International Journal of Engineering Science Invention (IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org || PP. 15-17

A Study on Strategies of Wastewater Treatment System as a Rural Business Model

V.Vijaya Kumar[1]
Seniour Lecturer, Department of Commerce, Sir C.R.Reddy (A) College, Eluru-534 007
Corresponding Author: V.Vijaya Kumar

Abstract: *Use of wastewater in agriculture in rural as well as peri-urban areas in India is not uncommon. Almost 90% of total water supplied for domestic use generates wastewater which could be diverted for agriculture purpose. Safe use of wastewater could be a potential source of water in agriculture especially for vegetable growers in peri-urban areas. These areas have large employment opportunity for female and male laborers to cultivate crops, vegetables, flowers, fodders that can be sold in nearby markets or for their livestock use. There are however number of limitations for wastewater treatment and reuse in agriculture such as mismatch between demand and water supply; salinity, treatment capacity and over nutrient application, etc. Moreover use of untreated wastewater in irrigation also may degrade groundwater system, accumulate salts in soils and create bad odour and further degrade other ecosystem services like downstream water quality etc.*
Keywords: *Wastewater, Peri-Urban, Treatment, Nutrient*

I. Introduction

Decentralized Wastewater Treatment (DWT) system developed at ICRISAT Campus, Hyderabad is believed to address number of these problems and water scarcity issues at local scale. At ICRISAT campus, Hyderabad domestic wastewater is received from a community outside the campus. This wastewater is being diverted through a series of settling tanks to a small lake. These tanks and lake is a habitat to several migratory birds and generates number of ecosystem services (regulating and cultural services). In coming wastewater is polluting surface water bodies in ICRISAT.

ICRISAT Water4crops team proposed to develop a DWT system to reduce pollutant load from this wastewater and reuse the treated wastewater for agriculture. The DWT system comprising a wastewater holding tank, constructed wetlands, and treated water storage tank is being constructed at ICRISAT.

Similar DWT system is developed at University of Agricultural Sciences, Dharwad (UASD). At UASD, the source of domestic wastewater is effluent from campus residential area and hostels. The rationale behind developing DWT is – water scarcity, farmers and consumers getting adversely affected by direct use of wastewater in agriculture, environment pollution by disposal of untreated wastewater, and lack of sewage treatment plants in several localities.

Wastewater treatment should be linked with integrated watershed development program at field and community scale (500-1000 ha). Implementing several agricultural water management interventions at one hand would enhance the water resources availability, and wastewater treatment on the other hand reduces total water demand (as the demand management approach). A multitude of resources and processes that are part of natural ecosystems can be strengthened by such initiatives. Coupling wastewater treatment along with IWRM (Integrated Water Resource Management) is not only helpful in enhancing crop production and income of small holder farmers but also in improving water quality of groundwater wells and downstream water bodies including better soil quality through C sequestration.

ICRISAT is in the process of developing the ‘sites of learning’ in two model watersheds (Kolar and Bellary district of Karnataka) showing decentralized wastewater treatment and its use in agriculture.

At Kolar, ICRISAT in collaboration with Coca-cola foundation and MYRADA are working with residents of these villages to agricultural productivity and livelihood through integrated watershed management program. Though this region often faces acute water scarcity, it is well recognized for tomato cultivation. High irrigation demand for is driving groundwater depletion. Muduvatti village is one of the nine villages from micro-watershed where DWT system will be constructed. This village has a masonry drainage canal of about 2000 m, which collects domestic wastewater from about 400 households and the rainwater. Another 500 m length of drain is proposed to be constructed. We identified two farmers who are using untreated wastewater for irrigation. They have constructed water collection pond to collect wastewater. Collected wastewater is being reused for the cultivation of vegetables. One farmer Mr. Govindappa has adopted drip irrigation with 3 hp diesel engine pump

and cultivated vegetables (bitter gourd, ridge gourd and tomato in one acre of land during the post-rainy season. Another farmer Mr. Nagaraj has also constructed a pond (15x20x2 m) and uses sewage water by flood and ridge and furrow method to irrigate one acre of land grown with brinjal, ridge gourd and tomato. We have collected wastewater samples from these water collection ponds and analyzed for various parameters (Table 1). These wastewaters have high concentration of bacteria, which is very unhygienic and could cause several skin diseases to farmers and other health related problems to consumers. We propose to convert present water collection pond into decentralized wastewater treatment system consisting a constructed wetland in one of two farmers' field.

Table 1: Characteristics of Wastewater Collected from Muduvatti Village.

Parameter	Values
pH	7.7-8.0
EC (mS)	1.8-3.2
TDS (mg/L)	400-1600
NH4-N (mg/L)	11.2-19.9
NO3-N (mg/L)	0.32-4.74
Bacteria (CFU/ml)	158000-266000
BOD5 (mg/L)	54.4-112.0
COD (mg/L)	128-352
S (mg/L)	12-196
Calcium (mg/L)	45-86
Magnesium(mg/L)	28-153
Sodium (mg/L)	348-4452
Potassium (mg/L)	65-389

II. Strategies of Wastewater Treatment

Consortium approach

The Water4Crops consortium partners have a common mandate to find solutions for emerging water and related problems for achieving sustainable development in Europe and India. The consortium is designated to satisfy all the project objectives, permitting to treat and reuse wastewaters for non-potable uses. The consortium is a conglomeration of public research institutes, private non government research institutes, universities, private industries both large and small, and consulting firms from Europe and India thus forming a perfect example for international public private partnership. The wastewater treatment protocols will be developed and assessed according to defined needs of local communities, to make them suitable for immediate agro-industrial exploitation at the end of the 4-years Water4Crops project.

