

Water management in urban slums

Turning problems into
opportunities.

Why we chose this topic

- 25% of slums in India are unrecognized by the government.
- Every individual has a right to clean and pure drinking water.
- It is our responsibility as citizens to uphold these rights and lend a helping hand.





Our aim

- To use the opportunity given to make a positive difference and impact on the underprivileged.
- To give an economically feasible solution to otherwise difficult issues.

**“BE THE CHANGE YOU
WISH TO SEE IN THE
WORLD”**

Water condition in urban slums

- 70.3% of urban slums receive impure drinking water, according to the Census of 2012.
- Spread of cholera, diarrhea or water borne diseases.
- Economical and effective filtration mechanisms absent.
- Presence of coliform bacteria.
- A large amount of family's income is spent for treatment of diseases and doctors appointments.

Why do these conditions exist?

- Unsafe storage of water.
- Heavy contamination during monsoons.
- Mixing of sewage water, absence of clean toilets.
- Lack of sanitation and hygiene in and near outlets.
- Lack of quality water distribution.
- Boiling of drinking water is not adopted due to shortage of fuel.
- Filtration is seen as unnecessary and time consuming, due to lack of awareness.

Jayanagar- 4th block



Bannerghatta- Bilekhalli



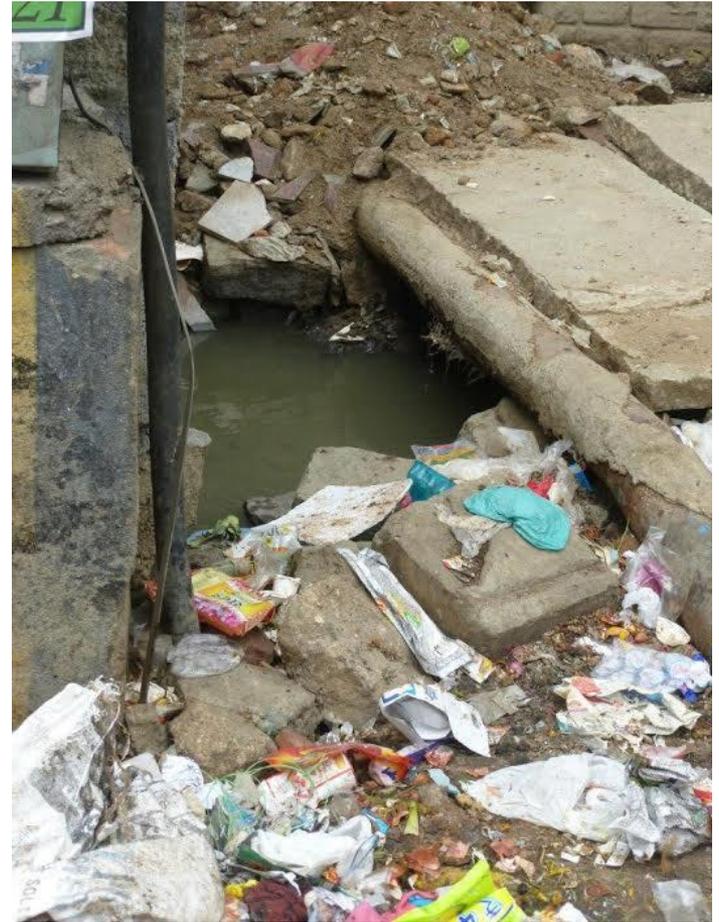
JP NAGAR 15th cross



JP NAGAR- 2nd phase



Bannerghatta- Arekere layout



Our observations

- We observed more vividly the sanitation conditions of their households
- Recorded details of water supply and BBMPs action in the area
- On interacting with the people living in the slum areas, we got a better insight into the adversity of their problems
- Collected water samples for testing

What is our solution?

- We have designed filters to purify water from these sources.
 - **Tap filter** : The tap filter is fitted with a rubber attachment to make it universal. There are 2 types –
 1. Activated carbon filter
 2. UF Membrane and AC
 - **Potable filter** : Water collected is passed through a circular filter with AC filtration.
- Provides point-of-use water treatment.
- Economically feasible filters.
- Easy to use with simple instructions.



