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"TREATMENT OF GREY WATER USING HYBRID REACTOR"

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Abstract: *Water scarcity is emerging as a major issue in the urban and peri-urban regions of India which is caused by a high population density, low rainfall and high groundwater extraction. Grey water treatment is one of the most beneficial way of treating and re-using water for day to day use as decentralized approach to overcome short range water shortages. There are several well established water treatment technologies that can be used to treat and re-use water as membrane bioreactor (MBR), rotating biological, contactor (RBC), constructed wetland (CW), etc. This paper focuses on treatment of Grey water using Hybrid reactor, hybrid reactor gives better quality of water that can be re-used.*

Key words: Grey water, re-use, Hybrid reactor.

1. Introduction:

Water shortages are emerging as major issues brought about by factors such as urbanization, pollution of water bodies, human lifestyle needing higher water demands, industrial growth increasing water use and higher water consumption due to urbanized lifestyles. Since new water sources are unlikely to be discovered, wastewater recycling can alleviate existing shortages. As Grey water is available easily and is available in abundance it makes it one of the best ways for re-using waste water. Grey water is defined as the urban wastewater that includes water from baths, showers, hand basins, washing machines, dishwashers and kitchen sinks, but excludes streams from toilets. According to WHO, the term "greywater" refers to untreated household wastewater, which has not been contaminated by toilet waste. It is considered high volume, low strength waste water with high potential for reuse and application.

In contrast to other methods of water capture like rainwater harvesting, which depends on hydrological circumstances, greywater reuse has been seen as a stable method of maintaining water security. Greywater accounts for up to 75% of the waste water volume produced by households, and this can increase to about 90% if dry toilets are used. It has also been estimated that greywater produced accounts for about69% of domestic water consumption. The major factors that affect the grey water vary highly among households depending on the food habits and standard of living. The major factors that affect the grey water vary highly among households depending on the food habits and standard of living. Grey water consists of low levels of contaminating pathogens and nitrogen, re-use and re-cycling of grey water is receiving increasing attention.

Re-use of greywater has been an old practice, and it is still being done in areas that are water stressed. The aim of this study is to assess the performance of greywater treatment system using a Hybrid reactor. Hybrid reactor is a reactor that combines two/more reactors in series or in parallel (as suitable) that is used to enhance the water quality of water obtained after its treatment.

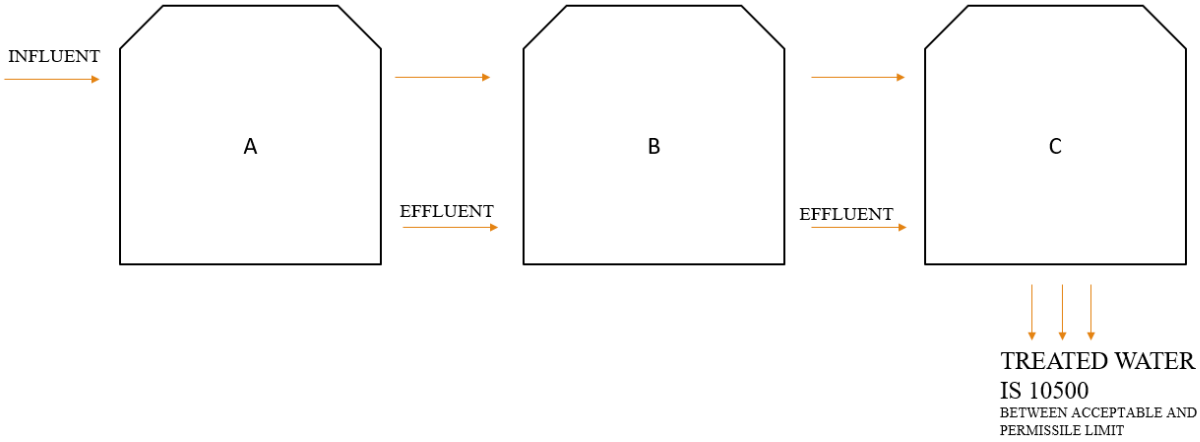
2. Material and methods

2.1. Study area context:

Study area for this project is 'H-block, Boys hostel College of Engineering Pune.' A source of Grey water behind boy's hostel from sewer tank, as shown below.

2.2. Hybrid treatment system:

Hybrid Water treatment system is different combination of existing water treatment system to treat water bodies more efficiently. Here we have placed two reactors in series one being aerator and another vertical flow Constructed Wetland. Effluent of first reactor system would be influent of later system. Further the limits would be checked as per IS 10500 between acceptable and permissible limit.



