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# Design of Water Purified with RO+UV+UF

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***Abstract:** In this water purifier we combine the RO (Reverse Osmosis) UV (ultraviolet) and UF (Ultra filtration) with TDS controller and AAA (alkaline antioxidant antibacterial). The water purifier is design on the basis of the efficiency increasing, cost of purifier, and maximum places it can be used for different type of water. The water purifier provided mineral cartridge in which the mineral is added and quality of water is increase. The TDS controller is provided to control the TDS of water and to decide the purification outline. It is economical and very efficient for purification of water with minimum wastage of water.*
***Keywords:** Purifier, RO (Reverse Osmosis), UV (ultraviolet), UF (Ultra filtration), AAA (alkaline antioxidant antibacterial)*

## I. INTRODUCTION

Water is essential for life. The amount of fresh water on earth is limited, and with the rapid industrialization, its quality is under constant pressure. Preserving the quality of raw water is important not only for the drinking-water supply, but also for food production and other water uses. Water quality can be compromised by the presence of infectious agents, toxic chemicals, and radiological hazards. Water quality deterioration in distribution systems is mainly caused by inappropriate planning, design and construction or inadequate operation and maintenance and water quality control. This has been linked to a significant proportion of the burden of waterborne and water-related illness. Stresses on these systems caused by rapid urbanization, population growth and aging infrastructure further exacerbates the problems. The integrity of well managed distribution systems is one of the most important barriers that protect drinking-water from contamination. However, management of distribution systems often receives little attention. Distribution systems can incorrectly be viewed as passive systems with the only requirement being to transport drinking water from the outlets of treatment plants to consumers. Hence it is the prime responsibility of Civil Engineering Department to arrange adequate and safe supply of water of acceptable quality.

The fresh water scarcity is a growing problem all over the world because only 1% of earth's water is fresh water available for human to drink. The US geological survey found that 96.5% of earth's water is located in seas and oceans and 1.7% of earth's water is located in the ice caps. The remaining percentage is made up of brackish water, slightly salty water found as surface water in estuaries and as groundwater in salty aquifers. The need for fresh water is at the top of the international agenda of critical problems, at least as firmly as climate change. India as a country has 16% of the world's population and 4% of its fresh water resources. Due to rapid industrialization and development, there is an increased opportunity for grey water reuse in developing countries such as India. Although India occupies only 3.29 million $km^2$ geographical area, which forms 2.4% of the world's land area, it supports over 15% of world's population. The population of India as of March 31, 2011 was 1,210,193,422 persons (Census, 2011). India also has a livestock population of 500 million, which is about 20% of world's total livestock. However total annual utilizable water resources of the country are 1086 km3 which is only 4% of world's water resources. Total annual utilizable resources of surface water and groundwater are 690 km3 and 396 km3, respectively. Consequent to rapid growth in population and increasing water demand, stress on water resources in India is increasing and per capita water availability is reducing day by day. In India, per capita surface water availability in the years 1991 and 2001 were 2300m3 (6.3m3/day) and 1980m3 (5.7m3/day), respectively, and these are projected to reduce to 1401 and 1191m3 by the years 2025 and 2050, respectively. Total water requirement of the country in 2050 is estimated to be 1450 km3 which is higher than the current availability of 1086 km3. Pure, clean water is an absolute must for our survival. Water resources used by humans for various domestic purposes such as drinking, cooking food, washing clothes, baths, recreations, flushing toilets, and car washing. Water is also used for various industrial purposes, agricultural purposes, power generation, fishing, and so forth. The quantity of available fresh water is inadequate to meet the growing demands of human beings. The conventional water sources, like rivers, lakes, ponds, and so forth, in the form of surface water are not fully dependable because most of these are rain fed. Presently, rainfall is below normal in most of the years. This results in failure of many surface water source schemes. Similarly, due to the reasons stated already the subsurface sources also fail in certain extent.

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## II. LITERATURE SURVEY

### *A. Membrane Technology Development*

Benny Freeman[1](1960) et-al- He studied Proving successful at producing purified water from salt water; membranes became a viable alternative to evaporation-based technologies in the water treatment market membranes have risen to the challenge and continue to perform efficiently and effectively.

Joseph G.Jacanjelo[2] (1997) et-al -He studied with the increase in water quality regulating and decrease in the availability of fresh water supplies in US, pressure driven membrane process are playing increasingly important role in drinking water. they are being employed to remove a wide range of contamination and depending on their use ,can be operated with minimum or no chemical pre-treatment that forms deleterious by products.