Ultrafiltration membrane



Nylon Mesh



Activated Carbon

RUBBER FOR ATTACHMENT



GRANULAR ACTIVATED CARBON

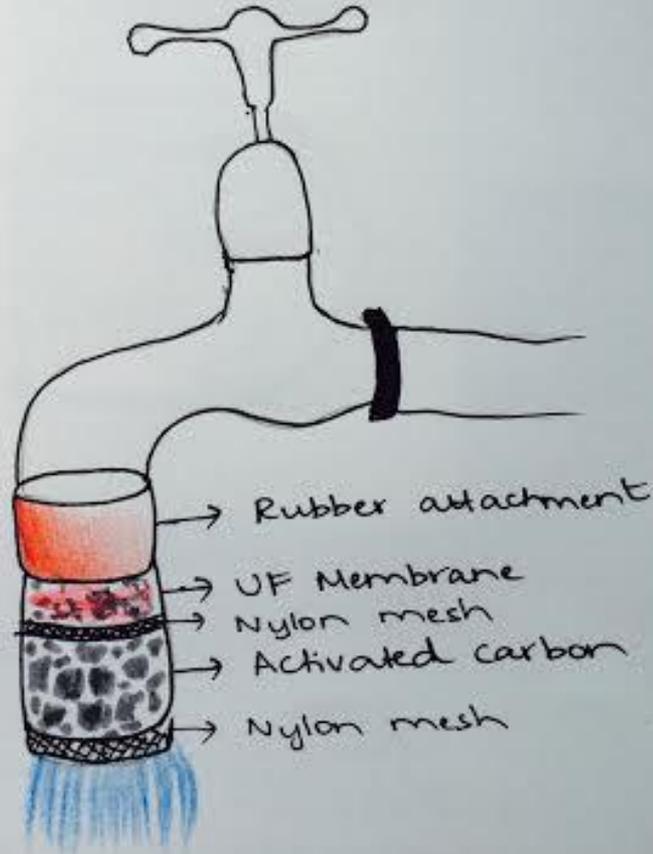


ULTRA FILTRATION MEMBRANE
(Poly ether sulfone)



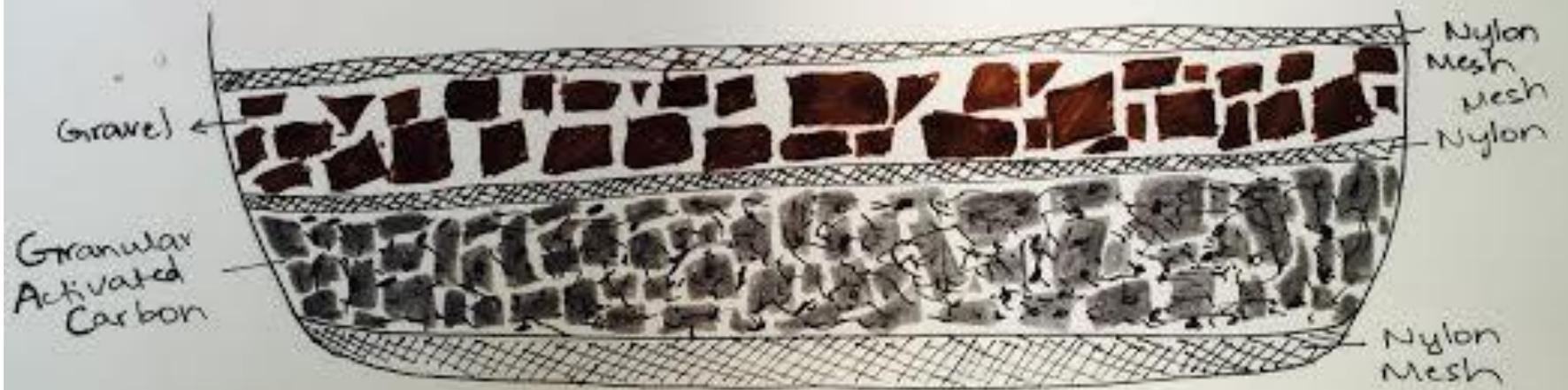
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TAP FILTER





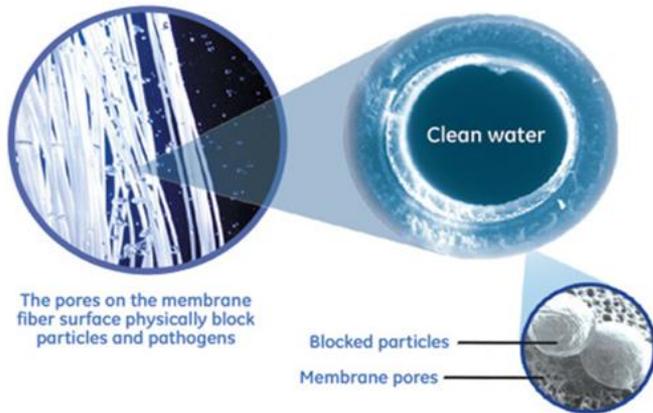
POTABLE FILTER

- Contains activated carbon and membrane for suspended particle absorption.



