Chapter 19
Safe Use of Wastewater in Agriculture Through Bioremediation Processes

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ABSTRACT

Population growth, industrialisation, urbanisation, and climate change have created huge pressure on freshwater resources to fulfil the demand. Approx. 70-80% of the freshwater supply returns as wastewater, which is difficult to tackle and manage. We need to tackle the freshwater demand from different sectors like domestic, industrial, and agriculture. Most important is how to use the wastewater safely in agriculture. Therefore, it is an apt time to refocus on ways to recycle water especially in sectors like agriculture and for ecosystem services. The major concern in using wastewater in agriculture is its quality as the wastewater may carry pathogens, heavy metals, and many other pollutants, which might reach to human beings and animals via food chain. A solution to wastewater reuse is through bioremediation techniques. Bioremediation should be considered as a feasible and futuristic technology for safe use of wastewater in agriculture as it will reduce the burden on centralised water treatment system as well as it being economic and eco-friendly.

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BACKGROUND

A major concern now a days internationally and nationally is of quantity and quality of irrigation water. There is a conflicting problem as on one hand there is an increasing scarcity of freshwater availability and on the other side wastewater generation has enormously increased. Wastewater generation is linked with increasing urbanisation, population pressure, industrialisation and all these have created a huge pressure on managing this wastewater which otherwise will create socio-economic and environmental problem (Chaidez et al., 2014). Before going into the details of wastewater, let us be clear about wastewater term.

Wastewater is any water which is not intended to be used directly for human consumption. In general wastewater is 99.9% water and rest are pollutants which we intend to remove or which makes it a wastewater. This 0.1% contains organic matter, inorganic compounds, nutrients, pathogens and toxic metals. Generally, municipal wastewater is a mix of domestic wastewater, storm water and industrial wastewater. Domestic wastewater is the water which is discharged from households, schools and other institutions of a place. While industrial wastewater refers to wastewater generated from the industries. The composition of industrial wastewater differs with the industry type (Hussain et al., 2002). As demand for water is increasing, the per capita availability of water has declined and day by day it is widening which is posing threat for human existence. Around 36% of global population lives in water scarce regions and as per the estimate by World Bank (2019), this figure will reach to more than 50% by 2050. Therefore researchers globally are focussing on measures for conserving water and at the same time it is appropriate time now to find ways to use wastewater as a resource and reuse it in agriculture (Hussain et al., 2002) as it will promote water security and resilience to climate variability in long term. In many regions of the world especially in water scarce areas falling under arid and semi-arid regions as well as peri urban and peri-industrial area where competition for water is very high among different sectors like industries, agriculture, domestic use, landscape etc. agriculture is the largest sufferer. Since agriculture uses more than 80% of freshwater use of wastewater for irrigation purpose is common. Figure 1 depicts use of wastewater for irrigation by different countries. As there is no official figure of wastewater use for irrigation in India therefore the figure 1 did not have mention of India. As per one estimate by Raychaudhuri et al. (2017), 62000 million litres per day of wastewater is produced in India of which only 27% is treated and rest is untreated. This untreated wastewater is being used by farmers in peri urban and peri industrial areas for their crop irrigation under water scarce situation. More than 73000 ha area is being irrigated with wastewater (Raychaudhuri et al. 2017).

International Water Management Institute estimated irrigation potential with wastewater in class I and II cities of India. Volume of treated wastewater and untreated wastewater generated from these cities are 11787 mld and 326467 mld respectively which has the potential to irrigate approximately 70722 and 1032213 ha of area respectively.

Current Status of Wastewater Use in Agriculture

Although proper documentation related to use of wastewater is lacking but we cannot deny its use of irrigation especially in peri-urban and peri-industrial area. There are many benefits for which farmers prefer to use wastewater like round the year availability, nutrient present in it, which reduces fertilizer cost and overall production cost (Banerjee, 2016; Rachana and Subhasis, 2019). In spite of all these benefits still wastewater use has many limitations. In most of the developing and under developed nation's use of untreated sewage is prevalent which is associated with many health hazards like bacterial, viral