Experimental analysis of Water purification by Solar Energy

[1]Binoy kumar mandal, [2]Purnanand painkra, [3]Abhinav tete, [4]Manu Prasad ponappan

[1]Binoy kumar mandal Department of mechanical engg. Mats university Raipur
[2]Purnanand painkra Department of mechanical engg. Mats university Raipur
[3]Abhinav tete Department of mechanical engg. Mats university Raipur
[4]Manu Prasad ponappan Department of mechanical engg. Mats university Raipur

ABSTRACT

There is almost no water left on earth that is safe to drink without purification after 20-25 years from today. Focusing on the system design and its operation optimization, the upgrading of the photocatalytic membrane water purification reactor was proposed This is a seemingly bold statement, but it is unfortunately true. Only 1% of Earth's water is in a fresh, liquid state, and nearly all of this is polluted by both diseases and toxic chemicals. For this reason, purification of water supplies is extremely important. Keeping these things in mind, we have devised a model which will convert the dirty/saline water into pure/potable water using the renewable source of energy (i.e. solar energy). The basic modes of the heat transfer involved are radiation, convection and conduction. The results are obtained by evaporation of the dirty/saline water and fetching it out as pure/drinkable water. The designed model produces 1.5 liters of pure water from 14 liters of dirty water during six hours.

KEYWORD:- *radiant heat transfer, photocatalytic water purification. membrane reactor*

1.INTRODUCTION

Water is the basic necessity for human along with food and air. There is almost no water left on Earth that is safe to drink without purification. Only 1% of Earth's water is in a fresh, liquid state, and nearly all of this is polluted by both diseases and toxic chemicals. For this reason, purification of water supplies is extremely important. Moreover, typical purification systems are easily damaged or compromised by disasters, natural or otherwise. This results in a very challenging situation for individuals trying to prepare for such situations, and keep themselves and their families safe from the myriad diseases and toxic chemicals present in untreated water. Everyone wants to find out the solution of above problem with the available sources of energy in order to achieve pure water. Fortunately there is a solution to these problems. It is a technology that is not only capable of removing a very wide variety of contaminants in just one step, but is simple, cost-effective, and environmentally friendly. That is use of solar energy. Only solar energy is required for the still to operate. There are no moving parts to wear out. The number of systems

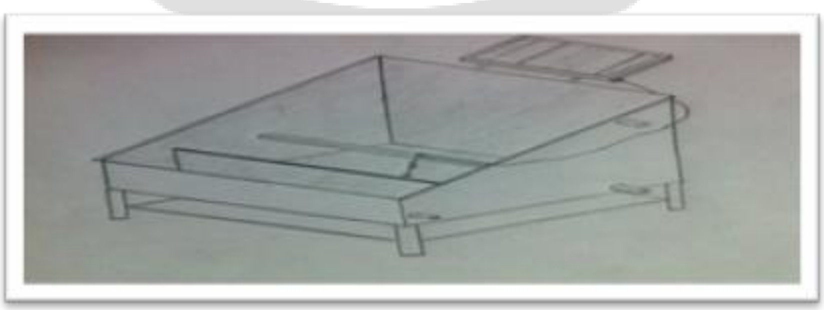

Fig .1 Purification System

designed to fitter or purity water has increased dramatically in recent years. As water supplies have increased in salinity, have been contaminated or have experienced periods of contamination, people have lost trust in their drinking water supply. Water filtration systems can be as simple as a filter for taste and odour to complex water treatment systems can remove more impurities but they are also the most expensiveto operate and required increased maintains.