Materials in the filter

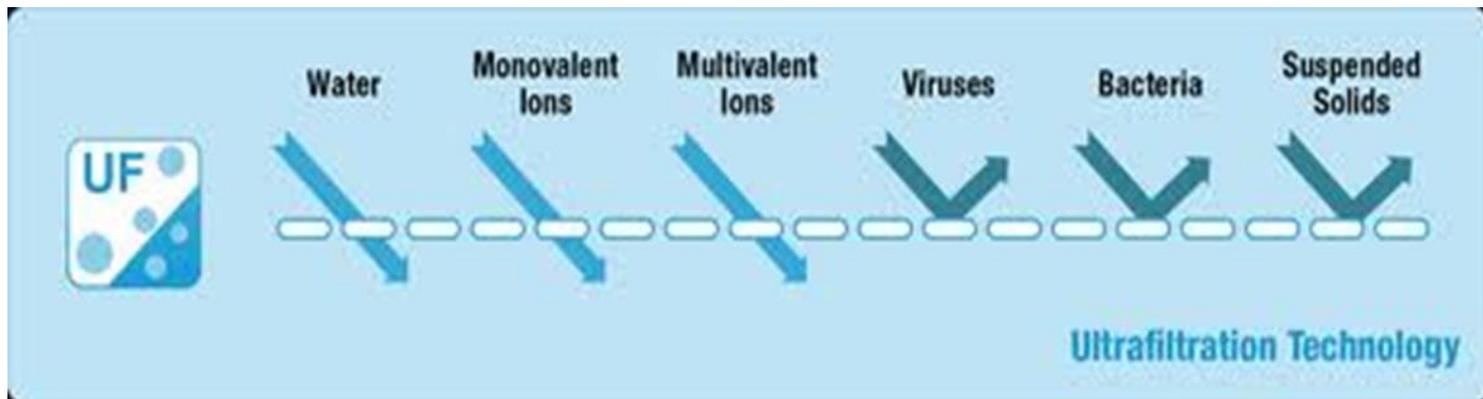
1. Ultra filtration membrane(Polyether sulfone)
2. Activated carbon
3. Nylon mesh



Mechanism of filtration

Ultrafiltration membrane

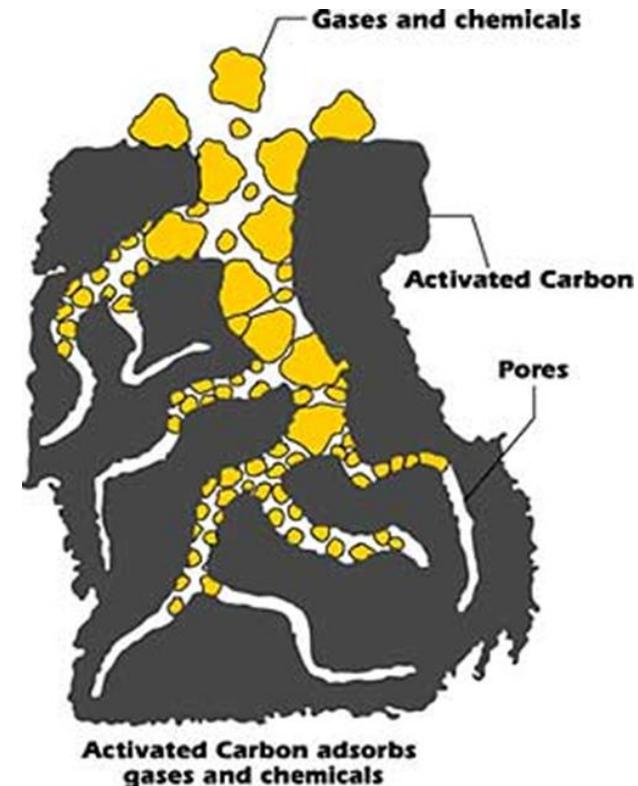
- Cheap compared to Nano-filtration membranes
- Low energy consumption
- Eliminates suspended matter and pathogens
- No chemicals required (aside from cleaning)



