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INTEGRATED WATER MANAGEMENT SYSTEM IN RESIDENTIAL BUILDING

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Abstract- *The main sources for potable water are ground water, surface water and rain water. Densely populated country like ours, ground water resource has already been too much extracted. Surface water bodies are becoming susceptible to unregulated industrial discharge. In this case reusing grey water coupled with rain water harvesting will be a good solution to some extent. Our study is carried out to investigate the potential of reusing grey water and a combined rainwater harvesting system for substituting and supplementing fresh water supply. We have collected gray water and pure water sample from several places of Chittagong city. Tests of different parameters are done. By observing and comparing the result of treated and untreated grey water, it can be said that this water can be made reusable. Results of this project suggest that treated grey water and rainwater will be a major source of water for our future generations.*

Keywords: Gray water, Reuse, Rain water harvesting, Treatment.

1. INTRODUCTION

Water is one of the most precious gifts of nature to mankind. Due to over exploitation & pollution, fresh water has become a scarce commodity. Increasing population &its necessities have lead to mark deterioration in water.

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water.

The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. Natural water contains different types of impurities are introduced in to aquatic system by different ways such as weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including mining, processing and the use of metal based materials (Adeyeye 1994, Asaolu 1997, Ipinmoroti 1993). The increased use of metal-based fertilizer in agricultural revolution of the government could result in continued rise in concentration of metal pollutions in fresh water reservoir due to the water run-off. Also faucal pollution of drinking water causes water born disease which has led to the death of millions of people. (Adefemi, 2010)..

Bangladesh is one of the largest climate ravaged countries all over the world. And so it makes one of the weakest when it comes to fight the crisis. For most people living in south west part of Bangladesh climate change is not something they read about on newspaper its really change their everyday lives. We may call Bangladesh the country of six seasons. But wrecking ourselves with our own population we created the country with 2 seasons only. The summer is extremely hot and the winter is very cold which causing problems in harvesting crops and also the search for safe water.

Lack of access to safe drinking water and adequate sanitation facilities are a significant barrier to improving the health and wellbeing and reducing poverty in Bangladesh. It's a sad fact that every year 1.6 million children dies for the want of safe water while 30 percent of them are from Bangladesh.

Bangladesh's water crisis affects both rural and urban areas, and is a matter of both water scarcity and water quality. While Bangladesh has made commendable progress in supplying safe water to its people, gross disparity in coverage still exists across the country.

The WHO estimates that 97% of the people of Bangladesh have access to water and only 40% percent have proper sanitation. With a staggering 60% of the population that has to endure unsafe drinking water, the nation is in danger. The availability of this water greatly fluctuates throughout the year as the warmer season brings massive amounts of water in frequent monsoons and the cooler season brings drought. The infrastructure cannot adequately deal with the barrage of water in monsoon season so the water is not saved for the drier months. Of the water that is available, over 80 percent is used for agriculture. The great rivers (Brahmaputra, Meghna, and Ganges) all originate in other countries and the amount of water that eventually gets to Bangladesh is greatly limited by the booming populations of China and India. Only 7% of the total land that creates the watersheds for these rivers is in Bangladesh. Therefore the Bengalis have very little control over how much water they receive from these sources.

1.1. Waste Water:

Spent or used water with dissolved or suspended solids, discharged from homes, commercial establishment, farms, and industries. any water that has been adversely affected in quality by anthropogenic influence.

Two types of wastewater are created in a home: grey water and black water.

1.2. Grey Water:

Gray water is wastewater from non-toilet plumbing fixtures such as showers, basins and taps. It is the waste water generated in the bathroom, laundry, and kitchen. Grey water is therefore the component of domestic wastewater, which has not originated from the toilet or urinals. Any wash water that has been used in the home, except water from toilets, is called grey water. Dish, shower, sink, and laundry water comprise 50-80% of residential "waste" water. This may be reused for other purposes, especially landscape irrigation. In Bangladesh, full waste water treatment and re-use is rarely feasible

1.3. Black water:

It is the liquid waste which originates in the sanitary conveniences, e.g. water closet, urinals, Baths, sinks etc of dwellings, commercial or industrials facilities and institution. Black water is water that has been mixed with waste from the toilet. Because of the potential for contamination

by pathogens and grease, water from kitchens and dishwashers should be excluded from grey water and considered as black water.

