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Review Paper on Use of Sequencing Batch Reactor Treated Wastewater on Urban Agriculture

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Abstract: ***Wastewater use in agriculture is much more commonplace than many believe. At present, approximately 20 million hectares of arable land worldwide are reported to be irrigated with wastewater. The unreported use of wastewater in agriculture can be expected to be significantly higher. It is particularly common in urban and peri-urban areas of the developing world, where insufficient financial resources and institutional capacities constrain the installment and operation of adequate facilities for proper wastewater collection and treatment. Wastewater use in agriculture has certain benefits, providing water and nutrients for the cultivation of crops, ensuring food supply to cities and reducing the pressure on available fresh water resources. However, wastewater is also a source of pollution, and can affect the health of users, consumers and the environment if safe practices are not applied. While populations and urban areas are growing at unprecedented rates and water scarcity is increasing, it is expected that, in the near future, the use of wastewater in agriculture will increase further in areas where fresh water is scarce.***

Keywords: SBR, Urban Agriculture, Treated Wastewater, Environment, Fertilizer, Salinity

1. Introduction

The successful and efficient reuse of treated wastewater, particularly in agriculture will depend on a multitude of strategies, which include increasing the reliability of reclaimed water as an alternative source to groundwater in irrigation, improving public awareness and attitudes towards reclaimed water, setting national public health and environmental standards for reuse, and implementing effective utilization plans in terms of increasing crop value and groundwater conservation.

Irrigation for landscaping and golf courses is also increasing in our country. However, several constraints including economic, institutional, health and environmental problems restrict the sustainable and safe reuse of wastewater. This will require concerted efforts, supported by regional and international organizations, to make a real change and increase the low volume of treated water reused, which currently represents very low percentage of the total generated wastewater.

Rates for treated wastewater would be based on what the market could uphold, without taking into account the costs required. The willingness to pay for different customers varies depending on the expected economic return. Moreover an increased public awareness of the benefits of water reuse can lead to increased demand and also induce consumers to state a higher willingness to use and pay for reclaimed water.

The selection of reuse technologies should be determined by cost-effectiveness, relative ease of replicability and the capacity of local community to operate and maintain the infrastructure. A comprehensive cost-benefit analysis of various water reuse technologies can also have a major impact in selecting and investing in appropriate wastewater treatment technology. "One of the most important lessons learned is that, to enable local end-users to feel confident with reclaimed water for irrigation, it is imperative to establish trusted institutions to ensure the highest standards of health and safety". Institutional strengthening of the water sector is required to instill and enforce standards, regulatory oversight and monitoring. It is important to note that those countries which have made most significant strides with water reuse (including Tunisia, Jordan, Gulf countries), fully fledged local or state regulations are supported by national guidelines and set the basic conditions for wastewater treatment and safe reuse.

Sequencing batch reactor (SBR) process is a noteworthy technology utilized for wastewater treatment plant. SBR is particularly effective in nutrient removal for irrigation purposes and producing sludge for fertilizers.

2. Literature Review

2.1.Intizar Hussain, Liqa Raschid, Munir A. Hanjra, Fuard Marikar and Wim Van der Hoek in Wastewater Use in Agriculture paper describes that Irrigation by SBR Treated Waste Water leads to Higher Wheat Grain Yields, Higher Protein Content Ingredients, No change in total fibre content and thus feed quality. Treated Waste Water is a potential source of irrigation water plus rich source of fertilizer. Higher irrigation leads to Higher leaf length and maturity period, Higher Sorghum grain yields, less amino acids contain in grains. Wastewater has something in addition to fertilizer elements that simulated grain production thus more giving higher yield than controls.

2.2.Sule Abubakar1 , Ab aziz Abdul Latiff2 , I. M. Lawal3 , A. H. Jagaba3 in Aerobic treatment of kitchen wastewater using sequence batch reactor (SBR) and reuse for irrigation landscape purposes paper describes that despite abundant freshwater resources in India on the whole, there are regions where demand exceeds supply. Within the holistic concept of total water cycle management, one solution to the challenge is wastewater reuse, which facilitates the use of treated kitchen effluents as a new source for non-potable water supply. Reuse or recycling of treated kitchen wastewater reduces effluent discharges into receiving waters and offers a reliable alternative supply of water for applications that do not require high quality water, freeing up limited. This study was mainly focused on the applicability of aerobic SBR to overcome the deficiencies in lack of prior treatment of kitchen wastewater before depositing into body of water and for reuse for irrigation purposes. Performances were investigated for twelve different hydraulic retention times as 135 minutes to 300 minutes. It could be found that regardless of HRT, COD removal efficiencies were not more than 63 %, besides; better nitrate removal efficiency was achieved when the system was running for HRT 300 min and it was 86%. Similarly, in terms of total suspended solid removal efficiency, HRT 300 min provided removal of 94 % from wastewater. Results obtained were within the standard. Finally, it was justified that HRT 300 minutes (5hours) was the best operating condition among them. The sequencing batch reactor is an efficient tool for biological carbon and nutrient removal, capable of achieving effluents with very low nitrogen and phosphorus concentrations from concentrated wastewaters.

