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A Review on Treatment & Reutilization of Domestic Wastewater by Removing Micro-Pollutant.

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Abstract

Water quality degradation in India is predominant due to the discharge of untreated or partially treated domestic sewage. Sewage is wastewater generated from domestic activities including kitchen, Bathroom, toilet & floor washing. Fast urbanization and increasing standards of living resulting in a steep increase in the generation of sewage in the country. Due to the paucity of resources, the sewage is not properly collected & treated in most of the urban centres of India, but treatment capacity of existing plants is not effectively utilized due to operation and maintenance problems. The sewage is accumulated within urban areas percolating in the ground and polluting the groundwater and water bodies. The only source of drinking in many urban areas, which poses serious health hazards. This creates opportunities for installing in-situ solutions such as compact containerised water treatment systems that could treat the effluent before it is discharged into local ecosystems to protect the environment and increase the water quality. This paper presents a detailed study of problems associated with domestic wastewater and reuse methods for sewage.

Keywords: *Domestic Wastewater, Reuse, Microscreening.*

1.0 Introduction .

Water supply and proper sanitation facilities are important basic needs of urbanization for improvement of the quality of life and enhancement of productive efficiency of the people. Water for domestic and industrial use in India is generally provided to residences in urban areas by a water supply networks and managed by a local or statutory authority. In rural/residential, rural and isolated locations, where potable water cannot be supplied from a water supply networks, water may be individually sourced from rivers, streams, wells and lakes. However it is estimated that 80% of the water supplied for domestic use, comes out as wastewater. Wastewater effluent is let out untreated and it either sinks into the ground as a potential pollutant of ground water or is discharged into the natural drainage system causing pollution in natural water bodies. Wastewater is needed to be conveyed to sewage treatment plants for treatment which must meet the aesthetic standards of ambient environment for receiving water bodies. However India lacks in sewage systems and wastewater management plants sufficient to meet the needs of its growing urban population. In many cities the sewer systems are in appalling condition or simply non-existing - and need extensive maintenance or replacement (7).

This creates opportunities for reuse of domestic wastewater in many locations where sewerage systems or treatment plants does not exist, for installing in-situ solutions such as compact water treatment systems but also solutions like reedbed systems/microscreening that could treat the effluent before it is discharged into local ecosystem (6). In this paper, domestic wastewater are characterised and treatment options summarised. Management opportunities are examined for the reuse of wastewaters, primarily from individual residences.

2.0 Water availability and use in India

In India availability of land out of total land area is only 2.45% and 4% of water resources of the world, fulfils demands of water 18% of the world population. Total available water resource for potable use in our country has been estimated to be about 1123 BCM (690 BCM from surface and 433 BCM from ground), which is just 28% of the water derived from precipitation. About 85% (688 BCM) of water usage is being diverted for irrigation, which may increase to 1072 BCM by 2050. Major source for irrigation is groundwater. Annual groundwater recharge is about 433 BCM of which 212.5 BCM used for irrigation and 18.1 BCM for domestic and industrial use (CPCB, 2011). In year 2025 water demand for domestic and industrial usage may increase to 29.2 BCM. This will be affect in water availability for irrigation will reduce to 162.3 BCM. The present population growth-rate about 1.9% per year, will be expected to cross the 1.5 billion by 2050. Due to increasing urbanization and industrial development in the country, the per capita average annual freshwater availability has been reduced from 1951 to 2010 is 5177 m^3 to 1588 m^3. However is expected to reduce to 1341 m^3 in 2025 and 1140 m^3 in 2050 (7). Thus there is an urgent need for efficient water resource management through enhanced water use efficiency and waste water recycling.

3.0 & Wastewater generation in India

With rapid expansion of cities, supply for domestic water supply is increased; result in more quantity of wastewater is increasing in the same proportion. As per CPHEEO guidelines, it is estimated that about 70-80% of total water supplied for domestic use gets generated as wastewater. The generation of wastewater by the class-I cities and class-II towns, representing 72% of urban population in India, However it is estimated that there is increase in daily wastewater generation about 98 lpcd to 120 lpcd (CPCB, 2015). As per CPCB estimates, the total wastewater generation from Class I cities and Class II towns in the country is around 35,558 and 2,696 MLD respectively. While, the installed sewage treatment capacity is just 11,553 and 233 MLD, respectively, thereby leading to a gap of 26,468 MLD in sewage treatment capacity.(5)

As increasing urban population, it is projected that by 2050, about 48.2 BCM (132 billion litres per day) of wastewaters would be generated thereby further widening this gap. Thus, overall analysis of water resources availability and wastewater generation in coming years indicates that, there will be need to provide integrated solution for reduced fresh water availability and increased wastewater generation for increased population and industrial development.

