SOLAR ENERGY BASED WATER PURIFICATION SYSTEM USING ELECTROLYSIS OF WATER

Rupak Lonare[1], Achal Sonekar[2], Diksha Gautre[3], Arti Karnake[4], Kalyani Gomase[5], Uday Kuthe[6]

[1] *Assistant Professor, Department of Electrical Engineering, Nagpur Institute of Technology, Maharashtra, Nagpur*
[2] *B.E Student, Department of Electrical Engineering, Nagpur Institute of Technology, Maharashtra, Nagpur*
[3] *B.E Student, Department of Electrical Engineering, Nagpur Institute of Technology, Maharashtra, Nagpur*
[4] *B.E Student), Department of Electrical Engineering, Nagpur Institute of Technology, Maharashtra, Nagpur*
[5] *B.E Student, Department of Electrical Engineering, Nagpur Institute of Technology, Maharashtra, Nagpur*
[6] *B.E Student, Department of Electrical Engineering, Nagpur Institute of Technology, Maharashtra, Nagpur*

ABSTRACT

As an energy storage medium, hydrogen has drawn the attention of research institutions and industry over the past decade, motivated in part by developments in renewable energy, which have led to unused surplus wind and photovoltaic power. In this paper, we are making a water purifier which works on solar energy. The basic principle behind this project is reverse osmosis. The solar radiations are collected by solar panel. This energy is then stored in a battery. The battery is connected to the purification unit through an electromagnetic relay. The purification unit consists of high-pressure motor, reverse osmosis system and the water tank. The high pressure creates the necessary pressure required to carry out reverse osmosis. The microcontroller 8051 keep watch to the level of water in the water tank and prevents it from over flow. Through this process we obtain the purified water in the water tank. Water purification is the process of eradicating detrimental chemicals, biological poisons, suspended solids and gases from contaminated water. In this work we have reported an investigation of compact filter which is cost effective for developing countries and ease of maintenance. We have arranged a solar water disinfection system that improves the microbiological quality of drinking water at household level.

1. INTRODUCTION

The world population is increasing day by day and also the demand for energy is increasing consequently. Oil and coal because the main supply of energy to day is predicted to finish up from the globe throughout the recent century that explores a heavy drawback in providing the humanity with a reasonable and reliable supply of energy. The requirement of the hour is renewable energy resources with low-cost running prices. Solar energy is taken into account jointly of the most energy resources in heat countries. Solar energy is incredibly giant inexhaustible supply of energy.

The reuse of water has been doubled as the greatest challenge of the 21st century (Asano, 2002), and, as such, great emphasis is being put into the development of new technologies for the treatment of wastewater for reuse. In general, the methods used include physical processes such as filtration, sedimentation and distillation, biological processes such as slow sand filters or biologically active carbon, chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light. There are many parameters which can be used to measure the quality of water, of which a common one is turbidity, the purpose being to measure impurities in the water. In sense of physical, turbidity is a reduction in the clarity of water due to the presence of colloidal particles or suspended, and commonly it is used as an indicator of the general condition of drinking water. Furthermore, turbidity has been used for many decades as an indicator of the

efficiency of drinking water filtration and coagulation processes, so that it is an important operational parameter for this reason. The high turbidity values refer to poor disinfection and possibly to fouling problem in the distribution network, so that it should be minimized.

Direct and Indirect Water Use: Advances in water technology and management for water use efficiency and conservation should focus on individual use, as well. Every day, Americans use water in various ways, both directly and indirectly. Direct water use includes water used for bathing, cooking, and drinking. In-direct water use refers to the water used to make products that we consume ("virtual water"). This includes water used to produce steel for cars, for clothing, or parts for the many tech devices we use. Figure 3 illustrates direct and indirect water use per capita in the U.S. Individuals can make conscious efforts to reduce water usage and, in doing so, contribute to larger water conservation goals. At home, this can come in the form of (direct) use reduction practices (reducing shower time) and efficiency management (watering gardens at optimal times during the day and with rainwater recovery systems; up-grading or improving appliances; and installing low quality toilets). Indirectly, making smart consumer choices can have a large impact on the virtual water we use. Buying local products and products that were made sustainably and using fewer manufactured products are easy ways to lessen your indirect water use. In the community, individuals should become aware of local water issues, policies, and conservation groups. Becoming involved in the management of water within your community raises awareness of water's importance. Ultimately, efforts big and small result in higher quality and quantity of water resources.

