JOURNAL OF INFORMATION, KNOWLEDGE AND RESEARCH IN CIVIL ENGINEERING
ISSN: 0975 – 6744| NOV 16 TO OCT 17 | Volume 4, Issue 2

THE SUSTAINABLE WATER MANAGEMENT – GREYWATER

RAUT VAIBHAV L.[1]
KUMBHAR VAIBHAV C.[2]
SALVI KETAN S.[3]
[1,2,3]Third Year Civil Engineering,SCSCOE, Dhangawadi, Bhor
Pune, India.
Vaibhavr365@gmail.com
Kumbharvaibhav79@gmail.com

ABSTRACT— *For any living being water air, food, shelter etc. Are the primary needs, for which water has the greatest importance. Pindar said "best of all things is water". In ancient times every individual or family was responsible to arrange for their water supplies. There were no collective efforts but with time urbanization came into picture and thus the collective efforts for provision of water started. But this urbanization caused a serious problem of resource exhaustion like water. Thus it is of prime importance to manage water resources in best way so that future generation could survive. Two immediate responses to counter this challenge are efficient allocation of the scarce resources, and development and use of alternative sources of water. While 'water markets' are seen as a means to achieve efficient allocation of the scare resources, treated wastewater and low-quality water are now considered as potential sources of water to supplement the freshwater supplies. The latter option that is use of reclaimed water as an alternative, with a successful and well planned reuse scheme can help achieve sustainability of water resources around the world. Wastewater reuse has been proven to ameliorate the pressure on the water environment and prevent water pollution. Greywater is one such type of wastewater generated from domestic activities such as laundry, dishwashing, and bathing which can be recycled on-site for uses such as landscape irrigation, flushing and constructed wetlands. The aim of this paper is to assess the role of greywater reuse in sustainable water management in urban regions. This paper also describes various approaches to recycle and reuse of greywater.*

KEYWORDS – *Grey water, Sustainability, recycle.*

I. INTRODUCTION

Increase in world population and urbanization leads to the decrease in available resources. Neither the growth nor essential resources be stopped. But only the method and mentality can be changed for sustainable management of such resources, so that future generations to come can be benefited from such resources. Water is one such resource whose optimum utilization is necessary now. Depletion of water resources due to high water demand and pollution makes governments and regulating bodies worldwide to develop new ways to conserve water resources, and reclaimed water use is one of the key methods being considered .Reclaimed water is wastewater originating from commercial, industrial or residential activities that has been treated or renovated to an acceptable standard for specific uses. Before being reused, grey water is generally treated, using a variety of treatment technologies of varying sophistication, to a quality where it can be reused for other applications such as subsurface and landscape irrigation, car washing, street cleaning or toilet flushing. There are a number of technologies available to treat the greywater for specific reuse applications. The use of wastewater recycled requires a proper sustainable & manageable approach.

II. INDIAN URBAN SCENARIO

Water is becoming a rare resource in the world. In India alone the International Water Management Institute (IWMI) predicts that by 2025, one person in three will live in conditions of absolute water scarcity (IWMI, 2003). Although India occupies only 3.29 million km2 geographical area, which forms 2.4% of the world's land area, it supports over 15% of world's population. The population of India as of March 1, 2001 was 1,027,015,247 persons (Census, 2001). India also has a livestock population of 500 million, which is about 20% of world's total livestock. However total annual utilizable water resources of the country are 1086 Km3 which is only 4% of world's water resources .Total annual utilizable resources of surface water and ground water are 690 Km3 and 396 Km3 respectively (Ministry of Water Resources, 1999).Consequent to rapid growth in population and increasing water demand, stress on water resources in India is increasing and per capita water availability is reducing day by day. In India per capita surface water availability in the years 1991 and 2001 were 2300 m3 (6.3 m3/day) and 1980 m3 (5.7 m3/day) respectively and these are projected to reduce to 1401 and 1191 m3 by the years 2025 and 2050 respectively. Total water requirement of the country in 2050 is estimated to be 1450 Km3 which is higher than the current availability of 1086 Km3. It is therefore essential to reduce surface and ground water use in all sectors of consumption, to substitute fresh water with alternative water resources and to optimize water use efficiency through reuse options. These alternative resources include rainwater and greywater to meet the anticipated deficit. Greywater is commonly defined as wastewater generated from bathroom, laundry and kitchen. Due to rapid industrialization and development, there is an

increased opportunity for greywater reuse in developing countries such as India, particularly in urban areas.

