Construction of Vortex Water Purifying Filter Chamber

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Abstract – *One of the major challenges that the municipal body and govt agency face is providing clean drinking water in both urban and rural areas. An alternate solution to this a cheaper and sustainable method for wastewater treatment which is discussed in this paper. Water filtration is a method to improve the water quality in sources like lakes and ponds by removal of minute particles of water and filtering it. As water filtration systems are often located in remote areas, solar panels are ideal for powering these systems. This paper describes a water aeration and filtration system powered by Solar panels. The portable nature of this system permits the user to conveniently relocate the system, aerate and filter bodies of water as needed. The present invention is a solar powered Vortex filtration system that incorporates a battery and a software for dynamic visualizations. The device can be used for improvement of water bodies for use in aqua culture systems, reservoirs, fish tanks, lakes, and ponds alike. The device doesn't require connection to the electrical power grid and may be used in different locations. Further, the device can be used during periods of low oxygen content and filtration of polluted water bodies. Increased efficiency can be obtained by matching the pump size, solar panels, filters, batteries according to the area of the water body to be covered.*

***Key Words*: Vortex Filter, PH, TSS, pathogens, Filter Composite**

1. INTRODUCTION

Clean drinking water is a luxury to about 1.5 billion people in this world. 88% of all the diarrhea cases can be attributed to unsafe drinking water, sanitization and hygiene. 1.8 million fatalities due to diarrhea occur each year.

Estimate by WHO shows that 94% of these diarrheal cases are preventable through modifications to the environment, including access to safe water. Simple techniques for water treatment, such as chlorination, filters, solar disinfection and storing it in safe areas could save millions of lives each year. Reducing death count due to unsafe drinking water is one of the major objectives developing countries strive to achieve water Quality, treatment of domestic wastewater from both rural and urban areas pose to be one of the greatest challenges that the government incur, in terms of machinery and expenditure. environmental pollution is caused due to improper discard wastewater, due to the outflow of effluents from various areas of domestic and industrial sources. Water resources are getting polluted on a large scale by disposal of untreated wastewater into nearby water source which leads to water pollution.

Untreated wastewater contains a large amount of organic matter which consume all the dissolved oxygen present in the water. This results in reduction in the amount of dissolved oxygen. This also satisfy the BOD requirements of wastewater.

Untreated wastewater also contains large amount of disease-causing microorganism that can dwell into human system and thus cause harm to human body

Water will be contaminated by the subsequent agents:

Pathogens – disease-causing organisms that include bacteria, amoebas and viruses, moreover because the eggs and larvae of parasitic worms. Harmful chemicals from human activities (industrial wastes, pesticides, fertilizers). Chemicals and minerals from the natural environment, like arsenic, common salt and fluorides. Some non-harmful contaminants may influence the taste, smell, color or temperature of water, and make it unacceptable in the community. Water from surface sources is usually contaminated by microbes, whereas groundwater is generally safer, but even groundwater is sometimes contaminated by harmful chemicals from human activities. Rainwater captured by a rooftop harvesting system or with small catchment dams is comparatively safe, as long as the primary water can flow to waste when the rainy season starts. The amount of water to be treated should also be assessed. This can be estimated by assuming that each person will need a minimum of 20–50 liters of water a day for drinking, cooking, laundry and personal hygiene. A community should be consulted when choosing a water-treatment system and should be made aware of the costs associated with the technology. Community members should be made aware of the behavioral and/or cultural changes needed to make the system effective over the long-term and thus be acceptable to them. Communities may also need to be educated about protecting water sources from animal or human contamination and mobilized. It should be emphasized that all the positive effects of a water-treatment system could be jeopardized if the water is not drawn, stored and transported carefully and hygienically. The Fact Sheets in the following section involve both community and household methods for treating water. Whereas the subsequent household and community water-treatment technologies are described in greater detail:

1.1 Household water-treatment systems

- Boiling
- Household slow sand filter
- Domestic chlorination

1.2 Community water-treatment systems

- Storage and sedimentation
- Up-flow roughing filter
- Slow sand filtration
- Chlorination in piped water-supply system

2. STEPS OF WATER PURIFICATION

1. Pumping and containment – The bulk of water is pumped from its source or directed into pipes or holding tanks. To avoid adding contaminants to the water, this physical infrastructure is made from appropriate materials and constructed in order that accidental contamination doesn't occur.

2. Screening (see also screen filter) – The first step in purifying surface water is to remove large debris such as sticks, leaves, rubbish and other large particles which will interfere with subsequent purification steps. Most deep groundwater does not need screening before other purification steps.

3. Storage – Water from rivers also be stored in bankside reservoirs for periods between a few days and many months to allow natural biological purification to take place. This is especially important if treatment is by slow sand filters. Storage reservoirs also provide a buffer against short periods of drought or to allow water supply to be maintained.

