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Wastewater Quality at Different Stages of Decentralised Wastewater Treatment Process in the Peoples Panchtala Colony at Kalishpur, Khulna

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Abstract

The main purpose of this paper is to determine wastewater quality at diferent stages of Decentralized Wastewater Treatment System (DEWATS) of the Panchtola Colony at Khalishpur, Khulna. To conduct the experiment, wastewater samples were collected from six different points such as in and out point of settler tank, middle and out of anaerobic center, out of planted filter, out of polishing pond of DEWATS at regular time interval. Different parameters such as Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), P^H, Nitrate, Phosphate, Temperature, Oil and Grease, Total Dissolve Solid (TDS), Fecal Coliform (FC), Dissolve Oxygen (DO), Total Suspended Solid (TSS) etc. were determined of collected wastewater sample. The test results show that the concentration of all harmful parameters were reduced to acceptable limit. This study was provided a clear vision that existing DEWATS can provide reliable low-cost sanitation and wastewater treatment solutions.

Keywords: *Decentralized, wastewater, compost, Fecal Coliform, Oil Grease.*

1. Introduction

Khulna is the third largest city in Bangladesh which is known to all as an industrial area. Most of its industries such as Jute mills, News print mill, and Hard board mill are situated in Khalishpur, Khulna. In the past, khalishpur was very busy and crowdie area when mills were active. To meet up the accommodation of factory workers a total of eight building were constructed at Peoples jute mill area in 1982. Every building has five floors, and for this reason it is called Peoples Panchtala Colony.

In order to address the pollution from the Peoples Panchtola Colony at Khalishpur in Khulna, the wastewater that is being discharged directly into the nearby open areas, would require proper treatment with regards to environmental conservation. Prior to the start of Nabolok EEHCO project which was funded by Water Aid Bangladesh, mostly the residential wastewaters including sewage were being disposed directly either into storm water drains or open areas without any treatment. Due to unaffordable cost of construction, most of the drains in the towns and cities are open as a result they are misused, sometimes serving as defecating sites for homes without adequate toilet facility [2]. In consequence, self-purification capacity of receiving water bodies is overloaded and it causes surface and ground water pollution, impacting directly to the health of community, reducing the value of environment [1].

To improve this dramatic situation, a new wastewater treatment plant was therefore needed. But the Municipality could not afford a centralized system for its entire area. For the circumstances, a small scale decentralized wastewater treatment system would be the most suitable to reduce the pollutant to an acceptably low level.

Nowadays, the decentralized approach is very popular system for sustainable wastewater management especially for developing countries like Bangladesh, where the water and sanitation issues are becoming a more and more important issue. To have a sustainable wastewater treatment system, an integrated assessment of each

alternative based on its economical, environmental, social, health and institutional aspects is necessary[5]. Decentralized wastewater management may be defined as the collection, treatment, and disposal or reuse of wastewater from individual homes, clusters of homes, isolated communities, industries or industrial facilities, as well as from portions of existing communities at or near the point of waste generation [3]. Up to 1,000 cubic metre of domestic and non-toxic industrial sewage can be treated by this system [6]. DEWATS applications are based on the principle of low - maintenance since most important parts of the system work without electrical energy inputs and cannot be switched off intentionally [4].

Decentralized system is the combinations of aerobic and anaerobic treatment process. The anaerobic treatment process comprise of settlers, baffle reactors and anaerobic filters. The aerobic treatment process has horizontal planted gravel filters and a polishing pond (Figure 1). The basic idea of that is to treat the wastewater (possibly together with refuses) on-site by means of low-cost treatment systems, and make direct use the treatment products (water, compost, biogas) [1]. Decentralized systems can work very well, that afford very high levels of treatment.