The rapidly rising demand for clean water, purified from hazardous chemicals (especially persistent organic pollutants and compounds of emerging concern) [1,2] with adverse health effects even at extremely low concentrations, pose one of the most severe challenges worldwide. Water treatment is currently a field of research, with tremendous application potential answering the big needs and high expectations of modern human societies for drinking water. Many techniques have been developed for water purification, and two of the most commonly used are filtration [3-4] and photocatalysis [5]. It is strongly believed that an innovative combination of these two approaches will open new and promising horizons in providing a low-cost purification solution for alternative water resources treatment. As a matter of fact, alternative, photocatalytic membranes exhibiting the dual action of pollutant retention/rejection/repulsion and photocatalytic degradation, have recently received much attention due to the simplicity of the overall process and the manifold benefits arising from the presence of the photocatalyst on the membrane surface and pores (anti-biofouling, less concentrated retentate effluent, cleaner permeate, higher flux) and vice versa, (increased pollutant concentration in the vicinity of the photocatalyst, turbulent flow and efficient mixing due to the asymmetric pore structure of the membrane) [6].

Photocatalysis attracts great attention because it has promising applications in degrading various pollutants and converting light energy into chemical energy. Photocatalytic performances are closely related to chemical property, morphology, surface property, and crystallinity. Microsphere photocatalysts reportedly exhibited superior properties in aqueous photocatalytic reactions due to their low density, efficient light harvesting capability and carrier separation, excellent electronic and optical properties, high surface area, easy settling, good delivering ability, and surface permeability, resulting in remarkably improved photocatalytic performances. This review focuses on the fabrication of microsphere photocatalysts and their advantages in environmental purification and energy conversion. The performances of certain typical microsphere photocatalysts, such as pure or doped TiO_2, ZnO, Bi_2WO_6, $PbWO_4$, $BiFeO_3$, BiOX (X = Cl, Br, I), Cu_2O, $(BiO)_2CO_3$, CeO_2, $CdMoO_4$, $CuInS_2$, $ZnGa_2O_4$, and others, for environmental purification and energy conversion were commented and compared. Various fabrication methods such as ultrasound-induced aggregation, hydrothermal, microemulsion, aerosol spraying, template direction, sol–gel method, and anion exchange were further presented and analyzed. The economic competitiveness of microsphere photocatalysts in practical environment photocatalysis was compared with that of nanosized ultrafine particles. The microsphere photocatalysts appear to be an effective alternative for photocatalyst recycling.[7]

Renewable energy resources are easily accessible to mankind around the world. Renewable energy is not only available in a wide range, but also abundant in nature. Renewable energy sector is meeting at present 13.5%oftheglobalenergydemand[8,9–12]. Renewableenergy sector is now growing faster than the growth in overall energy market in India. Switching to renewable energy sources for generationofelectricityprovidesbeneficiary management [13,14] stra-tegies from the economic, as well as establishment of the regulatory commissions in environment point of view. India has fol lowed the global change in power sector by 1998 under the Electricity Regulatory Commissions Act 1998 to promote compe tition efficiency andeconomyintheactivitiesoftheelectricity industry [15,16]. Central Electricity Regulatory Commission (CERC) has a key role in rationalizing tariff of generating companies owned or controlled by the Central Government in consultation with State Electricity Regulatory Commission (SERC) [17].

2 LITERATURE REVIEW

Wang and co-workers have reportedon the recent progress in the design of visible-light-driven photo-catalysts by the semiconductor multicomponent heterojunction,such as semiconductor–semiconductor, semiconductor–metal orsemiconductor–carbon [18]. These heterojunctions can be also madewith different materials, looking for large surface areas, optimumelectronic properties and remarkable adsorption capacities. In thatsense, recent advances have been also reported in the applicationof layered clay-based materials for photocatalytic applications[19]. Its heterojunction with semiconductors, including metaloxides, sulfides or silver compounds, yields photocatalysts withenhanced efficiency that can be easily recovered from the solution.

3 METHODOLOGY

3.1.Working Principle:

The basic principles of solar water distillation are simple yet effective, as distillation replicates the way nature purifies water. The sun's energy heats water to the point of evaporation. As the water evaporates, purified water vapour roses, condensing on the glass surface for collection. This process removes impurities such as salts and heavy metals, as well as destroying microbiological organisms. Is a passive solar distiller that only needs sunshine to operate; There are no moving parts to wear out.