2. METHODOLOGY

Water reclamation and reuse provides a unique and viable opportunity to augment traditional water supplies. As a multi-disciplined and an important element of water resources development and management, water reuse can help to close the loop between water supply and wastewater disposal. Effective water reuse requires integration of water and reclaimed water supply functions. The successful development of this reliable water resource depends upon close examination and synthesis of elements from infrastructure and facilities planning, wastewater treatment plant sitting, treatment process reliability, economic and financial analyses, public acceptance, and water utility management.

A key factor limiting the implementation of water reuse systems is often the cost of infrastructure needed for a conventional water reuse system, where the water reuse system consists generally of an upgraded secondary treatment process sited at an existing wastewater-treatment facility. It is often prohibitive logistically to return reclaimed water to urban areas where it could be used at maximum benefit to offset potable water supply consumption. The issues related to the return of reclaimed water to urban areas can be overcome, in part, using distributed water reuse systems such as satellite and decentralized configurations.

Study Area:

Six different areas in Chittagong city were selected to study on Chittagong city Building's used water. Those are

1. Jamal khan.
2. Monsurabad.
3. Akbarshah.
4. Halishahor.
5. Bus terminal.
6. Chandgaon.

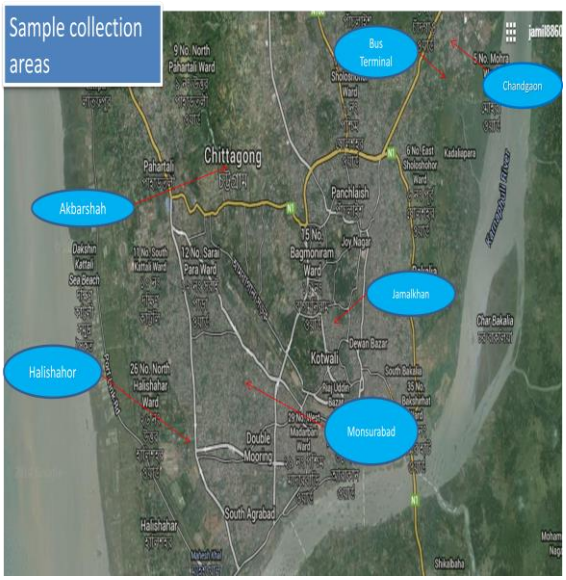

Fig.1: Area of sample collection (Google Map)

Sample type:

Three types of sample were collect:

- Tap water (unused).
- Used kitchen water.
- Used water from washing application (Water from shower. Wash basin, cloth washing)

2.1. Sample collection:

Three samples from each area were collected, i.e. total 18 samples were collected from the Chittagong city. The kitchen water samples were collected for 24 hours from 11.00 am to 11.00 am next day. The samples of washing applications were collected for 24hours from 9.0am to 9.00am next day. The samples were collected in plastic bottles. The bottles were cleaned and dried before collecting samples. After kitchen usages the sample was collected.

2.2 Laboratory Test:

The unused tap water and untreated grey water were tested for pH, Color, Turbidity, Chloride, BOD_5 (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), TS (Total Solid), TSS (Total Suspended Solid), TDS, Alkalinity and Hardness. Those tests were carried according to standard method.

3. RESULT AND DISCUSSION:

The variation of different parameters of different samples which we tested are shown below:

From the pH value's shown in the graph, we can say that the tap water from all the area are within the standard drinking range 6.5-8.5. In case of kitchen water sample acidic nature of water prevails. On the other hand, samples from the washing application are very little alkaline, but not much diverted from the tap water except the sample from Halishahor.

