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Treatment of Alkaline Water using Reverse Osmosis System with the Help of Renewable Solar Energy

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Abstract: The aim of this project is to develop a low-cost water purification system that provides clean drinking water. The project has a broad reach since drinking water pollution is a big global problem. This device would provide a solution to contaminated drinking water. Electric current is used to power the purifier during the water treatment process, reducing fluoride, chloride, and increasing the pH content of salty water, resulting in potable drinking water. To achieve this aim, a project management plan has been devised that divides the tasks amongst the community. The ultimate goal of designing this project is to provide clean drinking water at a low cost. The aim of this project is to develop and build a small-scale water purification system that needs little maintenance and is inexpensive. Initially, solar power would be used to power the purification system and to transition the system to renewable energy.
Keywords: Water Treatment, Reverse osmosis System, Water purification, Renewable energy.

I. INTRODUCTION

In developing countries such as India, population growth combined with industrialization is putting a strain on water supply, causing the water table to shrink. Even in India's water-rich regions, the water table is receding. Water and fresh air are unavoidable life tools. Initially, solar power would be used to power the purification system and to transition the system to renewable energy. Daily monitoring of drinking water is the most important criterion for ensuring that everybody has access to safe drinking water. The testing results must be validated using standard values.

One of the access points that provides water quality reports and other insightful reports based on water collected at the locality level (lower than village level) in various parts of India. We have been regularly educating people in the villages on water testing methods using water testing kits for the past few years. To avoid problems and ensure proper operation, the water circulating in a boiler or cooling system must be continuously corrected. Water monitoring must be done on a regular basis to monitor impurities, treatment levels, degradation, and deposits. The aim of this project is to develop and build a small-scale water purification system that needs little maintenance and is inexpensive.

II. LITERATURE REVIEW

E.R. Cornelissen et al (2021) found that A minimal pre-treated reverse osmosis system using only screens on surface water did not result in stable reverse osmosis operation, however, the ultrafiltration pre-treated reverse osmosis system also failed in the longer run. Periodical air water cleaning in minimal pre-treated RO resulted in an approximately 4-fold reduction of the spacer clogging rate, while not affecting the membrane fouling rate.

Linyan Yang et al (2020) found that The Fe-based heterogeneous catalyst carried the higher potential to improve the biodegradability of ROC (i.e., 0.32 v. s. 0.27 for B/C, the ratio between BOD_5 and COD) although its direct COD removal efficiency was inferior to the homogeneous one (i.e., 49% v. s. 59% after 25 min' reaction). Jacob F. King et al (2020) found that Addition of 300 mg/L CaO at pH 11 achieved partial removal of the native nickel and copper by precipitation. Ozone pretreatment further enhanced precipitation of nickel, but not copper. Ozonation achieved 5-log inactivation of MS2 in all five concentrate samples at 1.18 mg O_3/mg DOC. Ozonation at 0.9 mg O_3/mg DOC formed 139–451 mg/L bromate. Pretreatment of RO concentrates with chlorine and ammonia reduced bromate formation by a maximum of 48% but increased total halogenated DBP concentrations from 20 μg/L to 36 μg/L. Regardless, neither bromate nor trihalomethane concentrations exceeded threshold concentrations of concern for discharge to marine waters.

III. WATER TESTING PROCESS

The goal of sampling is to obtain for analysis a portion of the main body of water that is truly representative. The most critical factors necessary to achieve this are:

1) Point(s) of sampling
2) Time of sampling
3) Frequency of sampling
4) Maintenance or integrity of the sample prior to analysis

A. Sampling

First of all, the testing team goes to the water body present in the vicinity to collect sample water to be tested. There could be various sources viz. Hand washing taps, Open Well, Tank or say underground water reservoir etc.

Figure 1: Sampling from hand wash Pipe

Figure 2: Sampling from tank

Figure 3: Sampling from Open well

IV. EXPERIMENTAL INVESTIGATION

A. Physical Test

The physical test involves in testing Taste (Using your tongue), Color (By looking at the color of water), Odour (By smelling the sample water), Transparency / Turbidity (By looking for the clarity of water) and Temperature (measured using thermometer)

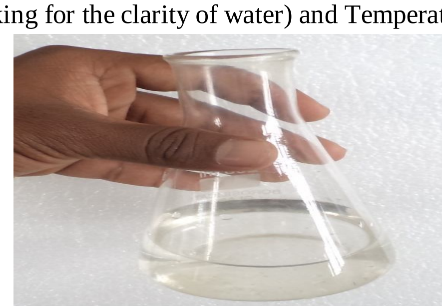

Figure 4: Looking Colour of water

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B. Chemical Test

1) pH

a) The Ranges of PH Value for OPEN WELL WATER = 7.2

b) The Ranges of PH Value for TANK WATER = 8.4

c) The Ranges of PH Value for HAND WASHING PIPE WATER = 8.2

2) *Chlorides:* The Amount of chloride iron present in the whole of the given water sample= 0.118 gm/mg/ppm