The distilled water from a still does not acquire the "flat" taste of commercially distilled water since the water is not boiled (which lowers pH) . Solar stills use natural evaporation, which is the rainwater process. This allows for natural pH buffering that produces excellent taste as compared to steam distillation. Solar stills can easily provide enough water for family drinking and cooking needs.

Solar distillers can be used to effectively remove impurities ranging from salts to micro organisms and are even used to make drinking water from seawater. Stills have been will received by many users, both rural and urban, from around the globe. Solar distillers can be successfully used any where the sun shines.

The solar stills are simple and have no moving parts. They are made of quality materials designed to stand- up to the harsh conditions produced by water and sunlight. Operation is simple: water should be added (either manually or automatically) once a day through the stills supply fills port. Excess water wool drain outs of the overflow port and this will keep salts from building up in the basin. Purified drinking water is collected from the out put collection port.

3.2. Supply fills ports:

Water should be added to the still via this port. Water can be added either manually or automatically. Normally water is adds once a day (in the summer it's normally best to fill in the late evening and the in the winter the early morning).

Care should be taken to add the water at a slow enough flow rate to prevent splashing onto the interior of the still glazing or overflowing into the collection through.

3.3. Overflow port:

Once the still basin has filled, excess water will flow out of this port recommends three times daily distilled water production to be allowed to overflow from the still on a daily basis to prevent salt build-up in the basin if flushed on a daily basis, the overflow water can be used as appropriate for your feed water.

3.4. Distilled output collection port:

Purified drinking water is collected from this port, typically with a glass collection container. Still that are mounted on the roof can have the distillate output piped directly to an interior collection container. For a newly installed still, allow the collection through to be self- cleaned by producing water for a couple of days before using the distillate output.

3.5.Solar still back ground:

Solar distillation is a tired and true technology the first known issue of still dates back to 1551 when it was used by Arab alchemists. Other scientists and naturalists used stills over the coming centuries including Delia Posta (1589), lavisher (1862), and mascot (1869).

The first conventional solar still plant was built in 1872 .by the Swedish engineer Charles Wilson in the mining community of last Salinas in what is now northern Chile (region //).this still was a large basin -type still used for supplying fresh water using brackish feed water to a nitrate mining community the plant used wooden bays which had blackened bottoms using logwood dye and alum.

The total area of the distillation plant was 4700 sq. meter of still surface, ore than 23000 till / day. This first still plant was in operation for 40 yrs.

Over the past century, literally hundreds of solar still plants and thousands of individual stills nice been built around the world. Still have built upon years of still research and development and use only food grade material and are the static of the art for commercial solar still Distillation.

4. RESULT AND DISCUSSION

In assessing new applications for a photocatalytic membrane process it is often necessary to carry out extensive testing, a procedure which can be both expensive and time-consuming. Great efforts in developing predictive methods have therefore been made. Computer programs used during simulation of membrane plants usually treat process parameters, such as cross-flow velocity, transmembrane pressure (TMP) and concentration as constant throughout the membrane module. However, the decrease of the driving force along the feed flow channel (in our case the intermediate flow channel) can be significant. A large decrease of TMP due to high cross-flow velocity and due to the small distance between the outer surface of the monoliths and the corresponding Plexiglas tube that surrounds them can lead to zero permeate flow in the bottom part of the module. This is especially true for our high flux photocatalytic membranes exhibiting water permeance of the order of 100-150 Lm-2bar-1h-1.

5. CONCLUSION

Finally, we concluded that this device need to be required some installations like

1. Temperature sensor
2. Pressure sensor/gauge
3. Ionic exchanger

Apart from these, this purification system is more advantageous than the normal solar distillation systems. The collected distillate from this system is very much suitable for modern engineering applications like in chemical laboratories, pharmaceutical industries, maintenance of vehicle batteries, domestic purpose and so on.
This solar water purification system is portable and maintenance free (cleaning is required through), it is an inexhaustible fuel sources, doesn't cause any pollution. it is an excellent supplement to other renewable sources. The collected water from the device as better taste when compared to rain water because it doesn't boiled.

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