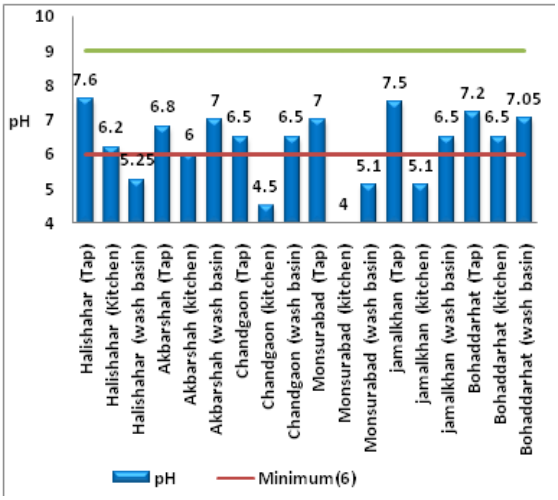

Fig 3.1: Variation of pH

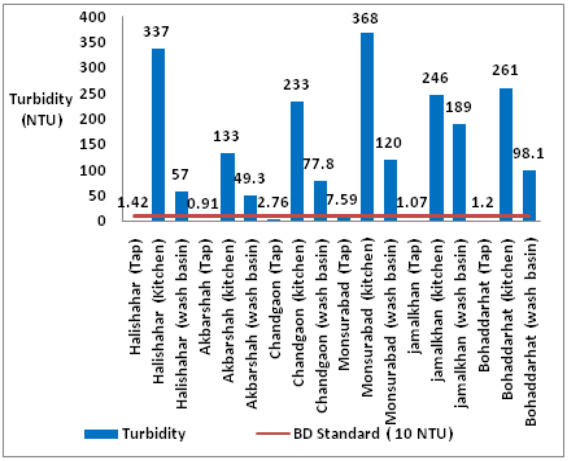

Fig 3.2: Variation of Turbidity

Considerable amount of change in the value of turbidity occurs in kitchen wash water . These values are needed to be carefully considered in choosing the right treatment methods. Generally , 15 NTU is considered as the standard as per Bangladesh Guidelines which is way too exceeded by kitchen and wash basin samples. Kitchen water has the poorest condition with respect to turbidity.

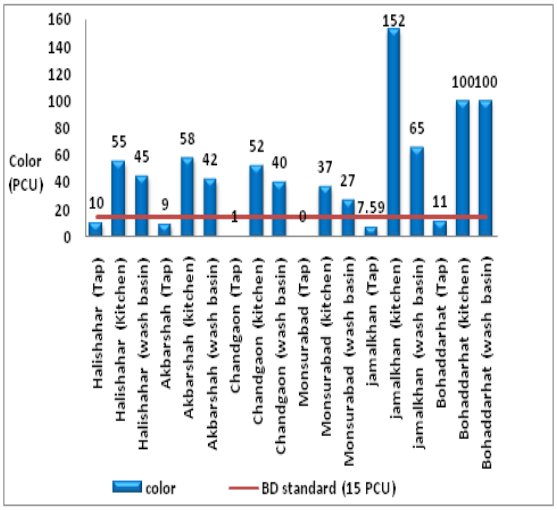

Fig 3.3: Variation of color

Color change is not that important if we want to purify water only for non potable use. But for aesthetic reasons we need to keep these variations in mind. As per Bangladesh guideline , 15 PCU is recommended as standard value. If used for non potable uses it is of little importance.