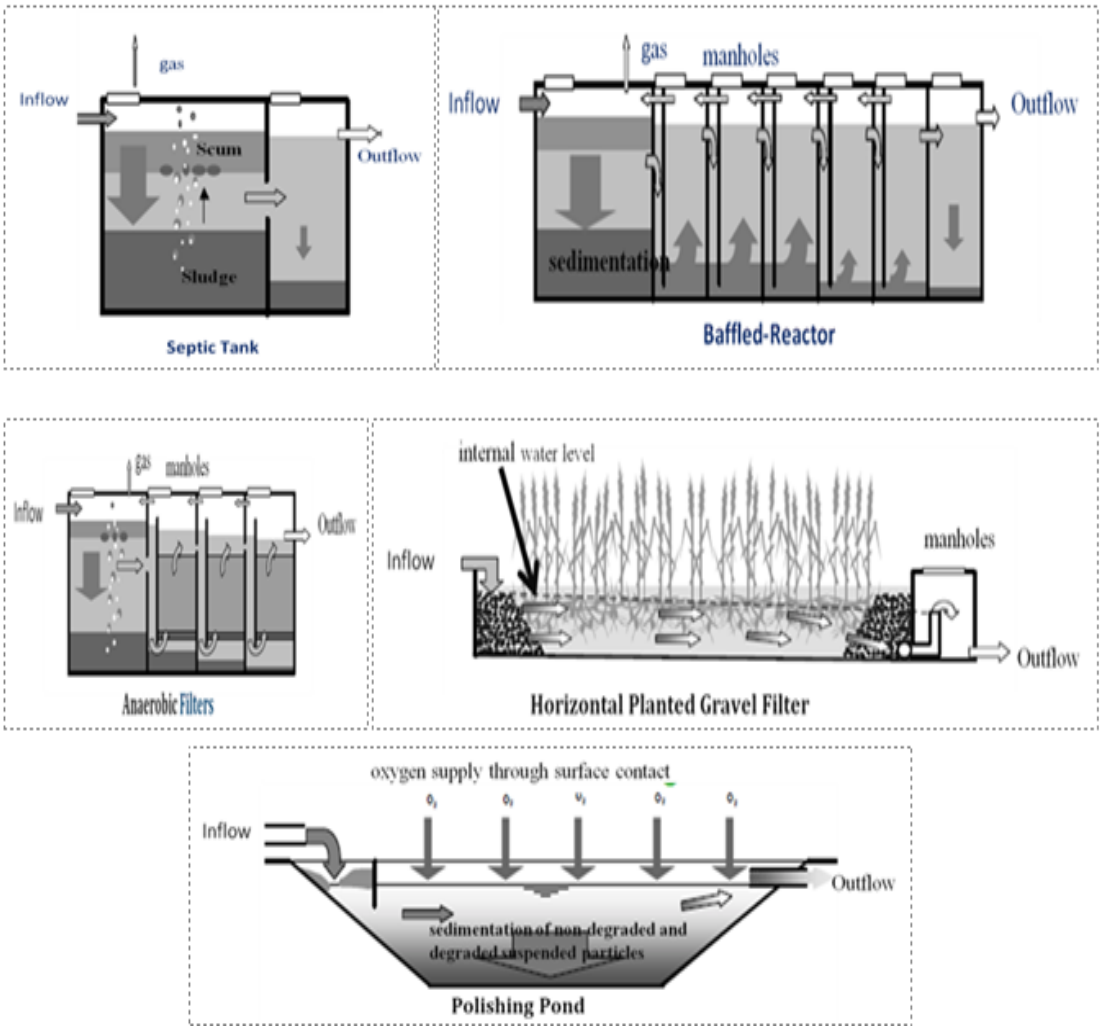

Fig.1. Schematic diagram of DEWATS

2. Before implementation of the Nabolok EEHCO project

Residential wastewater even sewage and Wastes were dumped beside their residence and near about the premises of their residence because there were not any sewerage systems or damping place (Figure 2). Thus foul odor were emitted which pollute the environment. Blockage of drainage systems occured for wastewater

overflow during rainy season. For that reason surface water bodies as well as groundwater was polluted. Moreover, wastes were spread of by scavenging birds and animals.

Fig.2. Waste and wastewater including sewage dumping practices before the Nabolok EEHCO project implementation.

3. Methodology

Collection of wastewater samples

The wastewater samples were collected from six different points such as in and out point of settler tank, middle and out of anaerobic center, out of plant filter, out of polishing pond of existing Decentralized Wastewater Treatment Systems of the Panchtola Colony at regular time interval. The wastewater samples were taken into the laboratory for examining its quality. Different parameters such as BOD, COD, P^H, Nitrate, Phosphate, Temperature, Oil Grease, Total Dissolve Solid (TDS), Fecal Coliform (FC), Dissolve Oxygen (DO), Total Suspended Solid (TSS) etc. were determined of collected wastewater sample.