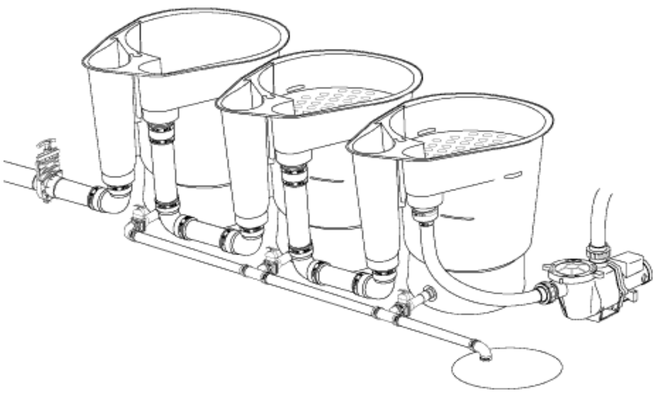
4. Pre-chlorination – In many plants the incoming water was chlorinated to minimize the growth of fouling organisms on the pipework and tanks.

The objective of this paper is to construct a Vortex filter with water circulation system with sedimentation. The design of vortex filter is such that it provides a cheaper and low maintenance alternative to exiting filters. The foremost function is to remove large debris that generally accumulate in bottom of the ponds. It basically acts like a primary stage filtration to remove waste and if placed and made clearly can remove up to 80% waste matter that enters the filter.

3. CONSTRUCTION OF ORGANIC VORTEX FILTER

Vortex filter is a low maintenance and reliable way of removing organic and inorganic compounds that generally gets accumulated at the bottom of ponds like koi ponds. These accumulated debris are with the help of large diameter pipes flown to a primary chamber where there is a rotating vortex which cause them to settle at the bottom. Due to the spinning motion of the filter the water is again then flown to a secondary chamber where a different type of filter that is mesh/ bio filter is used. This process can be again continued to remove more amount of debris and thus be done by adding subsequent chambers of filter at the expense of more cost. An external pump is used to again send the water back to the pond where the whole cycle is repeated.

Fig 1: Vortex Chambers



3.1 INSTALLATION

Since the four-inch inlet pipe offers little or no resistance to water flow, vortex filters may be situated at a Substantial distance from the pond. The first or the topmost chambers must be positioned just above the water level of the pond, so vortex filters are usually installed in pits product of concrete, concrete block, or treated lumber. Pit installation also protects the chambers from freezing weather. Since vortex tanks are quite heavy when filled, the bottom of the pit should be concrete, or paver blocks set on very well-compacted gravel. The pit must big so that it can accommodate the filter chambers, an ultraviolet sterilizer, all necessary plumbing, and a plastic sump pit if required. Although all our filters are furnished with lids, plumbing fittings, pipes, and valves must be ordered separately.

3.2 MAINTENANCE

Each chamber or filter is connected with a slit which is about 2 inches. There is also an opening at the bottom of the filter which is large enough for the debris to settle.it is always recommended to open the filter and check if there is any clogging which slows down the filtration process. Every month it is recommended that the filter pad is swapped or cleaned and out back again. It is also advised to change the pad every year for better quality results

3.3 SIZING

The size of the filter and the number of chambers should be completely dependent on the water quantity and land area

4. MATERIAL REQUIREMENTS

1.Acrylic plastic

2. Water pump

3.12v Solenoid

4. Solar panel

5.L293D

6. PVC Pipes

7. Battery

8.Filtering Media (Biological, Membrane, Charcoal)

9.Microcontroller

HARDWARE REQUIREMENTS-

Arduino UNO.

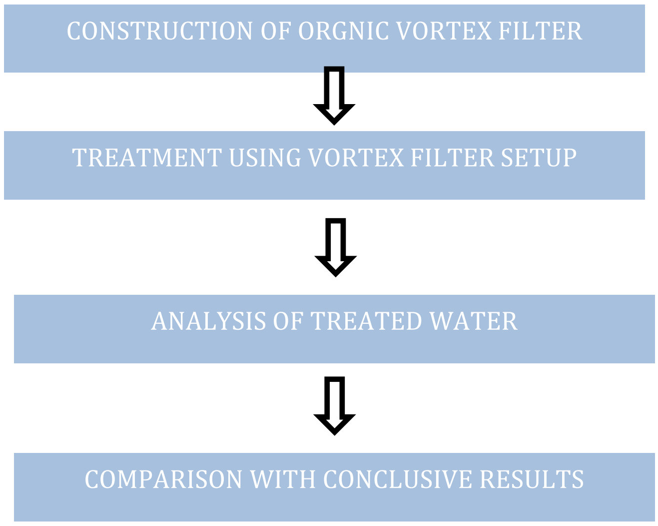
L293D Motor Driver or H-Bridge.

DC Motor.

SOFTWARE REQUIREMENTS-

Arduino IDE.