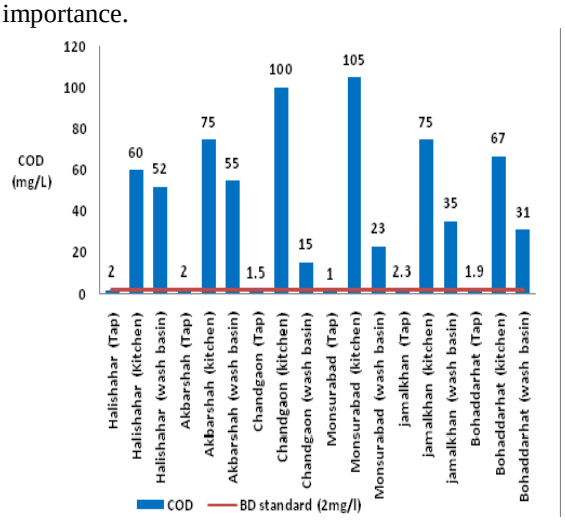

Fig 3.4: Variation of COD

Change occurs in the value of COD in kitchen and wash basin where kitchen water accounts for the greatest change. Standard for COD is 2 mg/L. Kitchen and wash basin samples divert more than 50 units.

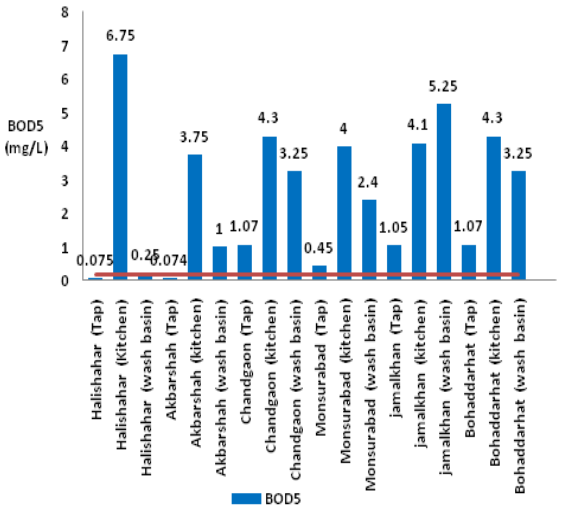

Fig 3.5: Variation of BOD5

BOD is one of the most important parameter while treating water and variations are noted from this graph. High value of BOD content is present in kitchen water. As per Bangladesh guideline , 0.2 mg/L is the standard value. In all cases the value exceeded way over this value.

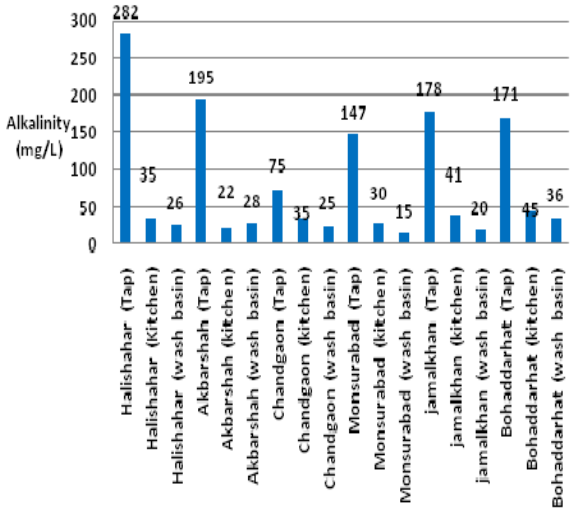

Fig 3.6: Variation of Alkalinity

The value of alkalinity gets reduced when used and posses no threat. It is of little importance and do not need any serious considerations.

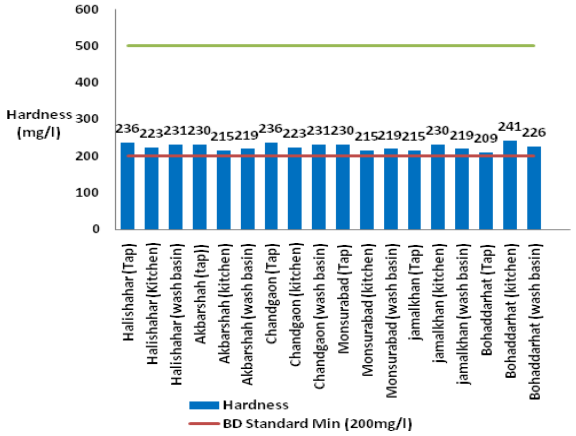

Fig 3.7: Variation of Hardness

Hardness is not that important because its change is not that high to exceed the tolerable limit. Little fall in values occur after usage.