Analytical methods

Laboratory determination of BOD_5 and DO were accomplished by using membrane electrode DO meter (HACH, USA). For the determination of COD, closed reflux method using $K_2Cr_2O_7$ oxidizing agent was used. The determination of pH and Temperature were done by using electrodes (HACH, USA). For TDS and TSS in wastewater sample was determined at 105^0C using laboratory oven. For determination of Nitrate (NO_3) and phosphate (PO_4), Nitrover and Phosver reagents were used [7]. For determination of Faecal Coliform, Membrane Filter procedure was used. For determination of Oil and Grease Partition-Gravimatric method was used. The calculated data of wastewater samples were compared and analyzed with Recommended Values.

The following recommended values of waste water are usually allowed for disposal in water bodies:

- BOD_5 of 40 mg/l.
- TSS of 100 mg/l.
- Faecal Coliform of 1000 No/100ml.
- Phosphate of 35 mg/l.
- Nitrate of 250 mg/l.
- Temperature of 30ºC.

4. Results and Discussion

Wastewater quality

Biochemical oxygen demand (BOD_5) and chemical oxygen demand (COD)

A high concentration of organic matter was found in intlet of settler tank. BOD_5 values of waste water samples in Outlet of polishing pond were 33.2, 34, 28.2, 37 and 10.8 mg/l respectively. In Bangladesh Gadget,1997, BOD_5 is 40 mg/l. The DEWAT had brought BOD_5 levels down from 560 mg/l to nearly 35 mg/l. Values of COD in Outlet of polishing pond were 520, 980, 280, 820 and 340 respectively. The below graphical representations of BOD_5 and COD provided that the values were less in Outlet of polishing pond (Figure 3). So it is a clear indication that waste water Outlet of polishing pond can be mixed natural water bodies or used for irrigation purposes.

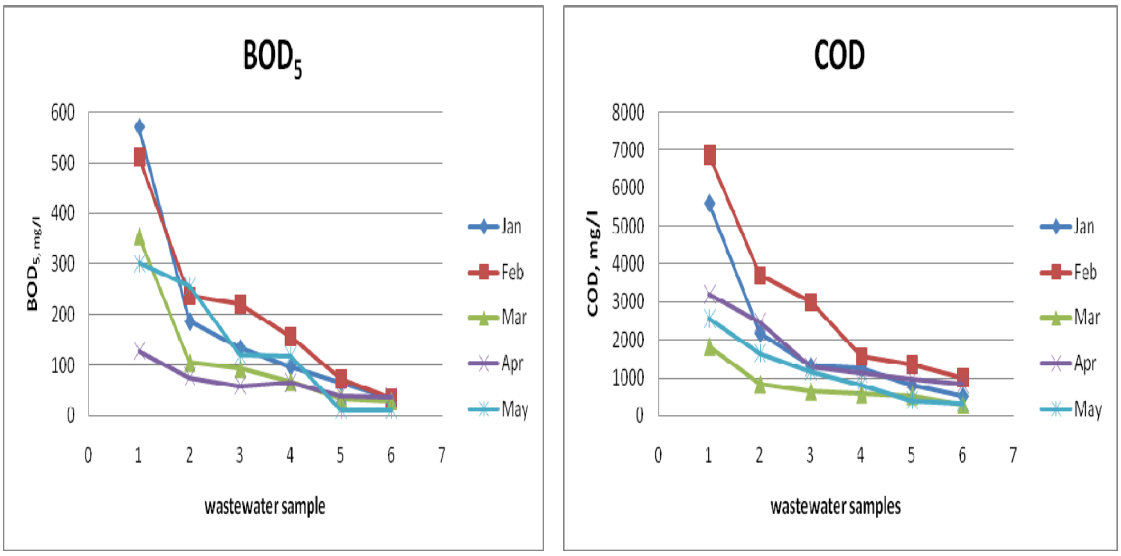

Fig.3. Graphical representation of BOD_5 and COD of waste water samples.