5. METHADOLOGY



6. WORKING PRINCIPLE

The wastewater from the source water body is connected to a DC motor and in turn to the central section of the filter body that is the main power supply board. The angled inlet generates a radial flow pattern.

ii. The power supply board consists of the temperature sensor, LCD display, microcontroller and a relay board. The power supply board is in turn connected to a solar panel which traps solar energy and makes the device sustainable. The system is connected enabled with a software- ThingSpeak which is an IoT analytics service that allows the user to accumulate data and further helps in the visualization and analysis of the same. This software when connected to internet also helps in getting real time updates and alerts. It is also capable of storage of data regarding temperature, humidity, pH and real time conditions of the vortex motor and the solar power supply.

iii. The main Vortex filter consists of 3 filter chambers that consist of different filters mainly the mechanical and organic charcoal and mesh filters. The vortex chamber is connected through pipes to the inlet from the source and the power supply board. Water is pumped into the vortex chambers into 3 subsequent filters. The movement of fluid takes place in a zig zag manner for easy flow.it is achieved thru connecting pipes in small slits. The silt trap can be flushed for cleaning and has an integral cleaning outlet to the side to ease dirt removal.

iv. In the inner chamber of the filter housing is the actual filtering area. The filter composite elements filter out the fine materials in an up-flow process and dissolved materials are precipitated and adsorbed. The next stage is when it passes thru the biological media (gravel, aqua rock) where there is the occurrence of biological breakdown. Bacteria present in this filter convert harmful substance like ammonia in less harmful form. Water then passes through the filter 2 which is a mesh filter of 0.45-micron cellulose membrane as for filtration. This type of filter is beneficial when the water sample is being analyzed since the water sample contains alluvial material, fine silts and clay and then there can be measurable variations in results when comparing the same fine sediment fractions filtered through different membranes. The water free of microbial and clay matter is further driven up to the filter 3 which is an activated carbon filter. Activated charcoal works through the process of adsorption. Adsorption binds impurities chemically on the surface of the charcoal filter rather than physically absorbing them. Activated charcoal is the ideal water filter because it removes toxins from the water without effecting the water of salts and minerals. When exhausted the filter is easily changed.

v. The filter chamber can be easily pulled up and the filter composite is removed from the shaft housing. The installed software enables the control and management of the system by providing the user with data visualizations as shown below.

