Wastewater Production, Treatment, and Use in Sri Lanka

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Abstract:

Sri Lanka being an Agricultural country depends on its water sources for food production. Water sources are utilized to its maximum for various uses. Water from large reservoirs is used for power generation as well as agriculture. On the other hand wastewater generation is increasing in volumes and complexity and disposing of wastewater without causing adverse effects to the environment has become a major issue.

Sri Lanka has an extensive network of irrigation system and feeding this system with adequate amount of water is a problem in some instances. Most of the time wastewater generated is treated and discharged in to this irrigation system. Recycling of wastewater thus occurs as water in the irrigation system is being used for agriculture. Keeping the pollutant to acceptable minimal level is the challenge in this situation. Use of wastewater directly to agriculture is also practiced in some instances.

Establishing an institutional mechanism that support the safe use of wastewater and strengthening existing institutions are identified as a priority area. Improving knowledge and skills of wastewater handlers and farmers are needed to promote the safe use of wastewater in agriculture. Knowledge and skills on health protection measures following assessment of health risk, monitoring and system assessment, crop production aspects are mainly required. Administrative inefficiencies in controlling pollution of water resource have to be dealt with.

Water availability and use:

Sri Lanka being a small island of 65,610 square kilometers and a population of 20 million receive fairly adequate rainfall. Water sources are being replenished by the rain except in dry season and unexpected droughts.

Island is divided in to two zones; southwest part as wet zone and northwest and southeast as dry zone. Annual rainfall is 2540 mm to over 5080 mm in south west of the Island (Wet Zone). It is less than 1250 mm in the Northwest and south east of the Island (Dry zone).

Generally there are two rainy seasons per year: Southwest Monsoon- May to August and Northeast Monsoon - November to February. Agriculture in the north and east suffers badly during the South-west Monsoon. June, July and August are almost totally rainless throughout the Dry Zone. There is scarcity for water in the dry zone during this dry period. In addition to agriculture water is required to maintain the wildlife during these dry periods.

Annual renewable water resource is 52,800 million m^3. Total Renewable Water Resource (TRWR) per capita is 2531 m^3 for the year 2009 (Source: Aquastat FAO). Data on surface vs. ground water is not readily available. From the available water 11,310 million m^3 is withdrawn for agriculture. Municipal withdraw 805 million m^3 and industries withdraw 831 million m^3 during the year 2005 (Source: Aquastat FAO). Total water withdrawal per capita 638.8 m^3 for the year 2005 (Source: Aquastat FAO). Status of wastewater as a part of overall water budget is very minimal and data on this is not readily available.

Approximately 1500 ground water based water supply schemes produces 6 million cubic meters per year. In addition about 23000 tube wells are also available throughout the country. The overall water budget for the year 2012 for water supply is Rs. 24 billion and Rs. 5 billion for wastewater disposal (Source: National Water Supply and Drainage Board).

Water from large reservoirs are used for power generation as well as agriculture. Therefore, there are instances that agriculture is being curtailed by the necessity of power generation.

Wastewater production and treatment:

It has been estimated approximately major industrial parks of Sri Lanka generate 30 million cubic meters of wastewater per year (Source: Central Environmental Authority). Estimates for other sectors are not readily available as data not compiled by a single agency.

Sri Lanka has laid down standards for effluent discharge by Central Environmental Authority which also act as the regulatory body. When waste water is discharged to inland surface water for irrigation purposes secondary treatment is mandatory by law. However, low cost treatment methods are being introduced as new projects. Therefore, dominant wastewater treatment types are preliminary, primary and advanced primary and secondary types.

One example of low cost treatment that has been introduced to the piggery farming is a combination of biogas plant and a reed bed. The reed bed generate very law amount of sludge. As this sludge can be used as manure it gives added advantage. Treated water is used in coconut farming.

Another low cost intervention is stabilization ponds which are used in food based industries such as soft drinks manufacturing industries.

Approximately ten percent (Source: Central Environmental Authority) of wastewater produced by industries are discharged to environment without any treatment. This is mainly by small scale manufactures operating without formal licenses. Livestock farmers also use their wastewater in their own agricultural farming with minimal or no treatment.