3) *Total hardness*

a) The Amount of total hardness of the given sample of water = 1800 ppm

b) The Amount of permanent hardness of the given sample of water = 1750 ppm

c) The Amount of temporary hardness of the given sample of water = 50 ppm

4) *Fluoride*

a) The amount of Fluoride present in Open Well Water = 2.665 mg/liter

b) The amount of Fluoride present in Tank Water = 3.743 mg/liter

c) The amount of Fluoride present in Hand Washing Tap Water = 3.811 mg/liter

5) *Total Dissolved Solids*

a) The TDS (Total Dissolved Solids) value for Open Well Water = 1450

b) The TDS (Total Dissolved Solids) value for Tank Water = 1750

c) The TDS (Total Dissolved Solids) value for Hand Washing Tap Water = 1980

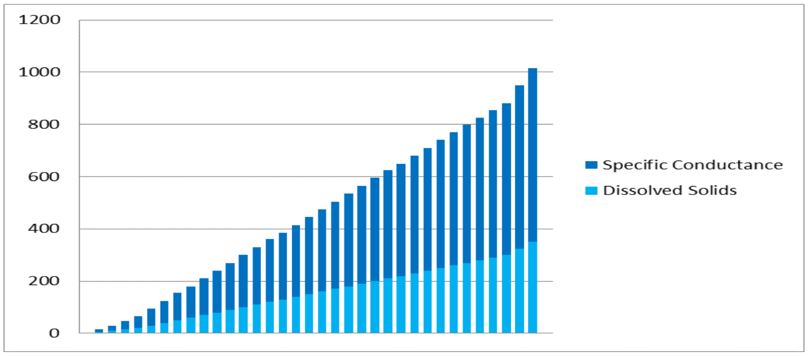

Figure 5: Dissolved Solids (ppm) Vs. Specific Conductance of Water

6) *Alkalinity*

a) The Amount of HCO23-alkalinity present in Open Well Water = 675 ppm.

b) The Amount of HCO23-alkalinity present in Hand Washing Tap Water = 850 ppm.

c) The Amount of HCO23-alkalinity present in Tank Water = 725 ppm

V. WATER TREATMENT UNIT MODEL

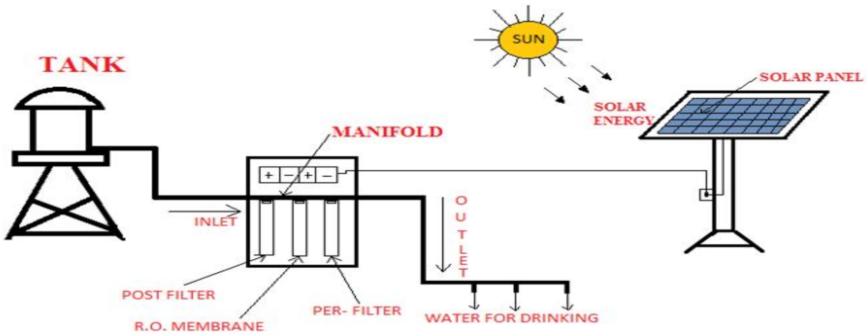

Figure 6: Treatment Unit with renewable energy

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A. Solar Panel

The solar collector of the six units of 185watts was store in battery, the sunlight flow through the absorber. The absorber was a 2 mm temperature-resistant black porous felt mat where through the wire was stored as shown in figure 7.

Figure 6: Solar panel

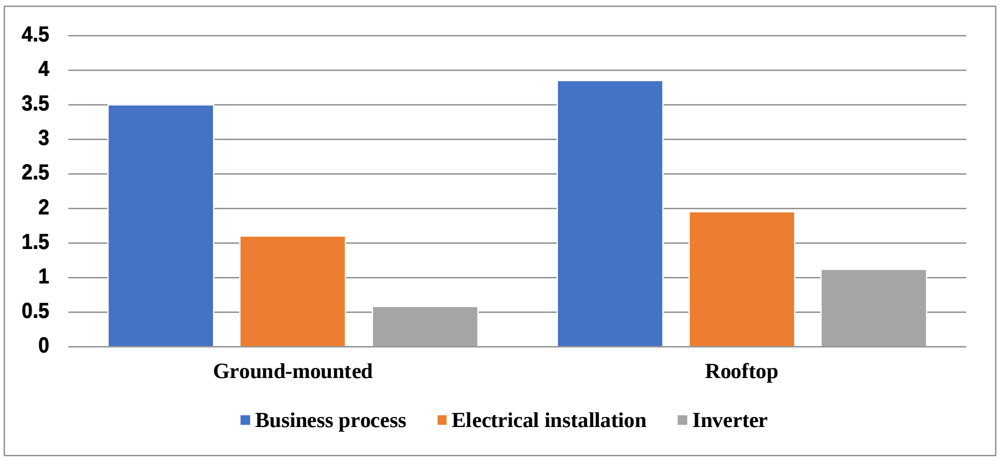

Figure 7: Solar Usage

B. Storage Tank

The storage tank capacity of more than 2500litres per day, were used to treated every day to stored.