1.1 Mechanism of water purification and disinfection

The water purification and disinfection system is divided into two steps. First is the compact filter preparation and second is the solar collector preparation. In this system, the water is filtered by using physical process of filtration as well as solar energy. At first the water is filtered by using the compact water filtration. Then the pure water is reserved in an aluminum cylinder surrounding with the square glass, which is connected with the solar flat plate solar collector. The solar collector consists of aluminum cane that absorbs the solar heat energy and passes through the aluminum cylindrical chamber. The solar collector is an air tight chamber in which glass is used as surface cover. Then the reserve chamber obtained heat either directly from the sun or the solar collector so that no significant effect on the disinfection of E. coli bacteria. From this, some condensed water is collected from the reservoir which is considered as pure water. There are many parameters of measuring water are tested by different instruments after and before treatment. Finally, we not only get the pure drinking water but also hot water from this system.

When two solutions of different concentrations are separated by a semi-permeable membrane, solvent (water) flows from a region of lower concentration to higher concentration. This process is called osmosis. This driving force in this called osmotic pressure. If a hydrostatic pressure in excess of osmotic pressure is applied on the higher concentration side, the solvent flow is reversed i.e., solvent flows from higher concentration to lower concentration. This process is called reverse osmosis. Thus, in the process of reverse osmosis pure water is separated from salt water.

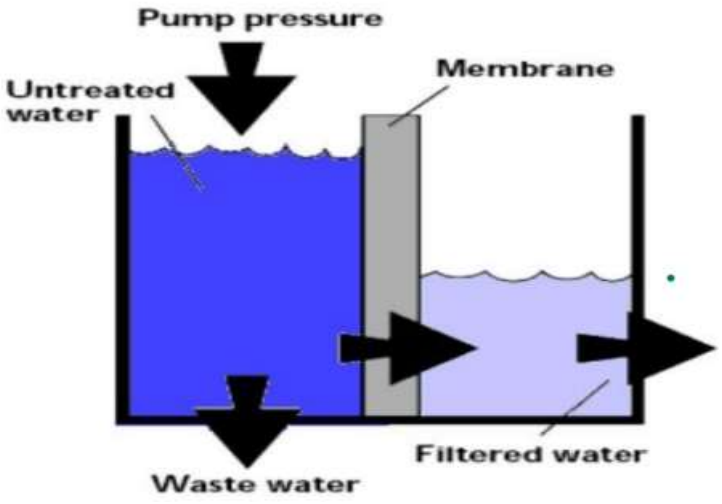

Figure1. Purification technique using solar

1.2 Preparation of solar collector

Solar water disinfection is a type of portable water purification that uses solar energy to make biologically-contaminated (e.g, bacteria, viruses, protozoa) water safe to drink. The filtered water is treated by solar energy in order to remove the rest pathogens, microorganisms, some viruses and bacteria. It also kills germs. Here the water is heated an aluminum cylinder sheet containing 12inch height with 7inch diameter and its capacity of containing of 5 liters of water. It is surrounded with the triangle box which is consists of glass sheet containing 9inch length, 9 inch wide and 13inch height. The triangle box is attached to the solar collector which is composed of columns of painted black aluminum can, a frame to house the columns and ventilation for the heat transportation. Solar thermal water disinfection uses heat from the Sun to heat water to 40-50 °C for a short period of time. The figure represents the proposed model of water purification and disinfection system. In the Figure 2, the number 1 indicates the compact water filter.