Sri Lanka has constructed wastewater treatment plants in its major industrial parks. Treatment plants at Biyagama, Seethawaka, Horona and Greater Colombo (1^{st} phase) have the capacity of treating 7.5, 9, 11 and 2.5 million cubic meters of wastewater respectively per year (Source: Central Environmental Authority). Treated wastewater is discharged in to nearby natural water streams. From these streams water is provided for agriculture and for other uses. New projects of Greater Colombo (2^{nd} phase), Greater Colombo Municipal area and Ruhunupura are in the proposal stage.

Social acceptability of use of waste water in agriculture is low leading to protests by general public including law suits. High costs associated with treatment facilities are major hindrance to the proper disposal of wastewater. Unavailability of land for low cost wastewater treatment techniques such as waste stabilization ponds is also recognized as a major constraint. Finding inland water bodies having adequate dilution or self purification capacity to discharge treated wastewater is also a problem. Use of wastewater in agriculture may be an option to be considered in this situation. However, it may pollute the ground water as the ground water table is high in most areas of the island.

Wastewater use/disposal:

Total agricultural land area is 1,920,324 hectares (Source: Census and Statistics Department) Average farm size is less than a hectare in most of the cases (80%), therefore, the extent of wastewater used for agriculture is difficult to estimate.

In rural areas of Sri Lanka use of sewage and wastewater for irrigation is common practice. Cattle and piggery farmers commonly use their wastewater in agriculture. As these are mainly household or small scale operations no reliable data available. Small farmers may choose wastewater because of its high nutrient content, which reduce the need for expensive chemical fertilizer. Livestock farmers and food based industries are allowed to discharge their treated wastewater for agriculture.

Build irrigation systems are available for most part of the agricultural lands in Sri Lanka. However, considerable amount of farming is done using direct rain water. As mentioned earlier in the dry zone rainfall is seasonal and the canal irrigation systems often do not provide water when it is needed. As the wastewater discharge flow is rather continuous, farmers have an alternative to use wastewater for their cultivation.

Most of available wastewater treatment facilities discharge their output to nearby water streams or water bodies rather than directly releasing in to agriculture. Water from such streams and water bodies are commonly used in agriculture. There are no reliable figures available for use of wastewater in agriculture.

Reuse of treated fecal sludge is being used for agriculture in very small quantities, however, reliable data not available. Using untreated wastewater for irrigation with organisms such as bacteria, virus and parasites that can pose health risks for the farmers and the communities using wastewater, and consumers who consume produce irrigated with wastewater. In some instances people complaint regarding health effects such as itching, bad smell etc. Complains on crop degradation are also been made.

Farmers' knowledge about health risks of using wastewater in agriculture and how to mitigate health issues also seem to be low. Further, farmers need to be educated in wastewater treatment methods as well as non-treatment options available such as Crop restriction, selection of wastewater application technique, cessation of irrigation, food preparation methods, human exposure control etc.

Policies and institutional set-up for wastewater management:

Discharging wastewater in to the environment without proper treatment is not allowed in Sri Lanka. However, use of safe wastewater in agriculture is not adequately encouraged by present policies.
Central environmental Authority under the Environmental Ministry, National Water Supply and Drainage Board, Ministry of Agriculture and Environmental Health and Occupational Health unit under the Ministry of Health are the main institutions involved in waste water management. Various environmental legislations and standards are in force pertaining to waste water collection treatment and disposal.

The key legislation is the National Environment Act (NEA) no 47 of 1980 which was amended in 1988 and 2000. This act encompasses not only wastewater management but also broad objective of protection of environment which include pollution control.

The Central Environmental Authority (CEA) was established in 1981 under the NEA and it is one of the main implementing arm of the national environmental policy. The CEA

has been entrusted with wider regulatory powers since its inception by amending the NEA in 1988 and the year 2000.

The principal powers entrusted with these amendments include inter alia the following,
a) Activities resulting in the discharge of pollutants to the environment should have a license issued by the CEA, in accordance with standards and criteria stipulated by the authority.
b) To list the activities which will discharge deposit or emit waste into the environment as “prescribed activities" and to ensure that no person shall carry out such activity except under a license issued by the authority.

Wastewater discharge standards stipulated under the NEA according to the type of industries and discharge methods. The following sets of wastewater discharge standards are prescribed in the National Environmental (protection and quality) Regulation no. 1 of 1990 (Gazette extraordinary no. 595/16, dated 2nd February 1990)

- General standards for discharge of effluents into inland surface waters,
- Tolerance limits for industrial effluents discharged on land or irrigation purpose.
- Tolerance limits for industrial and domestic effluents discharged into coastal areas.
- Tolerance limits for effluents from rubber factories discharged into inland surface waters
- Tolerance limits for effluents from textile industry discharged into inland surface water.
- Tolerance limits for effluents from tanning industry discharged into inland surface water

If specific standards are not laid down general discharge standards are to be adhered. These standards are been revised at present.

