



## Enhancing the performance of modified solar still using $\text{Al}_2\text{O}_3$ nanofluid by harvesting solar energy

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Manuscript received online 30 April 2020, accepted 01 June 2020

The present research work has been carried out to analyze and compare the enhancement in productivity of modified double slope solar still (MDSSS) using harvesting solar energy along with  $\text{Al}_2\text{O}_3$  nanofluid in the base fluid (Gomti river water). In terms of high demand for clean water, solar distillation is known as one of the most cost-effective and prominent technique as compared to other water purification processes, especially in coastal and arid areas. This method provided comparatively low yield; therefore, its performance was improved using  $\text{Al}_2\text{O}_3$  nanoparticle with a surfactant sodium dodecylbenzene sulphonate (SDBS). Experimental runs were carried out for the base fluid (without nanoparticles) and for nanofluid with 0.01 concentration. The effect of concentration of  $\text{Al}_2\text{O}_3$  nanoparticle on fluid temperature and thermal conductivity of the base fluid had been considered which greatly enhanced the rate of evaporation as well as total efficiency of the system. The efficiency of nanofluid was found to be 25% higher than that of the base fluid. Moreover, the payback period was also evaluated to check the feasibility of modified solar still using  $\text{Al}_2\text{O}_3$  nanofluid which was found more effective in terms of economic point of view.

Keywords: Solar still, solar energy, desalination, nanofluids, productivity.

### Introduction

Water is the basic need for every living thing and we know that without water life cannot exist in this world. We also know that 73% of the earth's surface is covered with water bodies, even after that there is a shortage of clean potable water for basic needs for living creatures. The main reason for the shortage of water is that around 96% of the water on earth's surface is saline, 2.7% percent of water is in the form of glaciers and 1.3% of ground water is available for use<sup>1</sup>. Due to the regular increase in population and pollutions of various forms, water scarcity is becoming an internal serious agenda. Due to the scarcity of water, there are various methods i.e. as desalination, electrodialysis, filtration, and reverse osmosis etc. are used to treat this water. Among all these processes, the solar distillation is found to be more effective and more economical and efficient process for the purification of drinking water by utilization of solar energy<sup>2</sup>.

Solar distillation is a coupled heat and mass transfer process. Internal mass and heat transfer relationship is consid-

ered for designing and calculation of various parameters in the solar still. The construction of material and geometry of the covering surface are the important factors for internal heat transfer coefficient<sup>3</sup>. In this study, experimental work has been performed to monitor the efficiency of modified double slope single basin solar system. There are some benefits of the solar energy based desalination technology such as: (i) solar energy is available free of cost during sunny days and it produced 500 Watt electricity per hour of sunlight, (ii) it requires low maintenance cost, because of no moving parts. Therefore, it is considered as reliable, (iii) the quality of product water is better obtained from this technology as compared to other methods because this act as a distilled water vaporizer without boiling the water, and (iv) it is also used to neutralize pH value, which is not acceptable for the pH of steamed distilled water as WHO standard<sup>4</sup>.

Recently, multitudinous researchers investigated the effect of different nanofluids for enhancing the productivity of solar system. Some studied are also available in the litera-