Image 1: Pump and Vortex Motor data

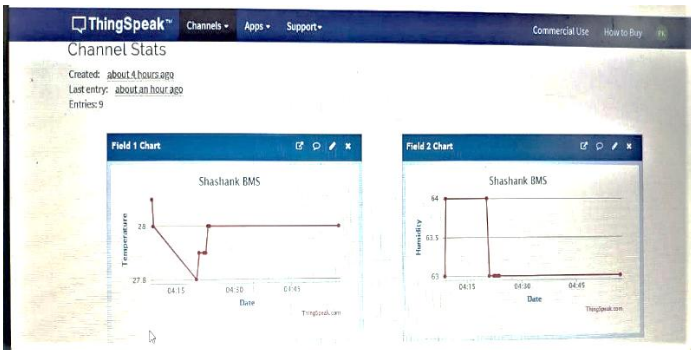


Image 2: Temperature and Humidity data

Image 3: Vortex Filtration Chamber

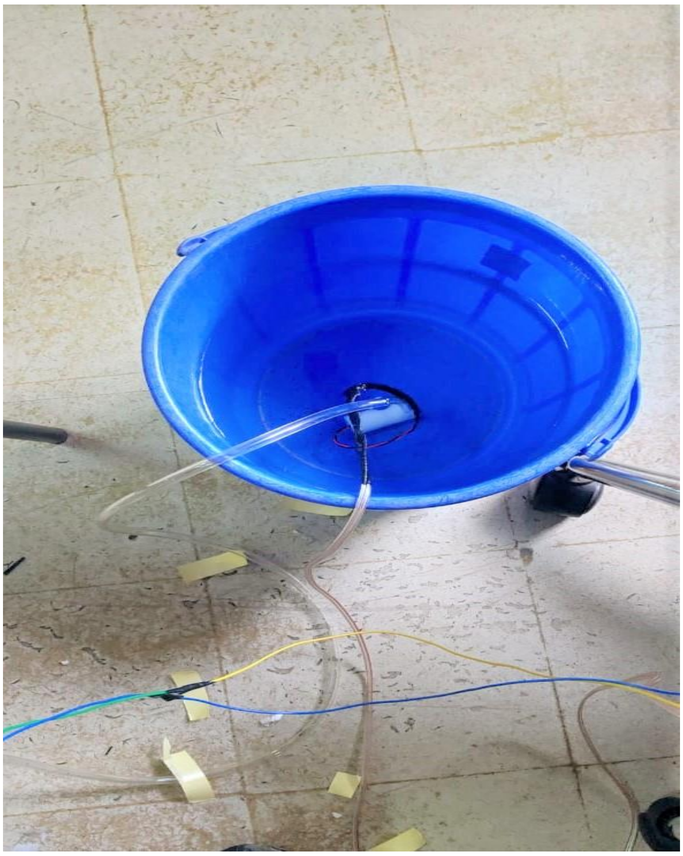


Image 4: Sample Source of water

Image 5: 3 Filters in Vortex Chamber

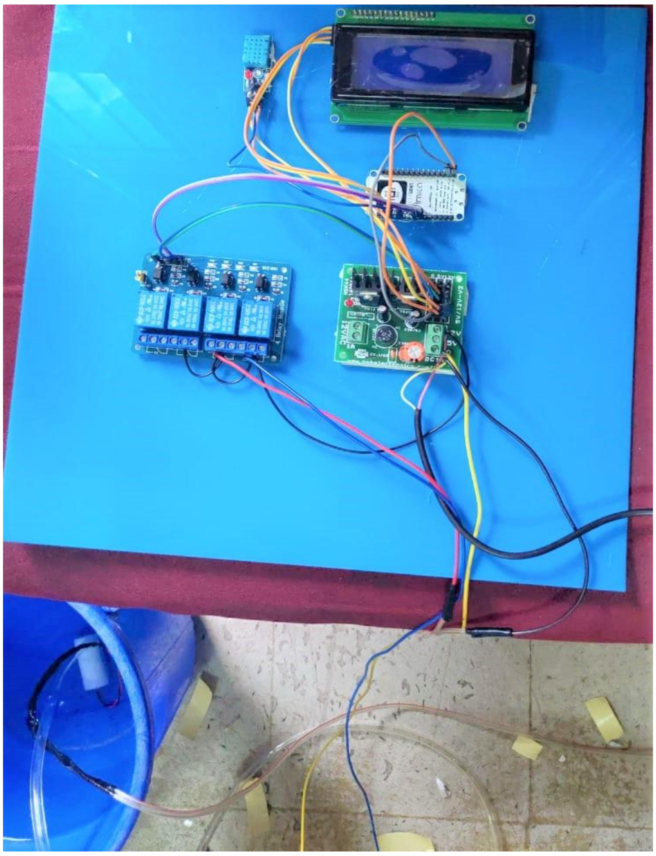


Image 6: Power Supply Board with LCD, RELAY BOARD AND MICROCONTROLLER

Image 7: LCD display of dynamic working data

6.1 TEMPERATURE TESTER---

PH is one of the most important defining factors present in a liquid. The PH itself is nothing but the concentration of H+ and OH – ions. Whenever the value of PH is too acidic or basic the aquatic species are affected. pH is expressed from value 1 to 14. Acidic solution is one which has a PH of less than 7 and basic is one which has a PH of greater than 7. The Vortex third filter is attached to a pH temperature-based monitoring system that works on the principal of ATC (Automatic Temperature Compensation). Measurement of PH is dependent on temperature. As and when temperature rises molecular interaction and vibration increase. This results in more ionization and ultimately leads to the drop in PH level

$H2O (l) \rightleftharpoons H+ (a) + OH- (a)$

6.2 CONDUCTIVITY TESTER

Measurement of conductivity is done either with 2,4 or inductive electrode conductivity sensor. The conductivity measurement can be TDS salinity and concentration of water. This helps in the comparative analysis of the salt concentration present in the water before and after the vortex filtration testing. TDS is most commonly associated with conductivity but rather it is the number of ions present not the conductivity. The meter used for TDS measurement measure conductivity and convert into ppm. It's an indirect way of measurement. When measuring salinity, units are typically expressed in ppm. Some comes pre-configured with the option to measure salinity if desired.

The conductivity measurements are dependent on temperature and ionic species present.

Water later exits the grill and enters the pond pumped with the help of the pump which is powered by the Battery, the battery is charged using the solar panel.

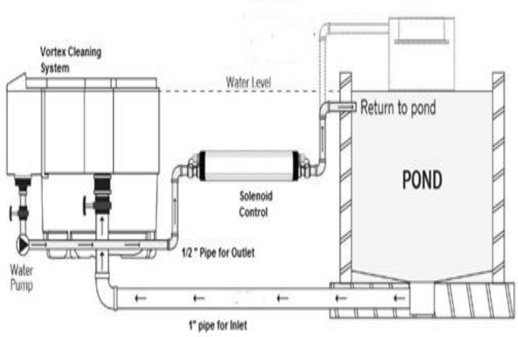


Fig 2: Filtration System Architecture

7. TECHNICAL DATA

- Inner diameter of Filter body: 260mm
- Height of the filter unit: 450mm
- Inlet and Outlet Pipe diameter: 35mm
- Minimum head loss between inlet and outlet: 12.5 cm
- Connectable area: 1000 to 2500 sq. Ft (according to site conditions)
- Maximum flowrate: 1.5cfs, filterable flowrate: 1.2cfs
- Sludge flush Pipe diameter: 75 mm
- Filter composite exchange interval 2 to 3 years

8. DATA COLLECTION

The methodology for data collection was as follows:

The working model, Vortex Filtering System was tested for lake environment in Bangalore. Hence, the details regarding the various parameters that are attributed to the waste water quality was studied and their reduction percentage is analyzed after the effective working of the model. The following data collection was is aided by certified NGO, **UNITED WAY BENGALURU** an NGO working towards Lake development and Restoration across Karnataka and constantly align their programs with Govt led initiatives, work with different communities and Corporates.

