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SOLAR STILL: WATER FOR THE FUTURE

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ABSTRACT

Being an abundant natural resource that covers three quarters of the earth's surface, water still a major issue, as less than 1% of fresh water is actually within human reach. Solar energy, most recommended renewable energy source is widely used in desalination fields. Solar distillation, particularly solar still is expected to solve this fresh water production problem without causing any fossil energy depletion, hydrocarbon pollution and environmental degradation. However, the efficiency of the solar still is debatable. As the main reason of low productivity in a solar still is the low heat transfer inside the unit itself therefore, a thoroughly modification on solar still design is presented based on the scope of increasing the heat transfer process inside the unit. Significantly, introducing optical controlling techniques together with focused sunlight receiver and having the process to operate under low pressure have speed up the rate of production within 10 hours of day light. However, the presence of focused sunlight receiver is not seem to improve the production of the solar still yet an increase value is recorded.

Keywords: solar still, renewable energy, desalination, water, global issue, solar energy.

INTRODUCTION

Water is nature's gift and has been recognized as a basic human need for numerous purposes where it plays a key role in the development of an economy and for welfare of a nation. It is an abundant natural resource that covers three quarters of the earth's surface yet the available fresh water is limited on earth where less than 1% of fresh water is actually within human reach [1].

In order to tap this seemingly boundless resource, desalination processes should be the most promising process, as this process basically removed salt from brackish and seawater to produce purified water. It is one of the most important methods of getting potable water correspond to Earth's natural hydrologic cycle that continuously desalinates water. Besides of being inexhaustible, clean and universally available, the use of solar energy in renewable energy based-seawater desalination, particularly solar still, is moreover significantly more economical than the use of fossil fuels [2, 3, 4, 5]. To rationalize this controversy, new experimental techniques are required. This paper aimed to introduce a new method of desalinating seawater with simple principle at a low cost. But, before the design is introduced, the understanding of why solar still is not applicable for industrial scale must be understood.

Solar still

The very basic system for desalting water by using solar as driving source is called solar still [6]. Solar might seem an ideal energy source, as it is virtually limitless and can be used to produce fresh water directly in a solar still. A solar still operates similar to the natural hydrologic cycle of evaporation and condensation. Normally, the seawater will be exposed to solar radiation and vaporize. The vapor then, condensed on the inclined glazing cover before eventually being collected in a container as desalted water [7]. It is simple and have no moving parts, and can be used anywhere so that the operation of it, is very easy and no special skill is required. As a matter of fact, the only thing that differ solar still with other type of process to desalinate water is the source of energy and its operation where no solar energy is converted to electricity and no additional desalination unit is attached to the process except that only the main solar still unit [8].

However, the installations of large scale solar still require large installation areas which is why, the greatest issues of the small water production by solar stills is its efficiency. In addition to that, the experimental works towards this remained in the small scale i.e., laboratory stage because mainly, the cost of the producing desalted water in industrial scale are more complex [9]. Thus, the increased cost for the construction of a complex unit was not justified. Therefore, it is obligatory to know the different parameters affecting the solar desalination process and how that particular parameters influence the operation of the stills, and the production rate of desalted water [9]. Nonetheless, the effectiveness of solar still process depends on several factors like the materials of construction, the orientation, the inclined angle of the cover glass, climatic conditions, tightness, operating conditions and thermo-physical properties [10].

IMPROVEMENTS ON SOLAR STILL

Back in 1991, Maalej has concluded his experimental and mathematical model results that the best performance of solar still is achieved if and only if the high intensity of insolation, minimum wind velocity and full insulation is exist [11]. He added that under these conditions, approximately 50% efficiency of solar still can be obtained and it is then agreed by Kalogirou in 1997 followed by Delyannis et.al in 2001 [12, 13]. A number of efforts have been made to develop and improve the performance of solar desalination systems, particularly solar stills. The change of the design in solar still may not always improve water yield and still efficiency.