III. GREYWATER

3.1 Introduction

Water is used for various domestic purposes like washing, drinking, flushing, cooking, bathing watering lawns etc. all this water of use is termed as wastewater which is a mixture of all water discharges within the household including bathroom sinks, bathtubs, toilets, kitchen sinks, and laundry wash-water sources. This wastewater is characteristically divided into three sub-categories related to the organic strength or level of contaminants typically contained in the water: black water; dark-greywater, and light-greywater. Blackwater comes from toilets and contains high concentrations of disease causing microorganisms and high levels of organic contaminants. Dark-greywater primarily originates from kitchen sinks, which can also contain disease-causing microorganisms and have high levels of organics contaminants from food waste and grease/oils. Light-greywater typically consists of drainage from bathroom sinks, tubs, showers, and often laundry. It can also contain disease causing microorganisms but they are usually in much lower numbers than the other two wastewater categories. Although light-grey water is generally also considered to have lower concentrations of organic contaminants than the other two wastewater subcategories, the level of organic contaminants can be comparable to the other two depending on the circumstances.

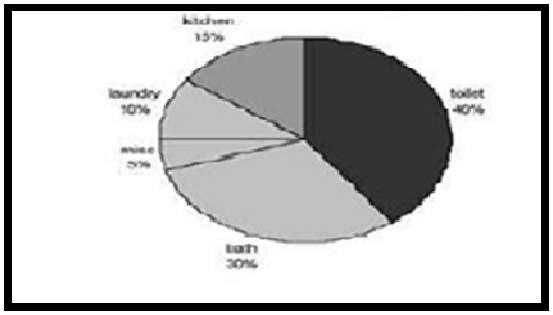

Fig.1 Breakdown of Household Wastewater By Source

From the Fig.1, clearly indicates that about typical household discharges grey water of about 65-70% of total volume of domestic water, which indicates that grey water reuse as an additional water resource.

3.2 Concepts for Grey Water Reuse

There are various methods that can be used for Grey water treatment right from simple low-cost devices that route grey water directly to applications such as toilets and garden irrigation, to highly complex and costly advanced biological treatment processes incorporating sedimentation tanks, bioreactors, filters, pumps and disinfection systems. There are a number of grey water systems commercially available, and may include one or more components including: primary solids separation, oil and grease removal, filtration, aerobic biological treatment, coagulation and flocculation, and disinfection. Some of these systems are able to remove pollutants and bacteria from grey water and the better systems include settling tanks, biological reactors and sand filters, enabling the treated grey water to be stored until needed without adverse conditionns occurring (like foul odors, corrosion, etc.) but the method which should be followed must be most effective and economic or in other words optimum in nature. Greywater reuse system can be broadly classified into two:-

3.2.1 Primary Greywater Systems:

These systems directly reuse virtually untreated domestic greywater from a single family dwelling for sub-surface lawn and/or garden watering with minimal treatment as shown in the Figure 2.These systems do not allow storage or treatment, apart from some surge storage and coarse screening/filtration which removes hair, lint and coarse particles. Greywater diversion systems which fall under this category, can be both designed-in to new homes, or retrofitted to many existing homes. Such systems use a diversion device is probably the simplest and most common method of greywater reuse. Various Diversion Technologies are available in the market under trade names such as Clivus Multrum, Envirosink®, Greywater Saver, Aquatron Separator, Nature Clear “Nature Loo”, Biolytix “Grey Water Recycler” AquaClarus “Simply Natural” etc.