Table 1: Lake distribution in Bangalore

size of lakes in hectares	Number of lakes
Small lakes < 20	57
medium lakes >20 &<50	19
large lakes >50	8

From the above data it can be interpreted that most of the lakes in Bangalore falls in the category of small lakes. Due to this it can be concluded very vaguely that the type of product that is to be manufactured should not only be compatible to most of the small lakes for efficient ad better use. The product should also be portable and small.

water in gallons	price of cleaning
50K-1.0L	3.5L-5.0L
1.0L-1.5L	5.0L-7.5L
1.5L-2.5L	7.5L-15L

2.5L-3.5L	₹15L-₹22.5L
3.5-5.0L	₹22.5L-₹40L
5.0-7.5L	₹40L-₹65L
7.5L-10L	₹65L-₹100L

Table 2: Cost analysis of water filters available in market

The Cost of cleaning a lake varies according to the size of the lake. The total cost of lake cleaning with respect to the water content and size of the lake is mentioned in the table above. It is interpreted from the above data that the cost starts from about 3.5L to 100L and can go more than that if the size of lake/pond is more. The size and gallon of water mentioned above is more apt for a small pond rather than a lake

Dissolved oxygen	COD (ChemicalOxygen Demand)	Nitrate	TH
10.3	19.2	10.87	172
9.2	23.4	6.25	588
6.2	40	4.715	224
6	44	5.46	
6	115	7.74	164
7	325	36.3	76
9	96	7.08	240
5.8	107	4.31	260
5.4	57.6	8.02	500
5.1	56.64	9.73	272
4.8	96	9.73	208
10	18.88	5.9	220
3.6	94.4	11.26	168
9.2	127	6.13	184
1.6	384	6.89	424
3.6	231	4.51	316
7.4	38.4	3.01	232
2.2	327	4.94	476
6.1	56.64	14.09	460
2	0	5.47	404

Fluoride	pH	Zinc	Magnesium
0.49	8.37	0.33	0.19
3.51	8.34	0.14	0.82
0.54	8.12	0.17	0.24
0.43	8.06	0.14	0.21
0.37	8.17	0.05	0.21
0.37	7.83	0.12	0.13
0.18	8.74	0.12	0.3
0.65	7.47	0.06	0.49
0.62	8.26	0.07	0.05
0.73	8.07	0.1	0.54
0.4	7.51	0.41	0.23
0.86	8.29	0.56	0.12
0.42	8.32	0.1	0.88
0.76	8.28	0.04	0.07
0.48	7.5	0.05	1.09
0.44	8.51	0.2	0.09
0.65	8.76	0.54	0.06
0.64	8.28	0.06	0.26
0.46	7.65	0.17	0.47
0.72	7.58	0.06	0.28
0.49	8.18	0.01	0.37

Name of the lake	Size of lake in hectares	Chlorine(mg/l)	PO-P(mg/l)	TSS (Totally suspended solids)
Amruthalli lake	9	131.6	2.55	260
Andrahalli lake	5	358	0.1	236.5
Anjanapura lake	7	190	0.2	670.5
Arakere	11	215	0.3	574
Arehalli sanna lake	5	44.9	0.05	309
Attur Lake	29	25	0.05	716
Bagalkunte lake	4	109	2.05	172.5
Balajinagar lake	4	123	0.2	180.5
Basapura lake	3	412	0.55	110
Begur tank	50	277	1.04	245
Belandur Tank	307	109	5.05	498
Bhattrahalli lake	5	476	2.8	74
Busegowdana lake	6	78.4	1	233
Chikkabasavanapura lake	5	277	3.63	104
Chinnappanahalli lake	3	272	0.2	177.5
Devara Beesanahalli lake	5	442	5.21	145.5
Devaralake	2	168	0.01	1261
Doddakalsandra lake	6	423	5.06	205.4

Table 3: Lake data and Constituents

8. ANALYSIS OF WASTE WATER

Since Vortex Filters are basically mechanical filters, all the physical and selected chemical parameters are analyzed. Water runoff samples were taken from focus locations and the following indicators of water quality was tested:

1. Water Temperature: The temperature of water is defined by certain factors like solar radiation and atmospheric temperature. These factors cause a change and variations in the temperature. The temperature of water plays a very important role in wetland dynamics and ultimately effects properties like alkanity, salinity oxygen level and conductivity. Resultantly in aquatic systems these parameters effect the reactions that take place in water like, carbon dioxide-carbonate-bicarbonate equilibrium. Temperature also effects the PH at large and also have an impact on taste.