2.3.Mathew Kurian , V. Ratna Reddy - in Wastewater re-use for peri-urban agriculture: **a viable option for adaptive water management** paper describes the findings of a study of water and sanitation services in India. The secondary review indicates that untreated domestic wastewater that enters rivers is a major source of contamination of drinking water sources. Data from major river basins in India, pointing to both increasing rainfall and temperature variability, further exacerbates the need for cost-effective wastewater management options. Our case study of Karimnagar (located in Godavari river basin) demonstrates strong links between wastewater generated during high rainfall months and storm drain overflows. Climate variability has an effect on public health of slum populations in Karimagar town, periurban agriculture practised in outlying villages and river quality. Poor river quality due to untreated wastewater from Karimnagar town had a direct effect on public health. Public health links were evident from skin rashes experienced by washer men and spread of disease among both human and livestock populations in downstream villages. An important finding of this paper relates to the economics of wastewater reuse. Cultivating with wastewater may be less financially viable as compared to cultivating with well water. Further, when we consider health risks for humans and livestock and returns on crops, a number of interesting perspectives emerge. Firstly, because of better nutrient value of wastewater, farmers do not apply fertilizer. Further, due to assured availability of wastewater, farmers can grow two crops. On the other hand, farmers spend more on pesticides due to high incidence of pests (whitefly and jassid) under well irrigation. Wastewater reuse for agriculture is sensitive to soil and crop type; in our study area only paddy could be grown using domestic wastewater. Crops grown using wastewater sell for less in local markets compared to crops grown using well water. Our study also found that better wastewater management had the potential to increase returns of wastewater agriculture by up to six times because of double cropping and lower expenses incurred on fertilizers. Depending on the location of individual plots, farmers also potentially stood to benefit from higher crop yields because of lower risk of flood damage and pest attack. Therefore, we may conclude that, although a huge potential exists for wastewater reuse in agriculture, its effectiveness as an adaptation pathway may depend on critical aspects of local farming practices, market conditions, crop varieties and implementation of cost-effective treatment measures that facilitate wastewater reuse.

2.4.Diana Norton-Brando, Sigrid M. Scherrenberg, Jules B. van Lier in Reclamation of used urban waters for irrigation purposes - A review of treatment technologies paper describes that the treated effluents' key characteristics of concern for agricultural use are salinity, pathogens, heavy metals and nutrient levels. Having reviewed reclamation technologies with regard to these parameters, the following is observed: Salinity is one of the most addressed irrigation water quality parameters in literature, from the treatment technology point of view. The use of SBR technology results in the removal of nutrients as well, which are considered valuable for agriculture. The acceptable salinity level of the treated effluent depends on the soil type, climate, type of crops to be grown, as well as irrigation and drainage technology applied, which are factors that are generally not considered in national water irrigation guidelines. Instead of setting a rigid standard for effluent salinity level, more flexible guidelines that take the above parameters into account seem to be advantageous. Moreover, more flexible guidelines give the possibility for the development and use of alternative technologies that allow salinity standards to be met while preserving valuable nutrients.

3. Methodology

The Project consists of three parts.

3.1. Sample collection of SBR treated wastewater and soil

a) Parameter of wastewater is analyzed before using for agriculture
b) Analyze the fertility of soil i.e. NPK content

3.2. Study the effectiveness of SBR treated recycled wastewater in terms of rate of application in water scarce seasons (winter /summer)

3.3. Preparation of model for cultivation of crops

a) Develop a model which will contain 3 trays having soil
b) Pouring of wastewater treated by SBR, Muncipal Water and Direct Waste water in each tray
c) Cultivation of crops in all the 3 trays

3.4. Analyze and observe the parameters and growth of crops i.e. to check the parameter of effluent and soil fertility

3.5. To find out that treated water by SBR used for crop cultivation is yielding good results

4. Result

The waste water which we are disbursing off to the nalas and rivers is not eco-friendly even if they are treated and disbursed. By treating this waste water by SBR treatment we can use this water for urban agriculture and many other uses for which we are using portable water presently. By using this waste water for urban agriculture we can save the portable water and its financial effects and water scarcity can be reduced, also we can save the environment by this method.

5. Conclusion

Despite facing considerable challenges, urban agriculture has the tremendous opportunity to contribute to economic and workforce development, building community cohesion and capacity, and contributing to solving significant barriers to access to healthy food in the community.

Approximately, seventy (70) percent of world water use including all the water diverted from rivers and pumped from underground is used for agricultural irrigation, so that the reuse of treated kitchen wastewater for purposes such as agricultural and landscape irrigation reduces the amount of water that needs to be extracted from natural water sources as well as reducing discharge of wastewater to the environment. Thus, kitchen treated wastewater is a valuable water source for recycling and reuse in the Mediterranean countries and other arid and semi-arid regions which are confronting increasing water shortages. Treated wastewater reuse in agriculture is a common practice in the Mediterranean countries and there is a considerable interest in the long-term effects of treated wastewater on crops intended for human consumption.

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Mr. Rajkumar Pandurang More obtained Graduate Degree in Civil Engineering from Marathwada University. His area of specialization is reuse of kitchen treated waste water by SBR in Urban Agriculture. He has published 5 Research Paper in National Conferences and 1 in International Journal. He is working as a Professor in PDEA, Akurdi, Pune for the last 26 years.