4.0 Domestic Wastewater Characterization

Domestic wastewater is the water that has been used by a community and which contains all the materials added to the water during its use. It is composed of human body wastes (faeces and urine) together with the water used for flushing toilets, and sullage, which is the wastewater resulting from personal washing, laundry, food preparation and the cleaning of kitchen utensils. It has been widely reported that domestic wastewater is generally characterised by two major waste streams: the toilet wastes, commonly referred to as the black water, and the other household wastes, commonly referred to as greywater or sullage.(1)

4.1 Wastewater Characterization

Greywater is, used water from your bathroom sinks, showers, tubs, and washing machines (1). Greywater

contain traces of dirt, food, grease, hair, and certain household cleaning products. While greywater may look "dirty," it is a safe and even beneficial source of irrigation water in your yard. But if greywater is released into rivers, lakes, or estuaries, its nutrients become pollutants, but to plants, they are valuable fertilizer. Reusing your greywater keeps it out of the sewer or septic system, thereby reducing the chance that it will pollute local water bodies.

Blackwater is a wastewater from toilets, which likely contains can contain faces, urine, water and toilet paper from flush (1). Blackwater mostly contains the pathogens of faeces and the nutrients of urine that are diluted in the flush water. Pathogens from faces are very hazardous to human health and environment if disposed of without any primary treatment. But blackwater contains nutrients that are high in NPK valves are used as irrigation purpose if septic tank provided.

The results of the characterisation studies have been used to predict the division of chemical/ physical pollutants between the two waste streams are greywater contributes about 65% of the flow, 70% of the phosphorus and 63% of the BOD_5, while the blackwater contributes about 61% of the suspended solids, 82% of the nitrogen and 37% of the BOD_5. The characterisation studies also demonstrated that a wide range of indicator organisms can be expected in raw bath and laundry wastewaters, which in turn indicated a potential for pathogenic greywater contamination. While the potential for pathogenic contamination appears to be substantially lower than that of either toilet wastes or combined household wastewater, greywater still requires adequate treatment and disposal (2). A typical distribution of the quality and quantity components of the blackwater and greywater streams is presented in Table 1.

Table 1. Pollutant Distribution of Household Wastes

Greywater	Pollutant	Blackwater
65%	**Flow**	35%
63%	**BOD5**	37%
39%	**Suspended solids**	61%
18%	**Nitrogen**	82%
70%	**Phosphorus**	30%
Low	**Pathogens**	High

4.2 Effects of domestic wastewater

- Wastewater from the domestic sector is another major contributor to water contamination and subsequent related water-borne diseases.
- Overgrowth of grass and plants on open ground due to discharged of domestic wastewater without any primary treatment.
- Nutrient pollution (nitrogen, phosphates, etc.) Causes overgrowth of toxic algae which can be eaten by other aquatic animals, and it may cause death; it can also cause outbreaks of fish diseases,
- Oil pollution can negatively affect development of marine organisms, increase susceptibility to disease, and affect reproductive processes;
- Waterborne diseases caused by polluted drinking water include typhoid, amebiasis, giardiasis, ascariasis, hookworm, etc
- Polluted wastewater penetrated into ground water table and pollutes it by mixing of different pathogens & bacteria, this polluted water may subjected to water borne diseases if used for drinking purposes.
- Waterborne diseases caused by polluted river or lake or beaches water are rashes, ear ache, pink eye, respiratory infections, hepatitis, encephalitis, gastroenteritis, diarrhea, vomiting, stomach aches, etc.