Alexei G.Pervov[3] (2000) et-al – He studied regarding dimensions of membrane modules and of NF membranes for treatment of majority of natural waters with different ionic compositions ensures certain efficiency of "cartridge service" approach to serve large amount of units in operation. Thus, development of service strategies has decisively influenced WATERLAB's manufacturing, sales and maintenance techniques.

Ben Corry[4](2007) - he studied The transport of water and ions through membranes formed from carbon nano tubes ranging in diameter from 6 to 11 Å is studied using molecular dynamics simulations under hydrostatic pressure and equilibrium conditions. Membranes incorporating carbon annotates are found to be promising candidates for water desalination using reverse osmosis, and the size and uniformity of tubes that is required to achieve a desired salt rejection is determined. By calculating the potential of mean force for ion and water translocation, we show that ions face a large energy barrier and will not pass through the narrower tubes studied ((5,5) and (6,6) “armchair” type tubes) but can pass through the wider (7,7) and (8,8) nanotubes. Water, however, faces no such impediment due to the formation of stable hydrogen bonds and crosses all of the tubes studied at very large rates. By measuring this conduction rate under a hydrostatic pressure difference, we show that membranes incorporating carbon nanotubes can, in principle, achieve a high degree of desalinate on at flow rates far in excess of existing membranes.

Stephen Hawkins[5] (2010) et-al - he studied regarding Carbon nanotubes (CNTs) are nanoscale cylinders of grapheme with exceptional properties such as high mechanical strength, high aspect ratio and large specific surface area. To exploit these properties for membranes, macroscopic structures need to be designed with controlled porosity and pore size. This manuscript reviews recent progress on two such structures: (i) CNT Bucky-papers, a non-woven, paper like structure of randomly entangled CNTs, and (ii) isopodous CNT membranes, where the hollow CNT interior acts as a membrane pore. The construction of these two types of membranes will be discussed, characterization and presence results compared, and some promising applications presented.

## III. WORKING METHODOLOGY

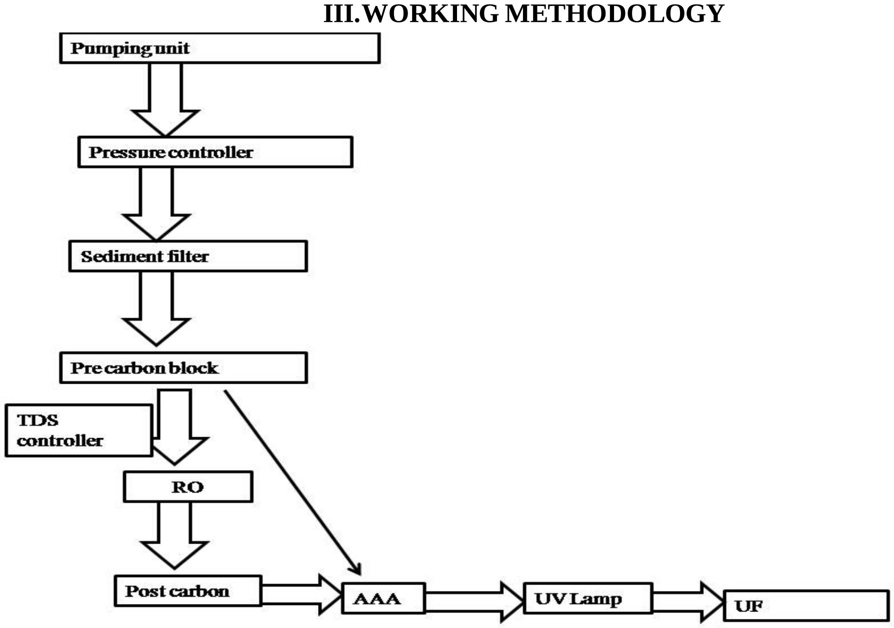


Fig. No. 1 Block Diagram of Design Water Purifier

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*A. Stepwise Purification Process*

1) *Pumping Unit and Pressure Controller:* In this unit the water pressure is measured and it is supplied by the pump of 24 A DC current is required. The water pressure maintain by the pressure controller.
2) *Sediment Filter:* In this filter all the floating impurities are removed by pores. The main function of sediment filter is to remove large and fine particles from a drinking water, such as sand, dirt, silt, and rust particles. Each cartridge is individually shrink-wrapped. The diameter of a human hair is about 90 microns. Sediment filters are used to catch particles 1/300 of that. Most sediment filters are given ratings by their manufacturers that describe their effectiveness at removing particles down to as specified size. The most common of these are “nominal" and "absolute."