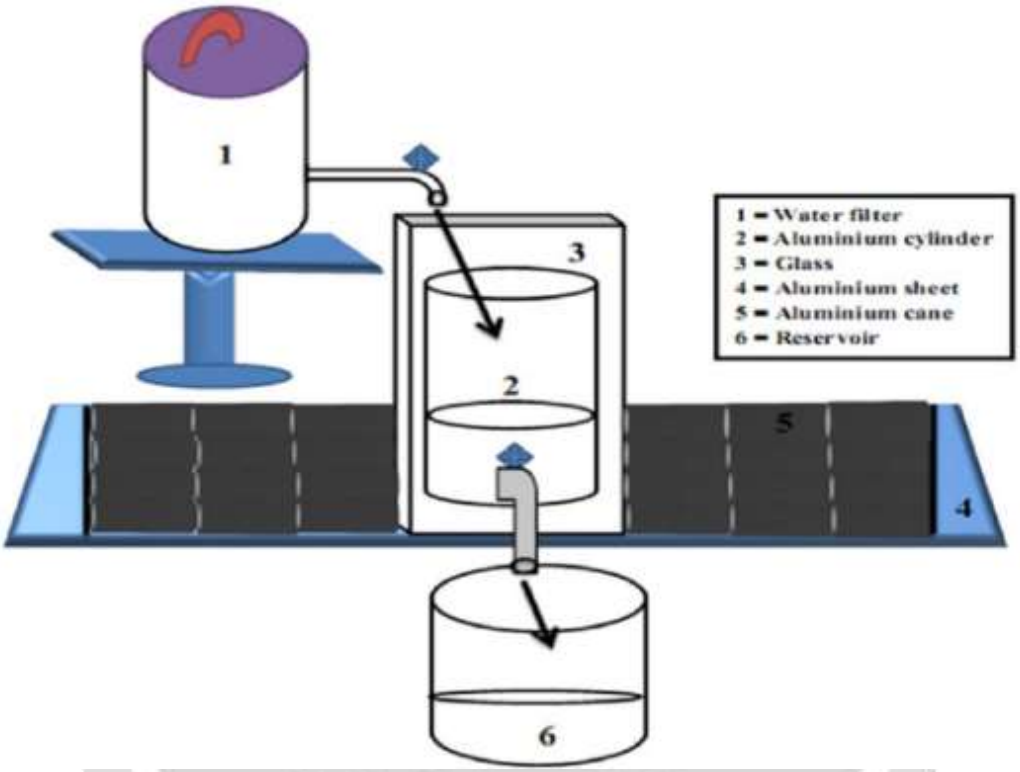

Figure 2. Schematic diagram of water purification and disinfection by solar energy

2. WHY IS THE PARTICULAR TOPIC CHOSEN?

When explaining why the particular topic of a solar energy-based water purification system using electrolysis of water is chosen, several reasons can be highlighted:

1. Sustainable Water Treatment: The topic is chosen because it addresses the pressing need for sustainable and environmentally friendly water treatment solutions. By utilizing solar energy and electrolysis, this system offers a renewable and low-impact approach to water purification, reducing reliance on traditional energy sources and minimizing environmental pollution.
2. Energy Independence: The chosen topic offers the advantage of energy independence by leveraging solar power. Solar energy is abundant and freely available in many regions, allowing the water purification system to operate off-grid or in areas with limited access to electricity. This energy autonomy makes the system suitable for remote locations and emergency situations.
3. Water Scarcity and Quality Concerns: Water scarcity and contamination are global challenges. The chosen topic addresses these concerns by providing an effective method for purifying water from various sources, such as groundwater, rivers, or rainwater. Solar energy-based purification systems using electrolysis can help communities access clean drinking water, mitigating health risks associated with contaminated water sources.
4. Technological Advancements: The topic is chosen to explore the advancements in solar energy and electrolysis technologies. As solar panel efficiency improves and electrolysis processes become more efficient and cost-effective, solar energy-based water purification systems become increasingly viable and practical for

widespread implementation. Investigating and understanding these technological developments is crucial for advancing the field of water treatment.
5. Humanitarian and Disaster Relief Applications: The topic holds significance in humanitarian and disaster relief contexts. During emergencies, such as natural disasters or refugee crises, access to clean water is often disrupted. A solar energy-based water purification system using electrolysis can be rapidly deployed to provide immediate and sustainable access to safe drinking water, potentially saving lives and improving the well-being of affected populations.
6. Interdisciplinary Importance: The topic of a solar energy-based water purification system using electrolysis combines principles from multiple disciplines, such as solar energy engineering, electrochemistry, and water treatment. Exploring this topic fosters interdisciplinary collaboration and knowledge exchange, encouraging the development of innovative solutions that merge renewable energy and water treatment technologies.