4.3 Literature study for wastewater treatment and disposal methods

Domestic wastewaters require treatment before disposal or reuse. There are a number of methods for the treatment of domestic wastewaters; some of literatures studied are described below:

Shobhan Majumder et al.(12) studied on working, treatment and performance evaluation of sewage treatment plant. In this paper they discussed on treatment methods used for urban area. Mostly in urban areas, wastewater is conveyed through sewerage system to sewage treatment plants or common effluent treatment plant, where the management authority decides on the treatment and disposal system. They also studied different wastewater treatment units (Screening, sedimentation, filtration and disinfection), physical & biological processes and effluent standards for disposal of wastewater. The managing authority is licensed by a state Environment Protection Authority and responsible for effluent disposal to the environment by land application or river discharge. Also they studied on increasing trend to reuse part of the treated wastewater for irrigation.

Bassim E. Abbassi et al.(4) focused on onsite sewage treatment for low incomes groups and advancement in septic tank. They concluded that, only a third of urban houses are connected with sewerage system networks (mostly in metropolitan cites). This lack of sewage treatment plant, majority of the houses about 65% Indian population use of toilets connected with septic tanks. Major part of Indian population is unsewered and uses of septic tanks to treat domestic wastewaters. But septic tank is only used for partial treatment of the toilet wastes and for final treatment, liquid waste is discharged disposal field.

Teng Yu et al.(13) suggested to use of biological aerated wastewater treatment plants for domestic wastewater treatment and studied performance and removal efficiency b**y** Aerated wastewater treatment (AWT). AWT is small self-contained proprietary biological treatment systems which rely on mechanical devices to provide mixing, aeration and pumping of effluent which has potential to reuse for non-potable activities. AWT systems are available in option with two tanks or a single tank where effluent is subjected to accelerated aerobic breakdown. Final effluent produced by combinations of pumps, air blowers, contact media for bacterial growth, and settlement and chlorination chamber with good management and maintenance (including periodic sludge removal), is clear and odourless, and meets the quality criteria approved by the State Department of Environmental guidelines.

B.-M. Wilén et al.(6) focused on sludge removal from wastewater by disc filtration, in which they studied use of microscreens for wastewaters and low-quality water treatment processes concerning sand filtration. Microscreening is a mechanical process in which filtration is done through a thin screening or meshes made up of different materials such as stainless steel, woven, fibres, cloth, etc. and, after filtering wastewater through micro-screen, the retained suspended matter and organics creates a contacting film over the microscreens, which separate the organic & inorganic materials, remove harmful gases, dissolved & suspended solids etc.

4.3.5 Consequence of conventional wastewater treatment methods

In unsewered areas, effluent discharged from septic tank is disposed by soil absorption using a soakage trench or placed in a transpiration bed where evapotranspiration and absorption are used (3). A number of surveys concluded that in excess of 40% of on-site systems were failing and contributing to nutrient related water management problems in absences of any maintenance. However due to lack of sewage treatment plants in many cities of India, wastewater is transported from sewerage system to nearby water bodies such as river, lake and disposes without any primary treatment, results in about 70% of water is polluted in India.

Even the treatment capacity of existing plants is also not effectively utilized due to lack of operation and maintenance problem. Nearly 39% of existing plants is not satisfactory in operation & maintenance and sewage pumping. Also effluent discharged is not conforming to the general standards prescribed under the Environmental protection rules for discharge into streams as per the CPCB's survey report. (This constitutes a major problem as discharge of untreated sewage is the single most important cause for pollution of surface and ground water in India.

5.0 Re-use management options

Adequately treated wastewater should meet strict quality criteria, for reuse in non-potable purposes. Non-potable reuse leads to both reduction water consumption from other sources, and a reduction in wastewater flow rate. Thus non-potable reuse of domestic wastewater can avoid adverse environmental consequences associated with conventional water sources and wastewater disposal systems. Non-potable domestic reuse can be planned either within single households/building, or on a larger-scale use through a reticulation system used for only non-potable activities.

Rural/residence where proper sewerage network is not available in such location, wastewater generated from individual houses and community facilities is usually managed by on-site treatment and disposal systems. Although a variety of onsite systems have been used, the most common system consists of a septic tank for the partial treatment of wastewater (3), and a subsurface disposal field for final treatment and disposal. The use of a segregated waste treatment system becomes more attractive and cost-effective if its use results in:

- Lower effluent pollutant concentration & mass,
- Reduced potential for pathogenic contamination if effluent is to be discharged,
- Conservation of water resources,
- Potential for recycling valuable nutrients to the soil in a beneficial manner.