Mechanism of filtration

Activated carbon

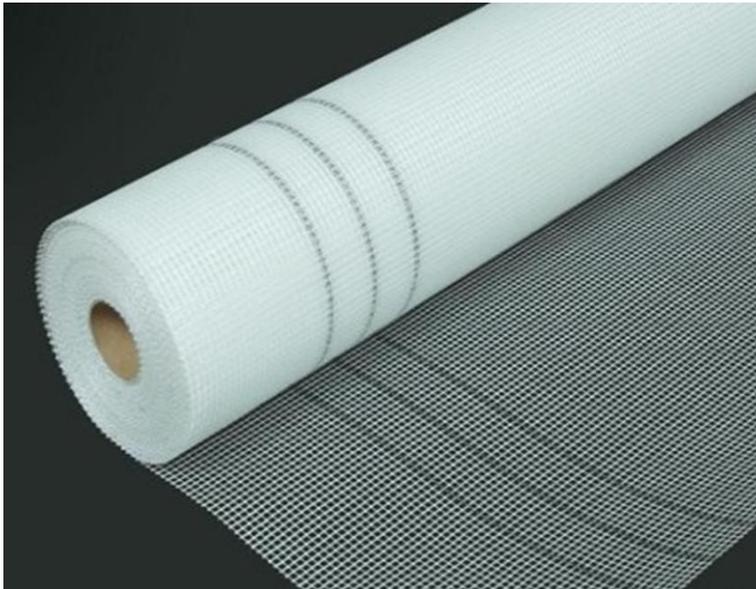
- Large surface area for absorption.
- Traps organic chemicals



Mechanism of filtration

Nylon mesh

- High elasticity and strength
- Smooth and dry surfaces, fine pores improves filtration



Our water filter

- Awaiting BBMPs and BWSSBs official certification for supply of product
- We have gained the support of a NGO for distribution of product and educating people dwelling in slums on its usage.
- 6 month guarantee
(Replacement required every 6 months, however we recommend disposing after 6 months)
- We gained the support from technicians in India's largest water filter company 'Kent', for the development of our product and its guarantees.

Economic Feasibility

- Activated carbon filter – Rs.60 / filter *
- UF Membrane filter – Rs.300 / filter
- Potable filter – Rs.150 / filter *
(Prices are determined by taking into account all material costs, no profit included)
- Kent UF filter – Rs. 2,500 – Rs.6,000 (Average)