Fig. No. 2 Sediment Filter

3) *Pre Carbon Block:* It is made up of burning the coal at 1000$^{o}$c without oxygen to form small particle of coal. The pore size of carbon block is less than 50nm. it removes all the impurities in chemical as well as physical form.
4) *TDS Controller:* As the name suggests it is a device which helps in controlling the TDS level of the water coming out of the RO. The RO process reduces the hardness of the input water by approximately 90%. This means, that for an input of TDS 700, the output will be close to 70. The control of this device is on our hand if the water in municipal water it is already purified water and it does not required RO treatment. The device is closed for RO the water directly go through the alkaline treatment.

Fig. No. 3 TDS controller

5) *RO Membrane:* In the reverse osmosis process demineralization of water is produced by forcing water through semi permeable membrane at high pressure. In ordinary osmosis, if a vessel is divided by semi permeable membrane and one compartment is filled with water and other with concentrated salt solution water diffused through the compartment containing salt solution until the difference between two side of the membrane create a sufficient pressure to counteract the original water flow the difference in level represent the osmotic pressure of the solution.

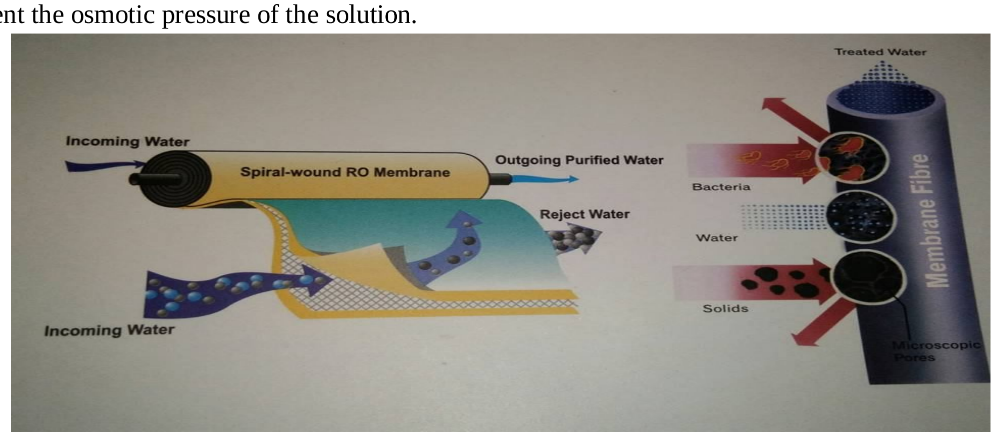


Fig. No, 4 Diagram of RO Membrane

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6) *Post Carbon Block:* The water from RO is directly we cannot drink because it is acidic so that it is passing through the block. It adsorbs the entire excess chemical and makes water normal for drinking.
7) *Antioxidant Alkaline Anti-Bacterial (AAA):* Antioxidant alkaline anti-bacterial is used after RO and pre carbon for municipal water. It includes material like ph stone, red balls, black silica, anti bacterial ball, carbon


Fig. No. 5 Alkaline Membrane

*B. Working Procedure*
1) Add mineral
2) Ph enhancer
3) Reduce ORP
4) Remove free radicals
5) Decrease NMR
6) Remove bacteria virus

Following table shows the comparison of market RO+UV+UF and Designed RO+UV+UF on the basis of test carried out on water after purification by using Designed RO+UV+UF.

Table No.1 Comparison of Market RO+UV+UF and Designed RO+UV+UF

| Sr. No. | Parameters | Market RO+UV+UF | Designed RO+UV+UF |
|---|---|---|---|
| 1 | TDS allowable max | 2000mg/lit | 2000mg/lit |
| 2 | TDS after purify of water | Reduce up to 90% | Reduce up to 90% |
| 3 | Total hardness allow max | 300mg/lit | 300mg/lit |
| 4 | Maintenance cost | More | Less |
| 5 | Electricity | More consumption | Less consumption |
| 6 | Capacity in one hour | 10 liters | 15 liters |
| 7 | Cost4 | 45000 | 4000 |

## IV. CONCLUSION

From the above experimental work the following conclusion are drawn,

*A.* The quality of water is within acceptable limits.
*B.* All types of water purified from water purifier.
*C.* It can be used for purified water also.
*D.* It is used for municipal water for purification.
*E.* It is economical.
*F.* The life span is one year.
*G.* The cost of maintenance is low.