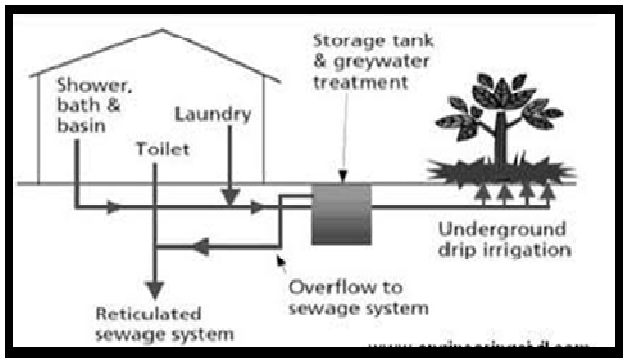

Fig.2 Primary Greywater System

3.2.1.1 Pros

Simple manual (hand adjust or preset) operation, Very low maintenance requirements (period manual screen cleaning), Ability to divert greywater for immediate reuse as required or desired Very low capital and operating cost.

3.2.1.3 Cons

No or limited (screening) treatment provided, Cannot be stored without risk of odour and other problems Does not kill or reduce the number of disease-causing microorganisms (pathogens) that may be present, Reuse application typically limited to immediate sub-surface irrigation only

3.2.2 Secondary Grey water Systems

In these systems grey water has to be treated and stored for toilet/urinal flushing and/or lawn and garden watering including surface watering methods as depicted in Figure 3.

Grey water from all sources after comprehensive treatment (e.g. screening, sedimentation, biological treatment, sand and/or carbon filtration, membrane techniques and disinfection) aims to achieve high quality of the treated grey water. Secondary grey water systems may be used for multiple occupancy buildings.

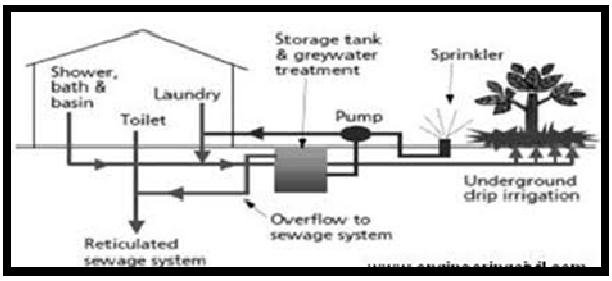

Fig.3 Secondary Greywater System

3.2.2.1 Pros

Potential for high degree of biological treatment ,High degree of operations flexibility to accommodate varying greywater strength ,Suitable for treating mixed wastewater for reuse applications if effluent is filtered and disinfected – which also allows the reuse water to be stored

3.2.2.2 Cons

Complex operational requirements, High operating cost, High capital costCan be subject to process upsets due to high greywater flows or chemicals present, resulting in poor effluent quality or discharge of large quanities of solids (sludge) that may block downstream irrigation pipe or create problems for reuse applications (e .g .sludge or sediment buildup in toilet tanks, reduced disinfection effectiveness etc.)

IV. ADVANTAGES AND DISADVANTAGES OF GREYWATER USE

4.1 Advantages

1. The obvious key advantage of domestic greywater use is that it replaces or conserves potable water use, and can reduce the cost of potable water supply.
2. Appropriately applied, greywater may contain nutrients (e.g. phosphorus and nitrogen from detergents), benefiting plant growth and resulting in more vigorous vegetation.
3. Offers potential cost reductions for regional sewage treatment facilities. Removing greywater from residential wastewater drainage to sewer decreases the flow through the sewer and to the treatment plant and enables the existing infrastructure to service more connections.
4. Greywater reuse applications require limited or no treatment, and where the greywater otherwise would have to be pumped to a centralized treatment plant and treated.
5. Greywater could supply most, if not all, of the irrigation needs of a domestic dwelling landscaped with vegetation in a semiarid region.
6. In addition to applications for outside irrigation, greywater can also be used for toilet flushing and, if treated to an advanced secondary or tertiary level, can also be used for a wide range of domestic water uses including bathing, showering, and laundry.