Overall, the chosen topic of a solar energy-based water purification system using electrolysis of water aligns with the goals of sustainability, energy independence, water quality improvement, technological advancements, humanitarian aid, and interdisciplinary research, making it a compelling and relevant area of study.

3. WHAT CONTRIBUTION WOULD THE PROJECT MAKE?

When discussing the contribution that a project on a solar energy-based water purification system using electrolysis of water can make, consider the following points:

1. Sustainable Water Treatment Solution: The project contributes to the development of a sustainable water treatment solution by harnessing solar energy and utilizing electrolysis for water purification. This approach reduces reliance on conventional energy sources, minimizes environmental impact, and promotes long-term sustainability in water treatment practices.
2. Access to Clean Drinking Water: The project aims to provide a reliable and affordable method for accessing clean drinking water. By implementing solar energy-based water purification systems using electrolysis, communities in remote areas or regions with limited infrastructure can benefit from improved water quality, reducing the risk of waterborne diseases and enhancing overall health and well-being.
3. Energy Independence and Resilience: The project's focus on solar energy-based water purification systems contributes to achieving energy independence and resilience in water treatment. By utilizing solar power, the system can operate off-grid or during power outages, ensuring a continuous supply of clean water in various situations, including emergencies and remote locations.
4. Environmental Impact Mitigation: The project's adoption of solar energy and electrolysis as the primary means of water purification helps mitigate environmental impacts. By reducing reliance on fossil fuels and conventional treatment methods that may generate pollutants, the project contributes to minimizing air and water pollution, protecting ecosystems, and promoting a cleaner environment.
5. Technological Advancement and Innovation: The project contributes to the advancement of solar energy and electrolysis technologies in the field of water treatment. Through research and development, it aims to improve the efficiency, cost-effectiveness, and scalability of solar energy-based water purification systems, driving innovation and pushing the boundaries of sustainable water treatment solutions.
6. Humanitarian and Disaster Relief Applications: The project's outcomes have potential applications in humanitarian and disaster relief efforts. By providing a portable, renewable energy-powered water purification system, it can contribute to addressing the immediate needs of affected populations during emergencies, ensuring access to safe drinking water and supporting relief operations.
7. Knowledge and Awareness: The project contributes to expanding knowledge and awareness of solar energy-based water purification systems using electrolysis. Through documentation, dissemination of research findings, and educational initiatives, it helps to increase understanding and promote the adoption of sustainable water treatment practices among researchers, professionals, policymakers, and communities.

In summary, the project on a solar energy-based water purification system using electrolysis of water contributes to sustainable water treatment, improves access to clean drinking water, promotes energy independence, mitigates environmental impact, fosters technological advancement, enables humanitarian aid, and enhances knowledge and awareness in the field of sustainable water treatment practices.

4. CONCLUSIONS

In conclusion, solar energy-based water purification systems using electrolysis of water have the potential to be a sustainable and efficient solution for providing access to clean water in areas with limited resources. The technology is based on the use of solar panels to generate electricity, which is then used to power an electrolysis device that produces hydrogen gas, which can be used to power a fuel cell and generate electricity or combined with oxygen gas to produce purified water.

The literature review suggests that the technology has shown promising results in terms of water purification and hydrogen production, with high energy efficiency and the potential for scalability. However, further research is needed to optimize the design and improve the cost-effectiveness of the system.

Overall, solar energy-based water purification systems using electrolysis of water offer a sustainable and renewable solution for water purification, particularly in areas with limited resources and access to clean water. With further research and development, this technology has the potential to play a significant role in addressing global water scarcity and promoting sustainable development.

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