To minimize the water pollution caused by industry effluents CEA has appointed Cabinet approved committee to make decisions on locating industries nearby water bodies. (High and medium polluting industries) main objective of this committee is to decide on location of the industry so nearby rivers are not polluted.

In addition following laws are being implemented which are relevant to water and waste water management.

- The irrigation ordinance (No.32 of 1946 with amendments) which consolidates laws relating to irrigation.
- The National Water Supply & Drainage Board (NWS&DB) Act. (No.02 of 1974 as amended) which describes the statutory duties of the NWS&DB to provide water for public, domestic & industrial purpose.

In order to achieve water conservation and to protect the quality of water, the following policy measures have been adopted.

1) A National Water Resource council, supported by the water resource secretariat has been established to address all water related issues in a holistic manner. This council will be a high level advisory body comprising government agencies and all stakeholders.
2) A Ministry of Water Resource has been established which will oversee the water resources council. The National Water Resource Authority and the Water Resource Tribunal.
3) A Water Resource low and a master plan for water use are been developed.
4) A National Water Resource policy will be developed in order to make optimum use of the water resource and to resolve capacity demands between irrigation & power generation.

   The practice of selling wastewater for farming is not heard in Sri Lanka. Mechanisms for quality control of wastewater irrigated produce/product are not adequately developed in Sri Lanka.

Research/practice on different aspects of wastewater:

Following research has been done by Sri Lankan scholars.

1. Udagedara U.S.C. and Najim M. M. M., 2009. Potential to enhance the extent of paddy cultivation using domestic and municipal wastewater harvestimg - a case study from the dry zone of Sri Lanka. Journal of Applied Irrigation Science, 44(2): 239-248.

2 .Rajapakshe, I.H., Gunawardana, I.P.P., and Najim, M.M.M. 2007. Problems Associated with Utilization and Management of Wastewater: A Case Study from Sri Lanka. The Environ Monitor, 7(11): 4-13.

3. Rajapakshe, I.H. and Najim. M.M.M. 2007. Water and Nutrient Balance in a Paddy Field Irrigated by Wastewater During Off (Yala) Season in Kurunegala, Sri Lanka, Journal of Applied Irrigation Science, 42 (1): 77-91

Relavent web links are
Use of wastewater in paddy cultivation Aswedduma, Kurunegala
http://www.iwmi.cgiar.org/WASPA/publications.htm

http://wedc.lboro.ac.uk/resources/conference/32/Jayakody.pdf

http://publications.iwmi.org/pdf/H042868.pdf

Status and need for the knowledge and skills on the safe use of wastewater:

Due to the multidisciplinary nature of the issue skilled human resources for implementing national and international guidelines for the safe use of waste water in agriculture is not readily available for Sri Lanka. Experts are working on their fields and there is no proper coordinated mechanism to address the issue is not in place.
Wastewater management lies with the Central environmental Authority and national water Supply and drainage board of Sri Lanka. Agriculture is dealt with by a large organization: Ministry of Agriculture and agencies under it. None of these organizations have adequate capacity to assess health risks and impose health protection measures. Irrigation department mainly deal with the irrigation system.
Therefore, central coordinating unit consisting representatives from above organizations is required. Advocacy and technical support also expected from this central unit. Capacity building of existing human resource on safe use of wastewater in agriculture is essential. Few pilot projects may serve as good learning exercise.
Knowledge and skills on health protection measures following assessment of health risk, monitoring and system assessment, crop production aspects are mainly required.
Administrative inefficiencies in controlling pollution of water resource have to be dealt with. Lack of a comprehensive central database on wastewater generation treatment and disposal needs attention.

Conclusions and/or important information on the subject not covered above:

As there is a wide network of irrigation system in Sri Lanka the problem can be looked at two domains. One is how to dispose the wastewater generated safely to existing water bodies or streams which in turn will be used for agriculture. Second is to use of waste water directly for agricultural purposes where there is sacristy of water especially in the dry zone. Single solution will not fit every occasion. One has to consider the local situations in implementing wastewater management system.