2.2.1 Aerator:

In order to remove dissolved gases like carbon dioxide and oxidize dissolved metals like iron, aeration is the process of putting water and air into close contact. Additionally, it can be used to purge water of volatile organic compounds (VOC). The treatment plant's first significant process is frequently aeration. Before they can affect the treatment processes, components are eliminated or altered during aeration.

Aeration reactor

Aeration motor

Aeration bubbles

Description: Inlet tank is provided with Grey water to feed into Aeration tank. Aeration tank is provided with a mechanical motor with aeration bulb, so that when it is placed in aeration tank bubbles get generated.

Different iterations of contact period for aeration is calculated to get maximum efficiency of BOD removal.

Table -1: Contact period for Aeration

Time (minutes)	Before BOD mg/l	After BOD mg/l
60	177	172
120	177	163
180	177	157
240	177	151
300	177	149

It is found that after 4 hours i.e. 240 minutes not much of change in BOD is seen.

2.2.2 Vertical flow Constructed Wetland:

An artificial wetland is a type of organic wastewater treatment system that mimics and enhances the functions of naturally occurring wetlands in the purification of water. Water, aquatic plants (such as reeds and duckweed), naturally occurring microorganisms, and a filter bed (often made of sand, soil, and/or gravel) are all used in the system. Vegetation is among the most important component, the vegetation that are most often used in constructed wetlands are persistent emergent plants, such as bulrushes (Scirpus), spike rush (Efeocharis), and other sedges (Cyperus), rushes (Juncus), common reed (Phragrnites), and cattails (Typha).

Cattails Canna Indica is commonly used plant for wetland establishment in China and other countries as it has rapid growth rate, large biomass and beautiful flowers with great capability of nutrient removal.

Cattails Canna Indica

Vertical flow constructed wetland is made with different layers of pebble rocks (well graded), sand and Canna Indica mounted above. Pebble source - **Mula Rive (Karmoli Village)**

40 mm

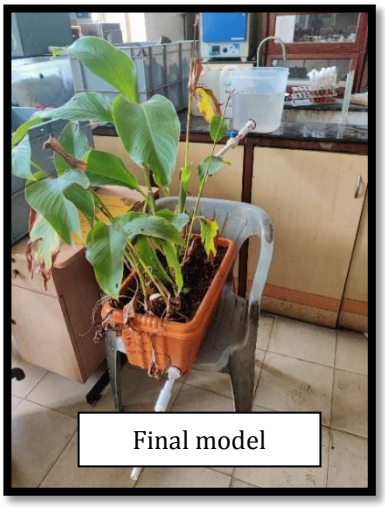
32 - 40 mm

20 mm

Sand

Black cotton soil

Canna Indica



Final model

Description: Media for Constructed wetland is made using different layers of pebbles ranging from 40-20 mm, on which sand is placed above it black cotton soil for Canna Indica to grow duly.

Final model shows the water collected after aeration, as influent to reactor. Grey water their filters and is collected in collection tank.

3. Results and Discussion:

The final test results are as follows:

Table -2: Test result

Tests	Before Aeration	After Aeration	After VFCW
pH	6.14	6.46	6.98
Dissolved oxygen (mg/l)	6	9.16	8.2
BOD (mg/l)	177	151	19
Suspended Solids (mg/l)	232	228	22
Hardness (mg/l)	198	198	120

Turbulence is created when water is aerated. The turbulence then leads to the release of aqueous CO_2 (carbon dioxide). The pH rises as a result of CO_2 from water outgassing. The only way to raise pH that doesn't also raise total alkalinity is by aeration from 6.14 to 6.46.

We can see Biological Oxygen Demand reduces to around 85.30% after aeration and reduces by 89.26% after treating with Vertical Flow Constructed Wetland (VFCW).

Suspended solids is reduced by 90.52% in final result. A significant amount of reduction in hardness is also seen.

4. Conclusion:

From the results above it can be concluded that Hybrid reactor can be used as a decentralized approach at a household or combined for 3 to 4 household. With increase urbanization, pollution of water bodies, human lifestyle needing higher water demands, industrial growth increasing water use and higher water consumption scarcity of water is increasing. And as Grey water is available in abundance, using a hybrid reactor is one of the best fitted solution to re-using water for Gardening as well as for agricultural use. Treated gray water is a substitute of fresh water to be used for non-potable purpose. The government may take measures to persuade the populace to install grey water treatment facilities in major buildings, complexes, public spaces, as well as single homes, particularly in locations where there is a water shortage.

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