6.0 Conclusion

From the previous researches it has been observed that there are different methods are used to reuse of domestic wastewater for irrigation and gardening purposes, which outcome of reduced in water demand and reduces the wastewater quantity on treatment plant. But these treatment units/plants are costlier for construction, operation, and maintenance and not effective in many regions..

Installing in-situ solutions such as compact containerised water treatment systems for treatment before the effluent discharged into local ecosystems to protect the environment and increase the water quality. One of in-situ solution is microscreening, having huge advantage over other conventional

methods for treatment, it require less space and more effective in water & wastewater treatment. There is need to research on effective methods for domestic wastewater treatment to reuse of wastewater.

7.0 Reference

1. Ahmed, M., S. Al Sidairi, S. A. Prathapar and S. Al-Adawi, (2008), " Evaluation of custom made and commercial grey water treatment systems: a case study from Oman", International Journal of Environmental Studies 65, Page No.33 – 40.

2. Anagnostou, G. Kaparos, A. Katsiri, E. Katsiri, A. Andreadakis, "Performance evaluation of Grey Water Treatment Systems for Urban Use using Multi-criteria Analysis", IWA Balkan Young Water Professionals-2015,Page No. 321-326

3. Bassim E. Abbassi, Raihan Abuharb , Bashaar Ammary, Naser Almanaseer and Christopher Kinsley. "Modified Septic Tank: Innovative Onsite Wastewater Treatment System", MPDI Water 2018, 10, 578

4. Bhardwaj R.M., "Status of Wastewater Generation and Treatment in India", IWG-Env Joint Work Session on Water Statistics, Vienna, 20-22 June 2005

5. Bhardwaj R.M., "Wastewater Management in India-A Challenging Task, Seminar on Urban Wastes Management", April 16-17,2004 Institution of Public Health Engineers, North India Centre, Delhi.pp.1-6

6. B.-M. Wiléna, Ann Johansena and Ann Mattssonb "Assessment of sludge particle removal from wastewater by disc filtration", IWA Publishing 2012, Water Practice & Technology Vol 7 No 2.

7. CPCB (1999), "Status of water supply and Wastewater Collection "Inventorization of sewage treatment plants", Urban pollution series: 2015

8. Census of India, 2001, Ministry of Home Affairs, Office of the Registrar General,India, 2A, Mansingh Road, New Delhi-110011,Website http://www.censusindia.net

9. Envis Newsletter, "Water Quality Management in India", By Central Pollution Control Board,Volume 1 Issue 1, January –March 2008

10. Rajneesh K. Gautam, Islamuddin, Nandkishor More, Saumya Verma, Spriha Pandey, Neha Mumtaz, Rajesh Kumar, Md. Usama, "Sewage Generation and Treatment Status for the City of Delhi, its Past, Present and Future Scenarioa Statistical Analysis" International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5 Issue V

11. Paulo Fernandes Lars, Flemming Pedersen, Bovbjerg Pedersen, "Microscreen effects on water quality in replicated Recirculating Aquaculture Systems" ELSEVIER - Aquacultural Engineering Volume 65, March 2015, Pages 17-26

12. Shobhan Majumder, Poornesh, Reethupoorna M.B., Razi Mustafa, "A Review on Working, Treatment and Performance Evaluation of Sewage Treatment Plant", Journal of Engineering Research and Application, ISSN : 2248-9622 Vol. 9,Issue 3 (Series -VI) March 2019, Page no. 41-49

13. Teng Yu, Jiang Linshi, Yu Miao, Gu Guizhou*, Li Zheng, "Study on Treatment of Domestic Wastewater by Biological Aerated Filter", ACCESE IOP Conf. Series: Earth and Environmental Science 330 (2019)-March 2019, Page no. 54

14. Y.M. Patil, G.R. Munavalli, "Performance evaluation of an Integrated On-site Greywater Treatment System in a tropical region" ELSEVIER- Ecological Engineering 95, (2016), Page No.492-500