4.2 Disadvantages

1. Greywater may contain sodium and chloride, or other chemicals that can be harmful to some sensitive plant species. Additionally, greywater is alkaline (high pH) and shouldn't be used to irrigate acid-loving plants such as rhododendrons or azaleas
2. Resulting diminished sewer flows from domestic greywater could potentially result in insufficient sewer flows in some circumstances to carry waste to the sewer plant (e.g. pipes with low slopes), or may result in a high strength sewage that combined with lower flow may lead to odor and corrosion problems in the centralized sewerage systems
3. Concern regarding the public health implications of greywater reuse and the need for research to determine the risks of greywater reuse
4. Cost of treatment and diversion/transfer pipe & pumps.

V. ECONOMIC EVALUATION OF GREYWATER REUSE

The two key capital cost components for greywater systems are for treatment and dual plumbing. In general, the costs for a greywater system can be classified as follows:

1. Design costs and permit fee,
2. Installation costs,
3. Operation and maintenance costs.

The design costs depend greatly on the suitability of the site and the complexity of the system. If greywater reuse becomes a legal practice, it would be expected that a permit would be necessary to construct an appropriate system and that there would be a fee. The installation costs would include materials and labor. These would be site and system specific. In some cases the owner might prefer to do part of the work, but for some specific components of the system a licensed specialist (plumber and/or electrician) would be required. The operating costs include electricity, disposable filters, and disinfectants. For systems with pumps and other ancillary equipment it may be necessary to meet the cost of repair or replacement parts.

VI. COMPONENTS OF GREYWATER REUSE SYSTEMS

The system should be as simple and easy to use and maintain as possible. The system Also , should minimize risks to human health, either by providing for adequate treatment of the greywater, or by with humans. The system also should minimize the risks to plants, which may arise from some of the contaminants in the greywater such as from chemicals contained in soaps or detergents (e.g. boron, bleach, and sodium), which could adversely affect plant health. The primary components for greywater reuse system intended to generate reuse water for surface irrigation or indoor usage with potential for human contact include:

1. Filters to remove hair, lint and coarse solids particles
2. Sedimentation tanks to separate and remove grease, oils & settle able solids from the greywater;
3. Aerobic biological treatment to remove soluble organic contaminants
4. Final clarification or filtration to remove solid particles and bacteria generated during biological treatment
5. Disinfection to remove pathogenic micro-organisms
6. Reuse water storage tank

CONCLUSION

Above discussion shows that the reuse of wastewater will not only save the money but also it retains the natural resources and helps to develop a sustainable environment. The scarcity of fresh water is increasing day by day. For the development of urban infrastructure, it is essential to have wastewater reuse for non- potable application since it will be very difficult to provide the huge water requirement for the developmental projects through local water supply authorities. Now a days, the local authorities as PCBs, National authorities such as MOEF etc. have set stringent rules in providing water and also have set standards for effluent from each development. Hence from the above discussion Grey water re-use can be considered as an effective way of decreasing water management have been encouraged by the Government by awarding Green Certification, to preserve the most precious resource of earth, 'Water'

REFERENCES

1. Guidelines for water reuse by US Environmental protection Agency, 2004
2. City Water Supply and Sewerage Board, Tariff of water and sewage.
3. Greywater Reuse for Sustainable Water Demand Management, Murad J. Bino International water Demand Management Conference, May 30- June 3, 2004.
4. Capital Regional District, Grey water Reuse Study Report, November1, 2004.
5. Grey water reuse in rural schools-wise water management, Guidance manual.
6. National Environmental Engineering Research Institute, January 2007