2. pH: The effect of pH on the chemical and biological properties of liquids makes its determination very

important. It is one of the most important parameters in water chemistry and is defined as -log [H+] and measured as intensity of acidity or alkalinity on a scale ranging from 0-14. If free H+ are more it is expressed acidic (i.e. pH 7). In natural waters pH is governed by the equilibrium between carbon dioxide/bicarbonate/carbonate ions and ranges between 4.5 and 8.5 although mostly basic. It tends to increase during day largely due to the photosynthetic activity (consumption of carbon-dioxide) and decreases during night due to respiratory activity. Waste water and polluted natural waters have pH values lower or higher than 7 based on the nature of the pollutant.

3. Total dissolved solids (TDS): TDS is the measure of all the contents of water present in different form which include molecular suspended and ionized. Waters with high dissolved solids generally are of inferior palatability and may induce an unfavorable physiological reaction in the transient consumer.

4. Total Suspended Solids: Suspended solids are the portions of solids that are retained on a filter of standard specified size (generally 2.0 μ) under specific conditions. Water with high-suspended solids is unsatisfactory for bathing, industrial and other purposes,

5. Total Hardness: Hardness is predominantly caused by divalent cations such as calcium, magnesium, alkaline earth metal such as iron, manganese, strontium, etc. The total hardness is defined as the sum of calcium and magnesium concentrations, both expressed as CaCO3 in mg/L. Carbonates and bicarbonates of calcium and magnesium cause temporary hardness. Sulphates and chlorides cause permanent hardness.

6. Color: In natural water, color is due to the presence of humid acids, fulvic acids, metallic ions, suspended matter, plankton, weeds and industrial effluents. Color is removed to make water suitable for general and industrial applications and is determined by visual comparison of the sample with distilled water.

7. Taste and Odor: The smell of water often gives some indication of its character. Generally, odor and taste are present in combination when water is sampled from runoffs for testing. The primary sources of taste and odor problems in runoff water are biological contaminants that originate from domestic and industrial wastes. Furthermore, anthropogenic sources which include chemical waste and spills can also increase harmful content and resultantly effect taste and odor. Such chemicals can affect both water quality and rainwater harvesting system equipment's. In most cases, water runoff paths traverse thru several naturally present compounds like calcium, iron and magnesium in varying concentrations which influence the taste of water.

Table 4:

SL NO	Parameters	permissible limit
1	PH	6.5-8.5
2	TSS	180-200
3	DO	6.0-7.0
4	COD	5
5	P-OP	1
6	CL	250-300 mg/l
7	Nitrate	45
8	Zn	5.0-15
9	Fl	1-1.5 PPM
10	mg	0.1-0.3
11	TH	200

This standard prescribes the requirements and the methods of sampling and test for drinking water as well as fresh water for household usage as per the Indian Standard, Drinking Water Specification – Revised Edition.

Substance	No of lakes	Percentage
Chlorine (mg/l)	67	87%
PO-P (mg/l)	25	32%
TSS	39	51%
Dissolved Oxygen	33	43%
PH	56	73%
magnesium	23	30%
zinc	10	13%
nitrate	2	3%
fluorine	0	0%
TH	43	56%

Table 5:

This table consists of 3 columns with column 1 indicating the chemical, metals and oxides and other harmful elements, Column 2 indicates the number of lakes in which these chemicals have exceeded the permissible limits and Column 3 indicates the total percentage of all the lakes analyzed that stand affected.

The water sample collected was analyzed for different for the parameters BOD, COD, Total nitrogen, total phosphate, pH, TSS.etc from the different locations of the lakes. Table 1.1 indicates the number of lakes analyzed that had superfluous amount of harmful chemicals that were present in them. This extraneous amount of chemicals was indicated by the comparison of the lake to the permissible limit in the country.

We took permissible limit data from different organizations which include (CPCB), (ICMR), (WHO) and (APHA). This data helped us to understand the basic permissibility and thus we analyzed a base target value which we planned to achieve.

Some water pollutants which become extremely toxic in high concentrations are, however, needed in trace amounts. Copper, zinc, manganese, boron and phosphorus, for example, can be toxic or may otherwise adversely affect aquatic life when present above certain concentrations, although their presence in low amounts is essential to support and maintain functions in aquatic ecosystems. The same is true for certain elements with respect to drinking water. Fluorine, for example, is essential for humans but becomes harmful or even toxic when its concentration exceeds a certain level.