Nitrate and Phosphate

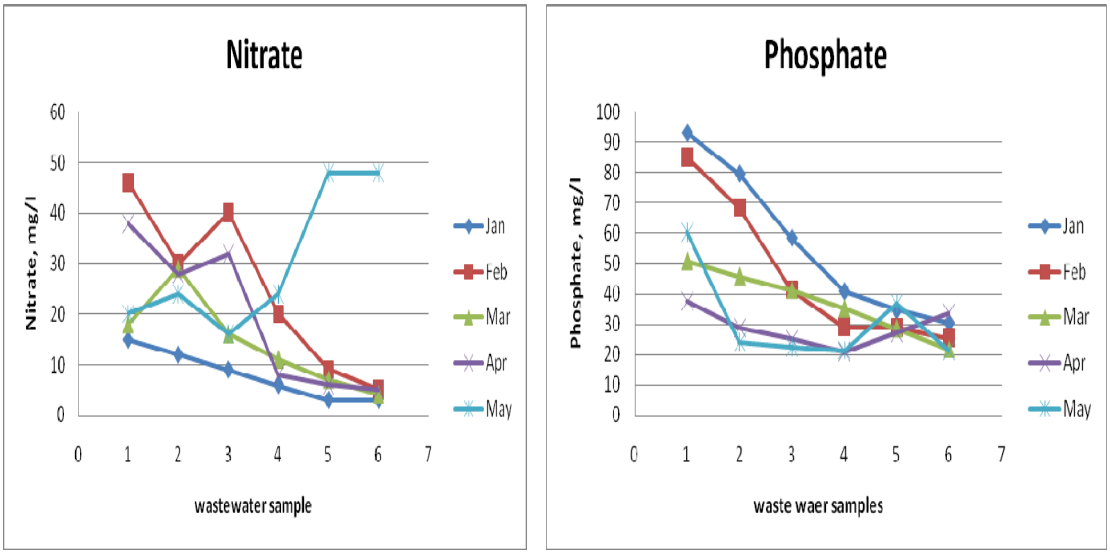

Fig.4. Graphical representation of Nitrate and Phosphate of waste water samples.

The above graph of Figure 4 also provided that Nitrate and Phosphate values were decreasing in Outlet of polishing pond which can be mixed with natural water bodies or used for irrigation purposes.

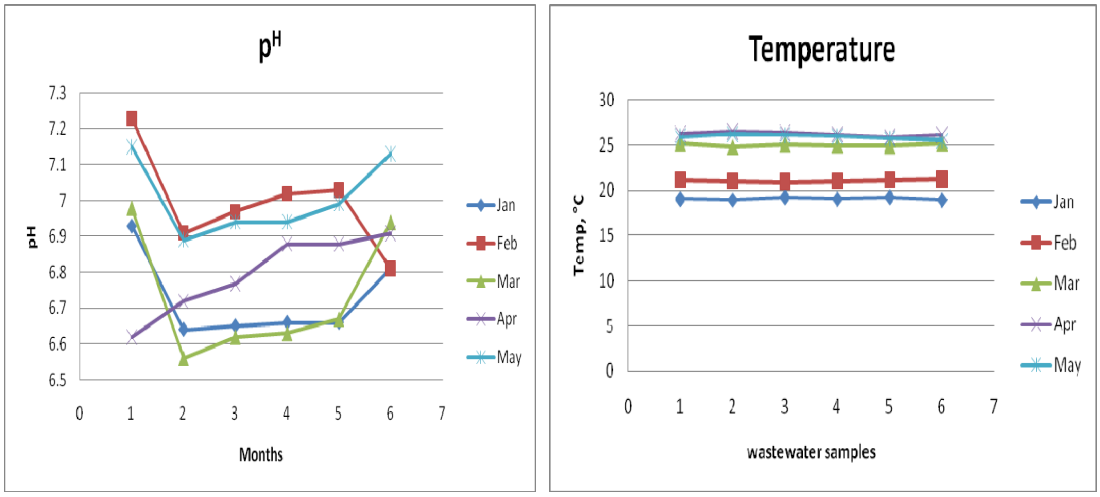

Fig.5. Graphical representation of pH and Temperature of waste water samples.