EU Consortium

Water4Crops-EU includes 22 partners uniformly-distributed from a geographical point of view. The EU Consortium includes different organisation types, namely: 5 Universities (FHNW, UNIBO, TUC, UNICT, UNIRM), 8 Research Institutes (IRSA, NERC, VITO, UFZ, IRSTEA-CEMAGREF, INRA, ALTERRA, CER), 4 (agro) industrial companies (SIMA-TEC, BIONACTIS, PHYTOREM, VITA 34 AG), 3 spin off/out companies (INOFEA, HORTA, ENVIHEALTH) and 2 consultant companies (GIZ, STEP). The EU consortium comprises the following complementary competences and expertises integrated in the consortium:

The development of wastewater treatment processes dedicated to the valorisation of its organic matter (VITO, UNIBO, IRSA, TUC, UNICT, FHNW, UNIRM);

Irrigation management, adaptation of crop to drought and to saline water and treated effluents (NERC, CER, IRSTEA-CEMAGREF, UNIBO, INRA, IRSA, UFZ);

Integrated Water Resources Management and Green Economy development (ALTERRA, GIZ, IRSA)

Indian consortium

The Water4Crops Indian consortium is unique in its composition. It brings together 12 organizations of different types – 6 research institutes (ICRISAT, TERI, NEERI, MSSRF, UASD & UASB), 5 industries (SAB Miller, Jain Irrigations, Ion Exchange & L&T) and one consultancy company (EIRC).

National research institutes like The Energy and Resources Institute (TERI) and National Environmental Engineering Research Institute (NEERI), who are the pioneer institutes of industrial wastewater research, will be engaged in finding solutions for reusing wastewater in different sectors. On field research institutes, along with the strategic research on water use efficiency, International Crops research Institute for the Semi-Arid Tropics (ICRISAT), University of Agricultural Sciences Dharwad (UASD), and Bangalore (UASB) are involved for conducting the research on water and crop management aspects. For dissemination, coordination and management, Euro-India Research Center (EIRC) and ICRISAT have vast experience. Industry partners of Water4Crops India consortium include – SAB Miller, Ugar Sugar, ION Exchange, Larsen & Toubro who will work towards developing and demonstrating integrated treatment processes for bio-refinery effluents. Another industry JISL will be involved in agricultural and water management activities including bioremediation of degraded wasteland (due to untreated wastewater irrigation) and bio-treatment of municipal wastewater for reuse in agriculture. MSSRF will develop water efficient crop variety for selected crops and on integrated mangrove-fishery farming system to optimise use of saline wastewater.

Mirror case concept

Water Crops aims at twinning successful examples from case studies in Europe and in India. Lessons learned will help the process of boosting business development and the co-creation of new business opportunities in the field of waste water treatment and agricultural water use. Water Crops will organise the integration of results by the set up of two mirror cases. The Mirror cases will act as "reflectors", 1) reflecting businesses point of view/demands to the technology developers, 2) reflecting achievements from individual technology development to the identification of new solutions and new local business opportunities, 3) mirroring the experience gained in India and in Europe. The mirror cases will be the Emilia Romagna region (Italy) and at the greater Hyderabad region (Andra Pradesh State, India). Both regions offer potential for excellent application of technology development research in increasing/diversifying agricultural production.

III. Conclusion

There is a large gap between generation, collection and treatment of waste water and it is anticipated that wastewater generation rate will reach about 130 million m^3/ day by 2051 with increasing urban population in India. Grey/wastewater is a potential source of water and could potentially be diverted safely for agricultural production after some of the essential treatment. Water4Crops provides an opportunity to efficiently utilize low quality industrial (food) and municipal wastewater and facilitate developing various methodologies for wastewater treatment and its feasible use in agriculture. This project would also describe practical solutions of wastewater treatment and its management which open-up various avenues to scale-up such technologies.

References

[1] Edwards, W., Sheldon, M.S., Zeelie, P.J., de Jager, D., Dekker, L.G., Bezuidenhout, C.C. (2013).water Re-use using dua-stage memberane Biorector for industrial effluent treatment. WRC report no TT556/13.

[2] Knüppe (2010): The challenges facing sustainable and adaptive groundwater management in South Africa. http://www.wrc.org.za

[3] Meenakshi, S. & Viswanathan, N. 2007. Identification of selective ion-exchange resin for fluoride sorption. Journal of Colloid and Interface Science, 308 (2): 438-450.

[4] Mwenge Kahinda, J., Taigbenu, A. E. and Boroto, J. R. (2007) Domestic rainwater harvesting to improve water supply in rural South Africa. Phys. Chem. Earth 32, 1050–1057.

[5] Onyango, M.S. & Matsuda, H. 2006. Removal of fluoride from Water Using Adsorption Technique.

[6] Rand Water. (2001). Setting of In-stream Water Quality Guidelines for the Vaal Barrage Catchment., (p. 11). Johannesburg.