9. COMPARATIVE RESULTS

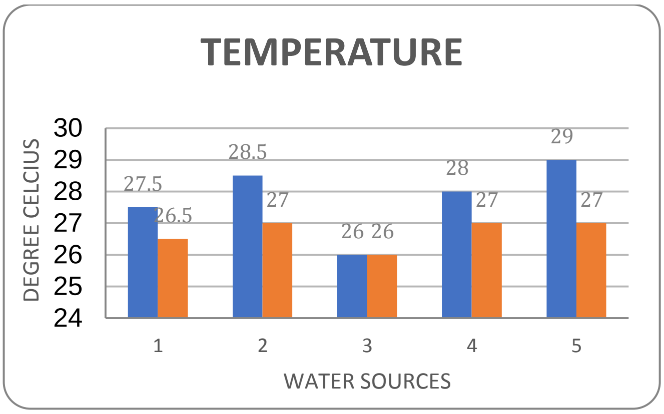
Parameters	Unit	Rain water	pond water	tap water	Rain water from main traffic road	Rain water from heavy Industries site
Temperture	℃	27.5	28.5	26	28	29
PH	[-]	7.8	8.2	8	8.4	8.7
Total dissolved solids (TDS)	mg/L	89	323	122	357	425
Total suspended solids (TSS)	mg/L	95	237	69	482	512
Total hardness	ppm	123	335	57	229	280
Color	HU	86	307	62	655	735
Taste	[-]	bitter	bitter	little chlorinted	Not permissable	not permissable
Odour	[-]	recognizable	bad odour	odourless/ non recognizable	Sulphorus like smell	medicinal
Chlorine	mg/l	nill	378	260	nill	nill
Dissolved oxygen	mg/L	10	3.3	5.8	10	8

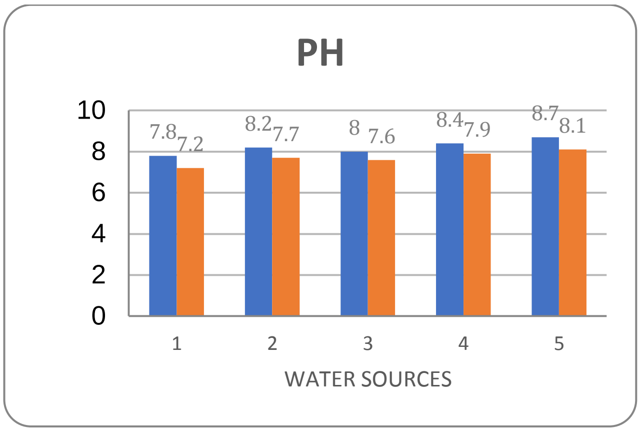
PRE – FILTERATION DATA

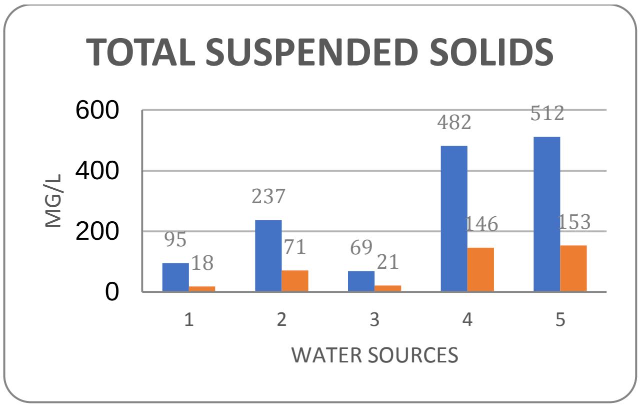
Parameters	Unit	Rain water	pond water	tap water	Rain water from main traffic road	Rain water from heavy Industries site
Temperture	℃	26.5	27	26	27	27
PH	[-]	7.2	7.7	7.6	7.9	8.1
Total dissolved solids (TDS)	mg/L	51	134	49	142	221
Total suspended solids (TSS)	mg/L	18	71	21	146	153
Total hardness	ppm	27.3	62	13.83	97.2	102
Color	HU	27	63	15	87	51
Taste	[-]	slight bitter	slight bitter	quite tasteless	bitter	bitter
Odour	[-]	odourless	quite odourless	odourless	recognizable	recognizable
Chlorine	mg/l	nill	296	233	nill	nill
Dissolved oxygen	mg/L	9.5	5.4	6.9	9.2	8.4