* Approximately

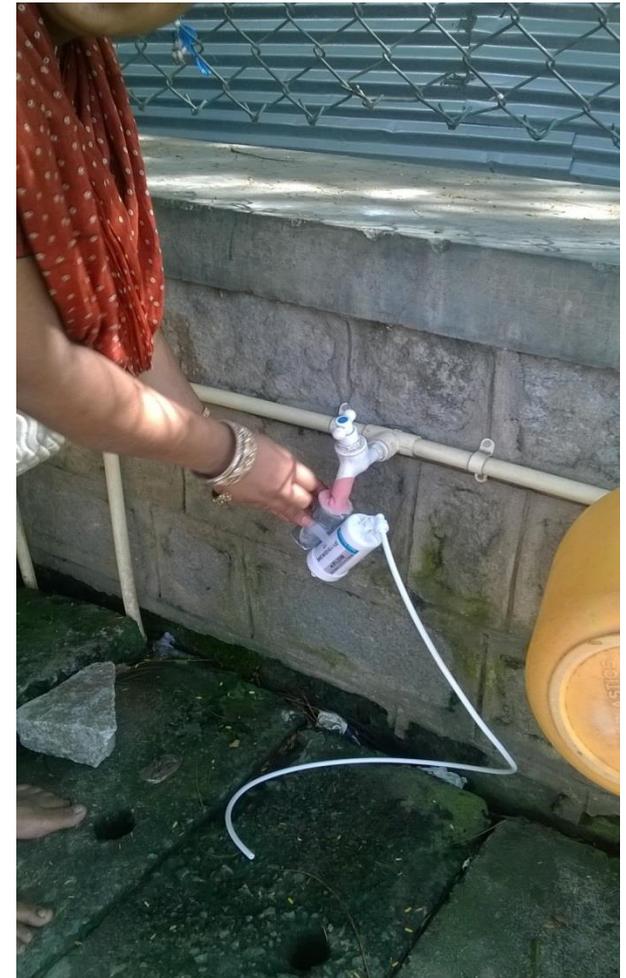
Products in the market

- Established brands such as Kent, Prestige, supply tap filters, with UF mechanism, economical feasibility absent.
- No company has designed filters specifically for slums (This information was gained from BWSSB)



Visit to slum (JP Nagar 2nd phase)

- Educated them on the importance of filtration
- Explained the method to use the filter
- Collected samples for testing



Water quality test

- Visited BWSSB to test a water sample for the following parameters :

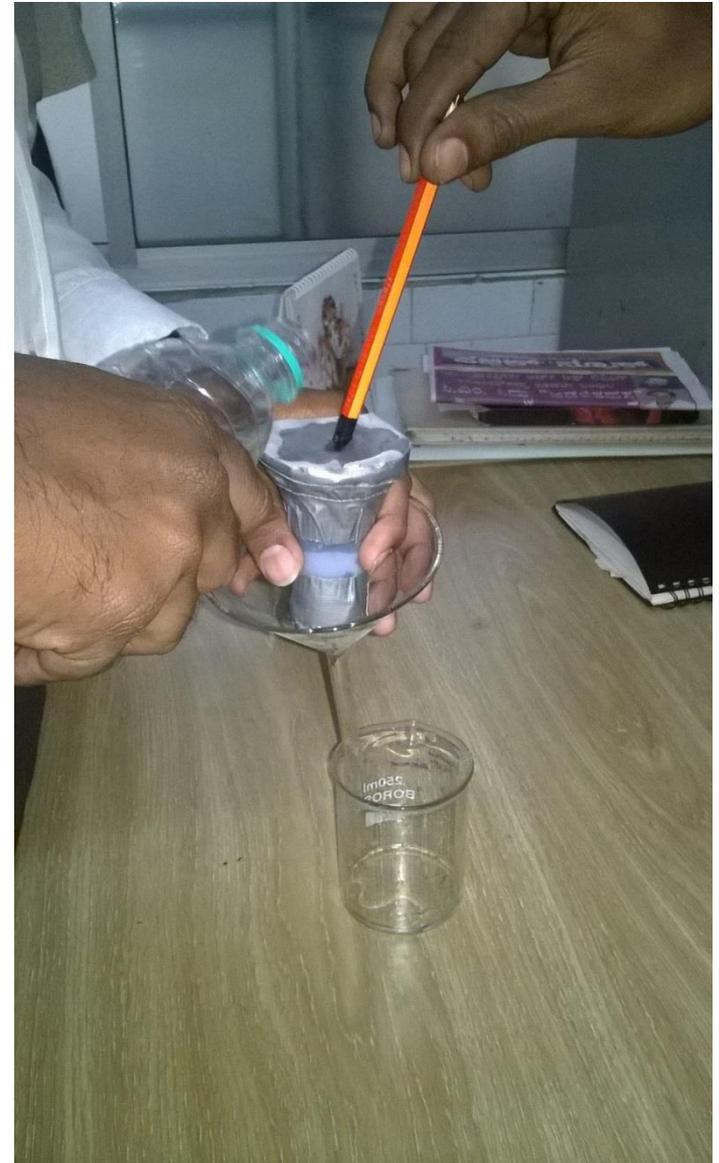
Factors	Before filter	After filter
Turbidity	24.1 NTU	6
pH	7.4	Normal
TDS(Total dissolved solids)	161 mg/L	Normal

- The filtration was done with our activated carbon filter.