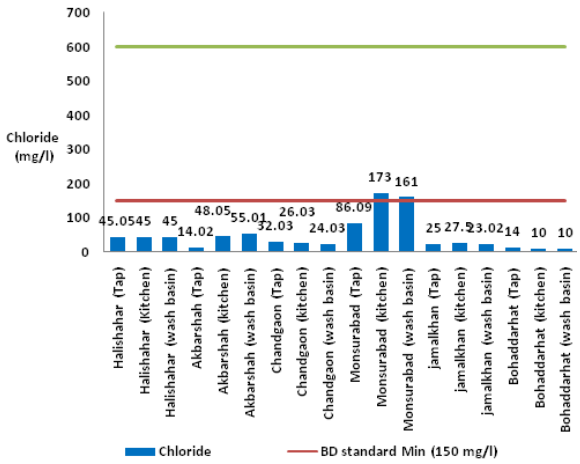

Fig 3.8: Variation of chloride

Sample of Water of Monsurabad area shows huge deviations from eligible values.

Otherwise , it is more or less around the standard value.

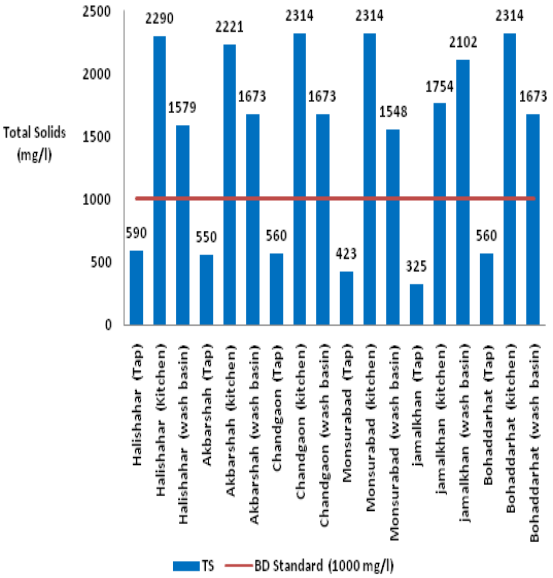

Fig 3.9: Variation of TS

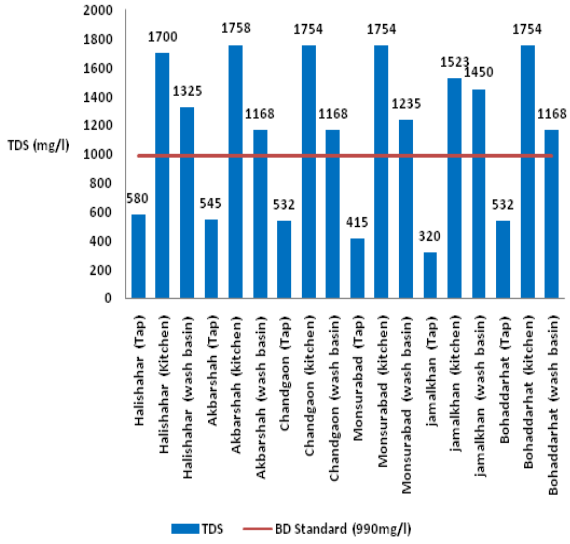

Fig 3.10: Variation of TDS

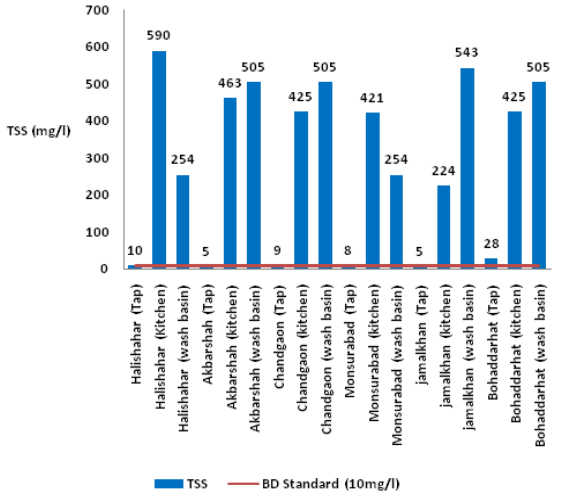

Fig 3.11: Variation of TSS

TS, TDS, TSS are the most important parameter when we consider treating domestic water as it is responsible for

different bad sides . Therefore, choosing a suitable treatment methods need careful considerations of these parameters because these parameters are required to be within range so that water will be aesthetically good.

3.1. Suitability of Untreated and treated Grey Water for Non Potable Uses:

Due to low contamination of grey water, it can be reused in various non potable uses. Observing the data provided in tables it can be said that kitchen water can be made reusable without treatment. Other water quality parameters do not satisfy the guideline provided for various non potable reuses due to its high concentration of suspended solids.

After treating grey water it poses more pertinence for reuse application. Due to the reduction in the concentration of suspended solids, kitchen water and wash basin water can be used for toilet applications.

