

⇒ **ABSTRACT: -**

As we all know that industrialization is the major cause of the contamination of drinking water. Polluted water is cause of communicable diseases and its purification is time and cost heavy task. So our problem statement challenges us to develop a cost effective water purification system for rural community. In the village Sandraur there is a need of an efficient water purifier which should be user friendly and provide the consumer with clean and safe drinking water. It would be electric in nature and portable too. So while developing the water purification system we faced some constraints such as cost effectiveness, time consumed per cycle, service time and methodology, time to complete the project. So after considering all the parameters we found that its features would be like it will consist of filtering membranes like Chlorine, UV, Sediment chamber, Carbon etc. It will have a storage capacity of 12.5 litres and will be purifying one cycle of water in 50 minutes. Its outer body will be water resistant. So It will waste very less amount of water. It would consume less power and will cost around Rs.2600 and need a service after every 5 months. It is having water resistant body and wastes minimal amount of water and will be treating water in every aspect. It will be having QR codes to check the condition of chambers at regular intervals to know the well-being of water. The main parameters we worked upon to purify the water were TDS, pH, Dissolved oxygen, Dissolved chlorine.

⇒ **EXISTING SOLUTIONS: -**

In our solution we have installed 7 purification stages but in the existing solutions there are only 4 or 5 which makes our solution more advanced and enhances the lie of the product, moreover normal RO filters installed by reputed companies like KENT, LIVpure etc. waste around 40 to 50% of the inlet water fed to them and even one has to bear a high service cost after every 3-4 months which is not possible for village people to bear so they need a water purifier which should come under their budget and requires minimal service cost. Moreover, they just make the Mineral amount very less which makes our body deficient of certain minerals which are very essential to our body and we have focused on it by adding natural Alkaline chamber in it which raises the DO amount in the water.

Also our main area of concern is the cost, so we have worked upon the cost as much as we can and we challenge no product with such features is available in the market at such a low price of Rs.2600. and with a service cost of Rs.40 that too after every 5 months and we feel that we can educate the people about service procedure so that they need not call anyone for service. Also we have installed QR codes against every purifying chamber which makes it easy for user to know when it is to be replaced and its present condition too which is of vital help to the community.

Also we have installed a protection tray between the water processing tray and the storage tank which protects the insects or any other microorganisms entering the tank area which is not available in any filter of its Price range.

This is a link depicting the cost of a 8L water purifier with 5 chambers and it costs around Rs.15000

https://www.amazon.in/Grand-8-Litres-Wall-Mountable-Water-Purifier/dp/B0073QJ32A/ref=sr_1_1_sspa?ie=UTF8&qid=1553711956&sr=8-1-spons&keywords=water+purifiers&psc=1

This is link depicting a gravity based filter but the purification level is only around 20-30% which is not a good ratio also it needs man power to operate

https://www.amazon.in/Gold-Optima-10-Litres-Non-electric-Purifier/dp/B009DA69W6/ref=sr_1_20?ie=UTF8&qid=1553711956&sr=8-20&keywords=water+purifiers

This is a link depicting the minute details of RO purifiers, each and every terminology is described

http://membranes.com/docs/papers/04_ro_water_chemistry.pdf

This video link depicts the harms a RO membrane can bring if not understood before use we undertook every precaution mentioned

https://www.youtube.com/watch?v=r_poL3r9K-E

This video mentions the research done on every component trusted and verified by WHO: -

<https://www.youtube.com/watch?v=HISQ2yahlhU>

Zero water wastage is not possible in any purification system hence shown in the video: -

<https://www.youtube.com/watch?v=X7OAIR-hvZE>

As we noticed in the above videos and links, we found the perfect ways of building a water purifier also we found certain methods for consumption of waste water. So here we get to know the future scope of our project which says that in the residential societies where there are flats or houses with identical maps there a pipe line can be set up for the waste RO water storage which can be used for cleaning purpose in home, gardening purpose and car washing etc.

The comparison between electric and gravity based filter(Non-electric) is shown in the image below:

UF vs Activated Carbon water purifiers

Activated carbon water purifier	UF water purifier
1 Activated carbon water purifier uses activated carbon or charcoal	UF water purifier uses hollow fiber threaded membrane
2 Activated carbon water purifier eliminates chemicals, removes bad odor	UF water purifier removes removes bacteria as well as cyst, microorganism which causes water borne diseases.
3 Effective on dissolved chemicals	Less effective on dissolved chemicals
4 Less effective on muddy turbid water	Effective on even water is muddy turbid
5 Small life time	Long life time
6 Frequent cleaning required	No need of frequent cleaning

Electric water purifier	Non electric water purifier
<ul style="list-style-type: none"> RO water purifier UV water purifier 	<ul style="list-style-type: none"> Sediment filter Activated carbon water purifier UF water purifier

RO water purifier uses electricity for increase water pressure. Water pressure helps to water across RO membrane to remove dissolved solids. UV water purifier uses electricity to generate UV radiation that kills contaminants, microorganisms.