Figure 8: Storage Tank

C. Reverse Osmosis (RO) Water Purification Method

Large-scale reverse osmosis water purification filters and facilities play an important role in turning salt water to fresh drinking water in many countries. The procedure is extremely simple. Bore water reaches high-pressure pumps before passing through a series of membranes that filter out salt water and other unwanted particles.

Figure 9: Water Purifier

VI. CONCLUSIONS

The following conclusions were drawn at the end of this study

A. The project was a success, and it was able to refine the design of a cost-effective, but reliable, easy-to-manufacture, and simple-to-use water purification filter for providing a balance between the elements of people, prosperity, and the earth.
B. The most common bacterial pathogens found in water around the world. The current configuration filters approximately 0.4-1 L/hr and uses approximately 5mL of 2000-ppm colloidal silver per filtration device. Because of its enclosed nature, the new device poses no risk of leakage or contamination of filtered water.
C. In comparison to other methods of water treatment, our project is to treated groundwater recharge is ecologically safe and less expensive than chemically induced coagulation, relying solely on reverse osmosis and solar energy to power the purifier.

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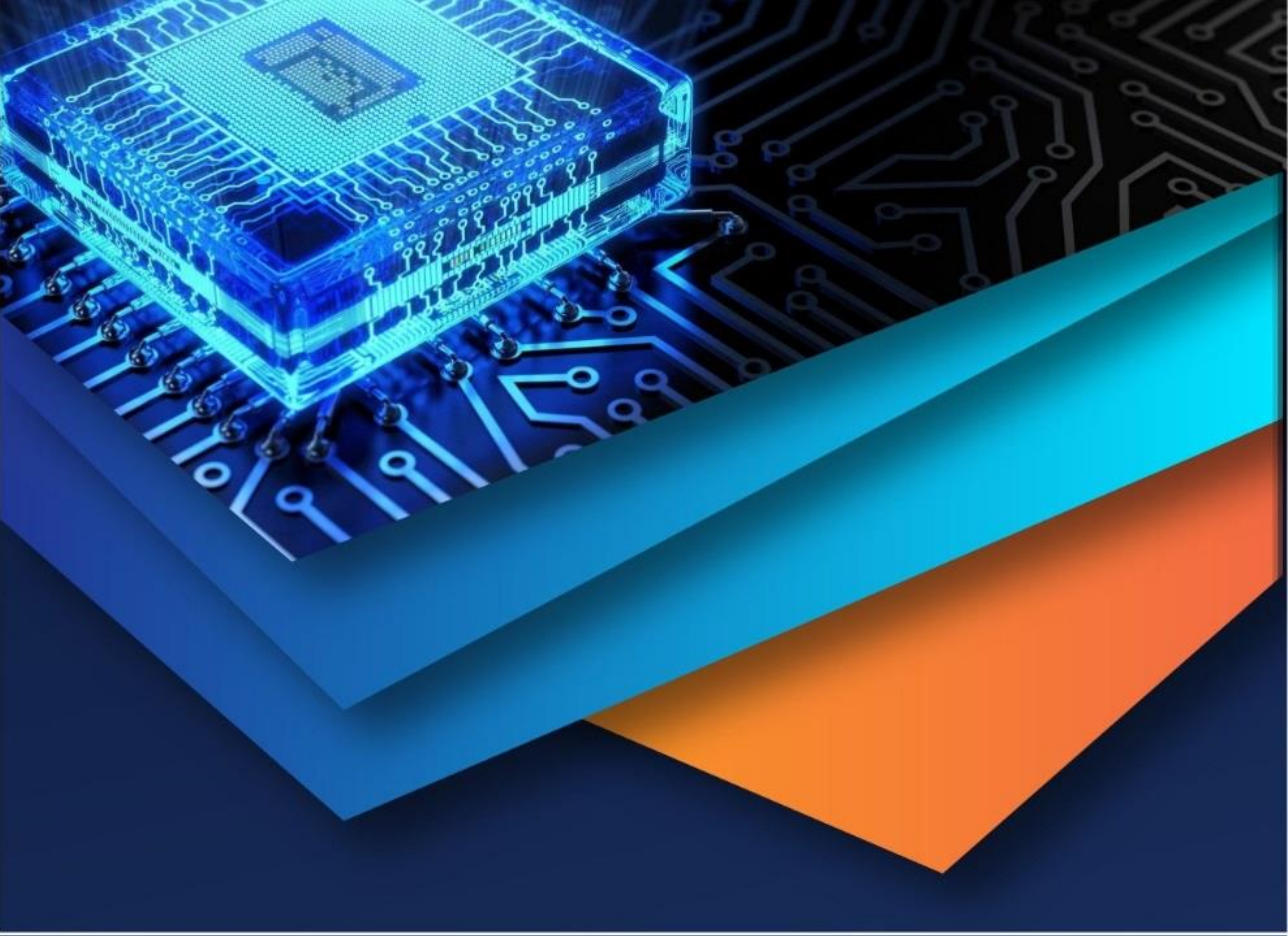

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