3.3 Grey water treatment Process:

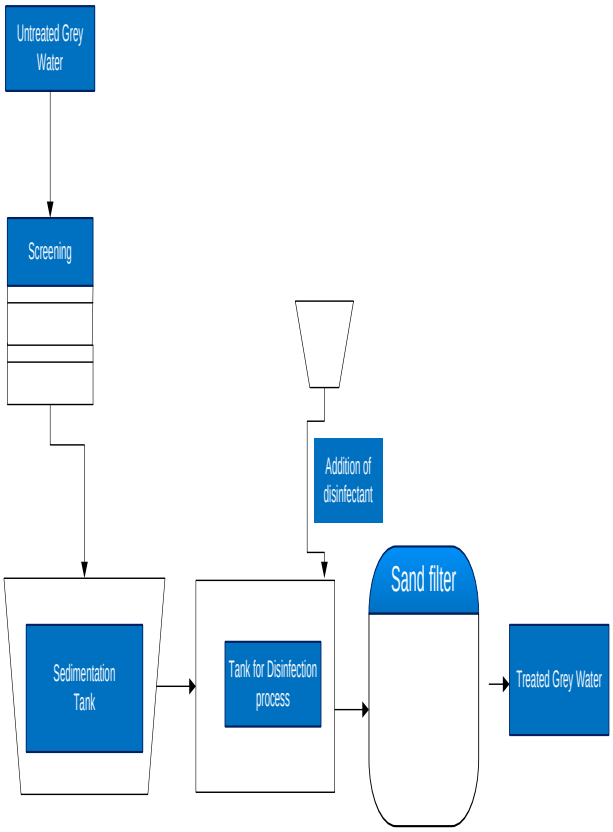

Fig 3.12: Flow chart of treatment process

4. CONCLUSIONS

The variations of different parameters are not so big and can be easily be brought within limits. Considerable changes occur in turbidity, TS, TDS, TSS, BOD and need careful considerations. Other parameters are so minimally changed or so near to the standard limits that if we use the water only for toilet flush, car washing, gardening and other non potable uses then those parameters need not to be considered for purification system designs .

The construction of our proposed system will require minimum cost if local materials are used and will be feasible for the households of Dhaka and Chittagong city. Treated grey water can be used for toilet flushing, car washing, gardening, and other non potable uses in city buildings. Further experiments are necessary to ensure pure water for residents.

Water is a key issue for sustainable development of future Bangladesh. Treated grey water can play a major role in substituting and supplementing the fresh water supply.

This study provide the information that by further research it is possible to make an efficient , cost effective , reliable and sustainable on site grey water treatment system..

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