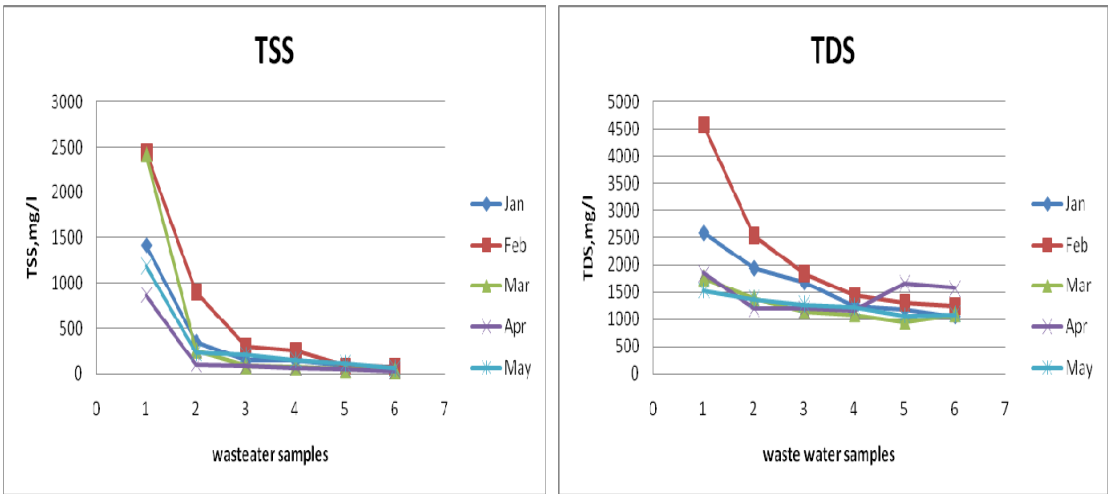

Fig.6. Graphical representation of TSS and TDS of waste water samples.

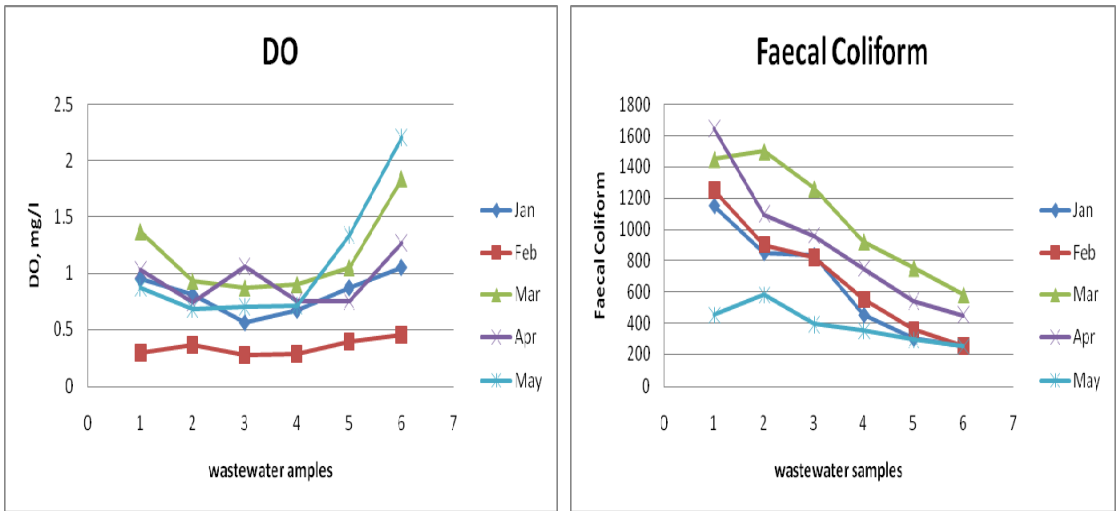

Fig.7. Graphical representation of DO and Faecal Coliform of waste water samples.

The values of Oil and Grease were zero for all collected waste water samples. Some other parameters such as pH, Total Dissolved Solid (TDS),Total Suspended Solid (TSS), Faecal Coliform, Temperature were also decreasing in Outlet of polishing pond. The values of DO were increasing which indicate that oxygen level were increased in treated wastewater sample. So,treated waste water can be mixed with natural water bodies or used for irrigation purposes.

There were some constraints in existing DEWATS system. The main Constraint was related to the operationalizing and functioning of the DEWAT which required regular supervision and community support. The rains in the monsoon affected the quality of treated wastewater which directly hampered the DEWAT operations. The main Constraint in the proper functioning of the DEWAT was to keep the water flowing through the system by screening the garbage or polythene and prevention of silting inside the chambers.

5. After implementation of the Nabolok EEHCO project

DEWAT has created clean and aesthetic environment (Figure 8). The open drain which was a breeding ground for disease germs is now safe space for colony people. For the successful functioning of the system, a community managed operation and maintenance system has been designed. A full time sweeper from the local community has been employed to look after the operation and maintenance of the system.

Fig.8. After implementation of the Nabolok EEHCO project

6. Conclusion

The wastewater quality was found to be gradually improved. The value of wastewater quality parameters such as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil and Grease, pH, Total Dissolved Solid (TDS), Total Suspended Solid (TSS), Faecal Coliform, Temperature Nitrate and Phosphate were also found to be gradually decreased. So, it is a clear indication that the treated wastewater can be mixed with natural water bodies or used for irrigation purposes or reused for the community toilet flushing.

7. References

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