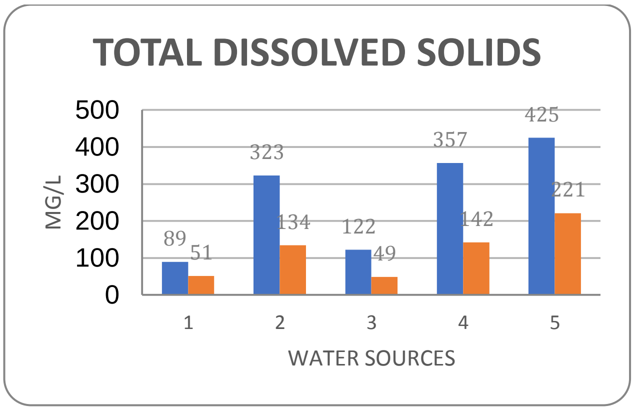
POST-FILTERATION DATA

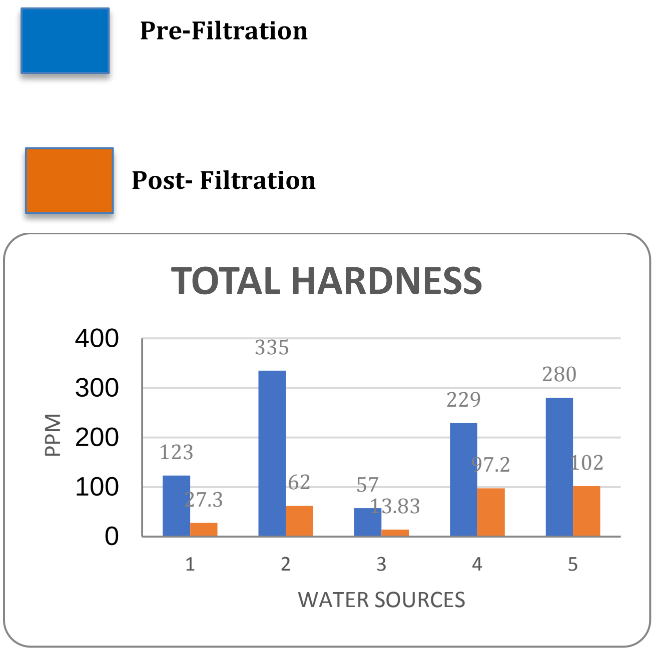
10. GRAPHICAL COMPARISONS OF PARAMETERS











11. SELECTION OF FILTER MEDIA

For the three consecutive hampers of the Vortex Filter, filter media played one the most vital role in purification of waste water from its source. Filter media is anything that placed in a filter that changes the quality of water flowing through it. With the variety of medias available, specific types can be chosen to obtain the optimum filtration of the waste water from its source.

There are three types of filter media are:

• Mechanical • Biological • Chemical

These filters use different techniques to perform the work. The technique depends on the filtering media. All three types are recommended in a filter, but a Vortex filter needs to have chemical and mechanical filters at a minimum. Components of these media types can be incorporated in the same filter chamber or different.

I. Mechanical Media: The components of mechanical media are inert: this means that the material this media is made of will do nothing to interfere with the water chemistry. This media mechanically or physically strains solids from water passing through it, which is vital for the efficiency of the chemical media. Mechanical media is available in much different porosity, which controls the size of the particulate that it can extract. Membranes can filter particles upto the size of about 1.6 nm. The larger the pores in the mechanical media, the larger the particulate matter must be for the filter to extract it. There are two layers of mechanical filter media involved in the filter composite. The bottom most layer is the first layer to which the water first comes in contact and it effectively strains out particle size up to the range of 150-200 microns. This media is known as coarse media which has pores density of 30 ppi and is easier to clean and reuse than finer media. The finer media forms the second layer which clarifies the water further, filtering out the particle size in the range of 10-20 microns. Since this layer is very vulnerable to clogging in shorter periods the coarse media acts as a protecting layer.

ii. Chemical Media: Chemical media such as poly filter and charcoal filters are effective at removing a variety of impurities, such as copper, chlorine, dissolved proteins, medical, or tap water impurities by binding these unwanted materials and trapping them within the media. Activated carbon resins, and other adsorbent chemical media bind and remove dissolved particulates from the water column through the process of adsorption. The two most popular forms of chemical media are activated carbon and resins. Since Activated charcoal is the most economic and widely available filter material, it is chosen as the third layer of the filter composite. Activated carbon/charcoal is filled with microscopic pores that cause certain organic or inorganic materials to stick to them. Since it forms the top most layers and has comparatively more buoyancy than sand or stone particles, larger size of charcoal granules of range 15-25 mm is opted to avoid them from floating and draining into the outlet pipe. Carbon removes many harmful elements from water, such as cadmium, zinc, heavier dissolved salts and hydrocarbons.

12. CONCLUSION

Waste water treatment by Vortex filters is state of the art because it reduces the costs for urban and rural usage of water cleaning filtration systems by using source control. This filtration unit has numerous advantages in comparison with other systems. The system is a combination of mechanical and organic filters with 3 filter units and is enabled with cloud data storage and data analysis of temperature and humidity with of the water in real time. It is convenient and easy to inspect and maintain. There is only low head loss. Filter media is kept in chamber, where there is no loose of material in the system. Filter media must be replaced in intervals between 3 and 5 years depending on the site's conditions. It is very easily portable and movable, and its size is compact and easy to handle. The filter media removes pollutants like suspended particles, pH and heavy metals, chlorine and chemical pollutants. Furthermore, there is temperature control and a significant decrease in the color, taste, odor, dissolved oxygen which in turn upholds the removal of BOD in waste water. The system is ideal for small ponds, lakes, industrial runoffs, farming sites and even household swimming pools. Highest pollutant levels in drainage and runoff can be reduced to acceptable loads for storage tanks, groundwater and surface waters. The modular design allows the adaption to nearly any site condition. Through this project we concluded that the

Vortex Filtration System is an essential attachment/inclusion for small, local as well as large water source bodies which act as water supply for domestic, rural and urban purposes. It is beneficial in maintaining good water quality and instilling the same during storage. This project will be helpful by providing better means of water purification after careful analysis of study area and application of suitable scientific technique to fulfil the demand of current generation and to retain the sustainability of the future generation. It will also help in the development of the nation.

13. REFERENCES

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