	Electric water purifier		Non electric water purifier		
Water purifier type	RO water purifier	UV water purifier	Activated carbon water purifier	UF water purifier	Sediment water purifier
What removed	Dissolved solid (TDS)	Water borne diseases causing bacteria, viruses	Dissolved chemical	Germs and viruses	Suspended matter, silt, sand
What they use	RO membrane	UV radiations	Activated carbon / charcoal	Hallow fibers	Cotton, cellulose filter
Cost	High	less	less	less	less

Electric water purifier such as RO water purifier removes dissolved solids (TDS) makes hard water to soft water. Whereas UV based water purifier kills microorganisms. In the case of electric water purifier with a combination of RO plus UV makes water softer and

Hence minute details for existing purifier is depicted in the content.

⇒ **SOLUTION: -**

Our solution is unique because it is a cost effective solution to the problem and no existing product with same features is available in the market. As we all know that industrialization is the major cause of the contamination of drinking water. Polluted water is cause of communicable diseases and its purification is time and cost heavy task. So when we analysed the condition of water in various testes we observed that the main area we need to work upon were TDS, hardness, waste water management, pollutants removal in the water. Also we found that we need to create a water resistant outer body so that it can be installed in outside region in some houses. We designed a water flow diagram such as to make the water clean as much as possible. In our project the water from the inlet enters the pre filter chamber where the dust and debris is removed and it also enhances the life of entire filter chambers next it goes to the chlorine chamber where it gets added with the chlorine amount as required by our body and then it goes to the sediment chamber where the minute filtration and settlement of dust and debris takes place and it passes the water to the membrane chamber where the ultra-filtration process takes place and the major dissolved impurities which are not visible to naked eyes are removed and from its outlets the water is passed into UV chamber where the microorganisms and other harmful bacteria is removed and the it is passed to natural alkaline chamber where natural minerals are added to it with the help of natural material, we have also set up an electrical circuit where the cut-off switch, SV, Pump, SMPS, UV adaptor is utilised for performing specific actions. Moreover, we have installed QR codes relating every chamber and the storage tank so that the life and the present condition of respective chamber can be analysed and its replacement time can be tracked. In the regular purifier one need to bear a service cost of Rs.350 after every 3-4 months but in our solution the service cost is Rs.50 and that too after 5-6months which makes it a reliable, cost-effective and efficient solution to the problem.

⇒ **UNIQUENESS: -**

Our product is best of its type and is the cheapest product offering such features. Its QR codes and minimal water wastage makes it unique in its domain. As depicted in the links and the videos above we observe that the cost of such units lies between 7000-16000 and the water wasted is around 40-50% but in case of our solution the waste water percentage is 10-15% and also we have worked drastically on the cost of solution. We are having 7 chambers which provide the water with every essential components and assure the removal of every harmful component. Also in case of our water purification method no artificial minerals or chemicals are added in the water to clean it but we focus on adding the essential minerals using natural materials so we provide the consumer with a better taste and quality of water which is very essential in present scenario. We have installed the insect or microorganism protection tray between the water purification chamber and the storage tank so that no insects from the spaces could enter the water tank and contaminate it. Also for servicing the water purifier special assistance is required but in our case the user can just scan QR code and know the

condition of respective chambers and spreading education how to replace the component can be spread and it can just be serviced for Rs.50 after 5-6 months which is a very beneficial thing for the consumer. **These things make our product unique amongst all the existing solutions.**

⇒ **BUDGETARY DETAILS: -**

The main constraint that was to be considered is cost of the product so it could be affordable to the community so while designing the product we kept in mind the cost factor and we were very much successful in achieving the same. Our product is available at a price of Rs.2600 and no product with same features is available at such a minimal price. Also we concerned about the future cost of the product so we found the service cost to be Rs.50 after every 5-6 months. The cost of each component is enlisted below: -

• Motor pump	Rs.500
• Membrane	Rs.400
• UV	Rs.90
• Body	Rs.500
• Carbon	Rs.80
• Sediment	Rs.70
• Cut-off switch	Rs.45
• SMPS	Rs.250
• UV adaptor	Rs.50
• SV	Rs.80
• Alkaline	Rs.50
• Clumps	Rs.30
• Pipe	Rs.50
• Teflon tape	Rs.10
• Connecting wires	Rs.20
• Pre filter	Rs.150
• Chlorine	Rs.75

The results and calculations showing cost per litre of water per chamber is depicted in the next image where we find out many results.

Calculations

DATE: ____/____/____

CHLORINE CHAMBER

Cost Rs 75

Service life :- 10500 litres

1 litre = Rs 0.00714

Sediment Chamber

Cost Rs 70

Service life \rightarrow 9000 litres

1 litre = Rs 0.0077

Carbon Chamber

Cost Rs 80

Service life \rightarrow 9100 litres

1 litre = Rs 0.0087

Motor

Cost Rs 500

life = 6 years

Membrane

Cost Rs 450

Service life - 20000 litres

1 litre = Rs 0.0225

UV

Cost Rs 100

UV lamp life \rightarrow 1 year

UV tube \rightarrow lifetime

Cost Rs 30

Alkaline Chamber

Cost Rs 70

Service life - 10000 litres

1 litre = Rs 0.007

SV

Cost Rs 120

No service required

Pic-Fillup

Cost Rs 35

Service required - 4-5 months