## V. ACKNOWLEDGMENT

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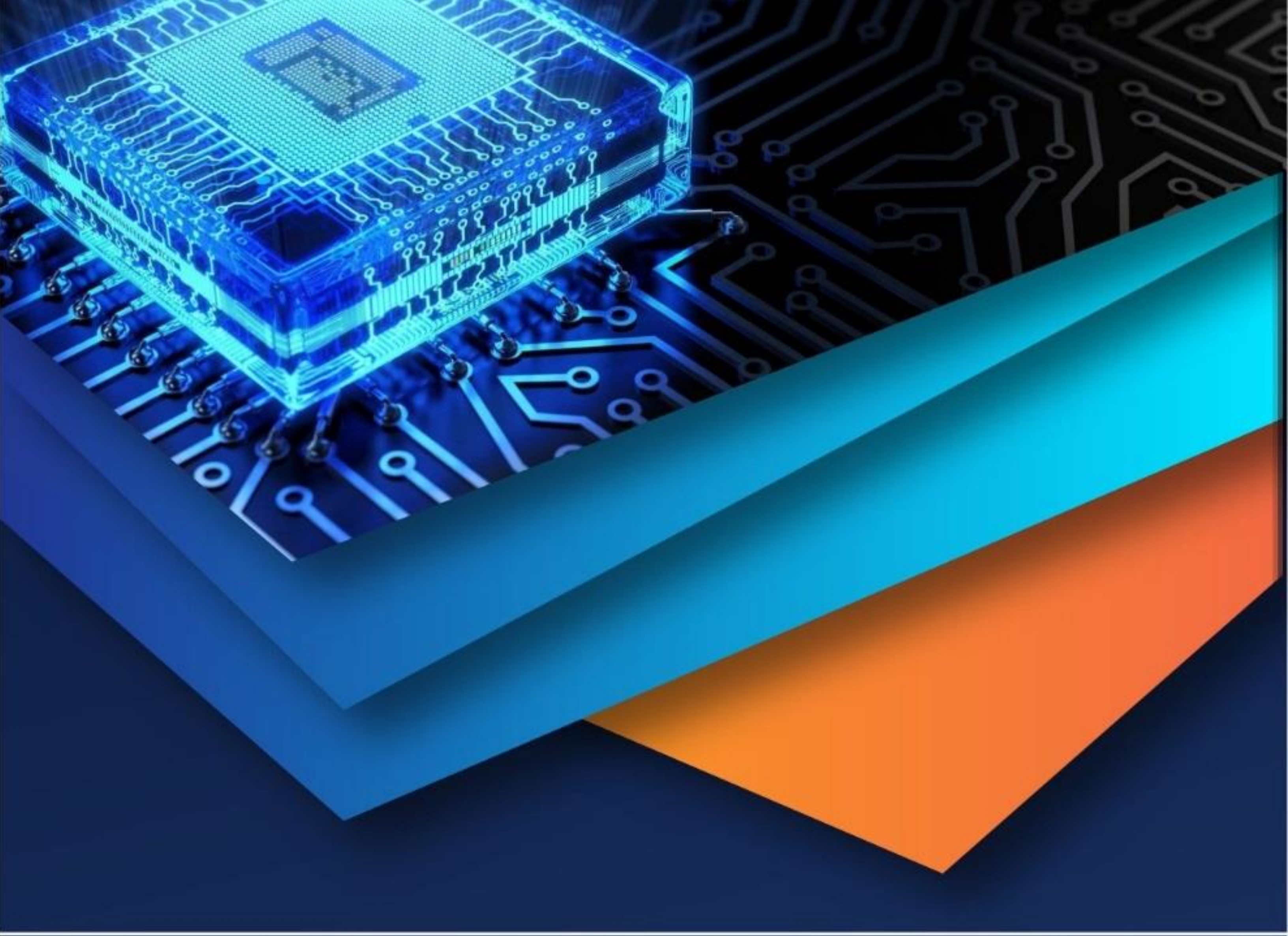


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