BANGALORE WATER SUPPLY & SEWERAGE BOARD

INDIAN STANDARD SPECIFICATIONS FOR DRINKING WATER IS : 10500

No.	Substance or Characteristic	Requirement Desirable Limit	Unacceptable Effect Out Side the Desirable Limit	Qualifier Essential	Remarks	Sl. No.	Substance or Characteristic	Requirement Desirable Limit	Unacceptable Effect Out Side the Desirable Limit	Qualifier Essential	Remarks	Sl. No.	Substance or Characteristic	Requirement Desirable Limit	Unacceptable Effect Out Side the Desirable Limit	Qualifier Essential	Remarks
1	Colour (after 2 hrs. 20°C)	15	None	Essential	May be exceeded in 10 days if it is not accompanied by any objectionable odour or taste.	11	Phosphate (as PO_4 eqt. Mg)	0.1	Exceeds the limit, water becomes turbid and objectionable odour develops.	Essential	May be exceeded up to 0.15 mg/l.	12	Carbonate (as CaCO_3 eqt. Mg)	200	Exceeds the limit, water becomes turbid and objectionable odour develops.	Essential	May be exceeded up to 250 mg/l.
2	Odour	Non-objectionable	None	Essential	It may occur after water has been treated by chlorination.	13	Chlorine (as Cl_2 eqt. Mg)	2.0	Exceeds the limit, water becomes turbid and objectionable odour develops.	Essential	May be exceeded up to 2.5 mg/l.	14	Alumina (as Al_2O_3 eqt. Mg)	40	Exceeds the limit, water becomes turbid and objectionable odour develops.	Essential	May be exceeded up to 50 mg/l.
3	Taste	Agreeable	None	Essential	May be exceeded only after quality has been satisfactory.	15	Fluoride (as F^- eqt.)	0.5 to 1.2	Low fluoride level can lead to dental caries, high fluoride level can lead to fluorosis.	Desirable	May be exceeded up to 1.5 mg/l.	16	Iron (as Fe eqt. Mg)	0.3	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.5 mg/l.
4	Turbidity (NTU, 20°C)	10	None	Essential	May be exceeded up to 15 NTU in absence of other water quality parameters.	17	Barium (as Ba eqt. Mg)	4.0	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 5.0 mg/l.	18	Cadmium (as Cd eqt. Mg)	0.01	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.02 mg/l.
5	PH value	6.5 to 8.5	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 9.0 in absence of other water quality parameters.	19	Strontium (as Sr eqt. Mg)	4.0	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 5.0 mg/l.	20	Lead (as Pb eqt. Mg)	0.05	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.1 mg/l.
6	Total Dissolved Solids (TDS) (as CaCO_3 eqt. Mg)	500	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 1000 in absence of other water quality parameters.	21	Copper (as Cu eqt. Mg)	0.05	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.1 mg/l.	22	Chlorine (as Cl_2 eqt. Mg)	2.0	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 2.5 mg/l.
7	Calcium (as Ca eqt. Mg)	75	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 100 in absence of other water quality parameters.	23	Iron (as Fe eqt. Mg)	0.3	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.5 mg/l.	24	Alumina (as Al_2O_3 eqt. Mg)	40	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 50 mg/l.
8	Magnesium (as Mg eqt. Mg)	35	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 50 in absence of other water quality parameters.	25	Cadmium (as Cd eqt. Mg)	0.01	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.02 mg/l.	26	Lead (as Pb eqt. Mg)	0.05	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.1 mg/l.
9	Sulphate (as SO_4 eqt. Mg)	450	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 750 in absence of other water quality parameters.	27	Barium (as Ba eqt. Mg)	4.0	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 5.0 mg/l.	28	Strontium (as Sr eqt. Mg)	4.0	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 5.0 mg/l.
10	Chloride (as Cl^- eqt. Mg)	250	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 500 in absence of other water quality parameters.	29	Iron (as Fe eqt. Mg)	0.3	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 0.5 mg/l.	30	Alumina (as Al_2O_3 eqt. Mg)	40	Exceeds the limit, water becomes turbid and objectionable odour develops.	Desirable	May be exceeded up to 50 mg/l.



Effective in removing turbidity, color
and odor



Challenges

- The UF Membrane possesses a problem of frequent clogging. Thereby giving a usable duration of 6 months before clogging.
- Water pressure is required for purification, hence a height of 25ft and 2 inches(minimum) of pipe is required for substantial purification.
- Pressure is required for purification through the UF membrane. Hence, only tap water can be purified with it.

The process of designing and developing a product for the overall benefit of the public, is a long process.

The NGO we are working with as well as the BWSSB, have offered their long-term support.

Our project does not end here, we will continue working until we are certified by the BWSSB to distribute the devices and our goals are achieved in making a **positive difference.**

Thank you!