiber (Rehman et al., 2020a; Kalsoom et al., 2020; & Adnan, 2020a). It is non-renewable source which is degraded day by day. Moreover, natural and anthropogenic deteriorate quality of land and degraded it for agriculture use. Agriculture sector is directly linked with soil while most of the agriculture land is degraded (Toor et al., 2020a; & Toor et al., 2020b) by many factors but the most important are heavy metals (Adnan et al., 2020; & Hayat et al., 2020). These pollutants are produced by natural as well as human activities. The microbiota presents in rhizosphere as well as in phyllosphere of plant (Kalsoom et al., 2020; Rehman et al., 2020a; & Rehman et al., 2020b) are strongly disturb by these pollutants.

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The migration of these pollutants into unpolluted zones as leachates or dust through the distribution of heavy metals holding sludge of sewage and soil are a rare examples of proceedings contributing towards the environment (Gaur & Adholeya, 2004). The use of industrial wastewater is an earliest practice but its inadequate amount causes many damages. Therefore, the awareness is required to use wastewater (Angelakis & Snyder, 2015). Industrial wastewater reuse in agriculture involves the advance use of "treated" wastewater irrigation for crop (Jaramillo et al., 2017). Moreover, to be used as fertilizer for orchards and crops industrial wastewater was transported to the cultivated fields. Moreover, first indication of wastewater reuse is found in the middle of olden Greeks. In addition, empires of Roman and Greek recycled domestic wastewater at the boundaries of major cities (Tzanakakis, 2007). In water resources planning, reuse and reclamation of wastewater has become a significant element in semi-arid and arid regions. However, water is not simply a valuable ordinary resource that sustains people's development and existence, but also establishes the main essential element of the environment (Gu et al., 2017). Moreover, quick development of the national economy, consumption of domestic and industrial water is increasing continuously. This diminishes the availability of water for farming purposes. Moreover, irrigation water is not definite, and shortage of water (drought) is becoming gradually more serious as a consequence (Vörösmarty et al., 2000). Furthermore, drought is one of the most main factor that restrictive the crop production in agriculture (Adnan, 2020b). It affects negatively on the mechanisms of plant life cycle such as protein formation, lipids, nucleic acid and carbohydrates which decreases the final crop production and growth (Toor et al., 2020c). This review article illustrates both constructive and destructive properties of wastewater used in agriculture. Furthermore, it also highlights the effects of industrial wastewater on the soil environment as well as plant physiological system.

1. Industrial Discharging and Case Studies

According to a case study in India many industries discharging their raw and semi cured wastes into the loamy channel. This polluted drain water has been used for cultivation of vegetables, cereals and others economically vital plants (Nath et al., 2005). Being a massive agricultural country, in China wide amounts of water are spent on the production of agriculture. More than 70% of the total water consumption is accounts for irrigation water (Shi et al., 2014). About half of the over-all cultivated land could be irrigated at present. About 75% of the nation grain production presently produce by non-irrigated lands, more than 90% of vegetables and more than 80% of cotton, (Kalsoom et al., 2020). According to a case investigation in Pakistan in the province of Sindh, only 2 sugar mills have fixed mechanisms for the treatment of industrial wastewater mainly because of the pressure from international acts as these industries distribute their products.

Through the global water shortage, major consideration has been paid to recycling the industrial wastewater for irrigation of several crops. The irrigation of plants through the wastewater is a serious biological and social issue. Poorly treated wastewater can have damaging effects on plants, soil and the environs, and be hazardous to people. Because it may contain high concentrations of heavy metals and salt depending upon the wastewater source. Growth of wastewater-irrigated plants and physiological processes may be badly affected by the high concentrations of salts, mainly salt-sensitive crops (Bañón et al., 2011)

2. Contaminants and Plant Growth

In addition, some plants species have been effective in contaminants absorbing such as Cr, Pb, Cd, and many radionuclides from soils. Some of phytoremediation types, phyto extraction, can be used to eliminate heavy metals from soil using its uptake metals ability which are vital for the growth of plant (Fe, Mn, Zn, Cu, Mg, Mo, and Ni). Some metals with mysterious biotic role (Cd, Cr, Pb, Co, Ag, Se, Hg) can also be added (Adnan et al., 2020; & Hayat et al., 2020). According to a report, the photosynthetic process has been inhibiting by heavy metals. Because the central atom of chlorophyll, magnesium, can be exchanged by heavy metals like Cd, Cu, Zn, and Pb which blocks the light-harvesting ability of chlorophylls and damages photosynthesis in stressed plants (Küpper et al., 1996). Associated with some advanced states, the source of sewage irrigation mainly comes from crude or raw industrial and domestic wastewaters (Pedrero et al., 2010). Application of wastewater on a sand column by (Vandevivere & Baveye, 1992) and stated that aerobic microbes reduced the saturated hydraulic conductivity more than 4-times, mainly in the upper zone near the surface of soil.

3. Soil Contamination and Heavy Metals Release

Soil is not just a base for supporting growth of plant and its breeding, but also the base of agricultural production for human. In the soil all types of human farming activities are generally carried out, and plentiful agronomic products are attained from it indirectly or directly. It is found in the edge of the lithosphere, biosphere, atmosphere, and hydrosphere, contributing in a range of processes including physics, biochemistry, chemistry and, and becoming the vital location for the cycling of nutrient and energy flux. Similarly, soil contamination by the heavy metals release as a result of anthropogenic and industrial activities is a threat to ecosystem and health of human. In the soil, presence of heavy metals is known to have possible toxic impact on health of human and quality of environment via surface water and ground water (Akinola & Ekiyoyo, 2006).

4. Sewage Irrigation and Efficiency of Nutrients

Application of nutrients efficiencies through irrigation of sewage ranged from 20 to 790 for P, 140 to 920 for N, and 125 to 930% for K, depending upon the amount of sewage and type of crop (Ensink et al., 2002). This predictable pollution shows that application of sewage to most of the crops may outstrip nitrogen and phosphorous fertilizer necessities over the emergent season (Murtaza et al., 2010). In the 1990s, in many parts of the world the attention in the use of wastewater for agronomic purposes (indirect irrigation with raw wastewater) improved due to this sector's high water demands. Wastewater reuse was a worldwide concern during this time, due to the associated risks to environment and public health. Therefore, in 1973, the World Health Organization (WHO) conscripted the article "Reuse of effluents: methods of wastewater treatment and health safeguards", with the aim of defending the health of public and assisting the balanced use of wastewater and excreta in aquaculture and agriculture. This early recommendation was enlisted in the absence of epidemiological trainings and from a negligible hazard approach (Carr, 2005).

CONCLUSION

Taking everything into consideration, safe use of industrial wastewater is an alternate source of irrigation. Furthermore, wastewater used for irrigation is valued by agronomists, largely due to bulk of nutrient present in it. This industrial waste water influences positive effects on farming. Generally, farming is a main consumer of industrial wastewater. In addition, wastewater reuse risks in agriculture are wide, fluctuating from alterations to physicochemical and bacteriological properties of soils to impacts on health of plants.

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