

IMPROVED SOLAR WATER DISTILLATION UNIT FOR DRINKING WATER PRODUCTION FROM HARDWATER

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Water distillation is one of the deionization processes which evaporates water using heat energy. Although, several solar water distillation systems are being introduced, they are not in use due to numerous reasons. Therefore, this study aimed to introduce an efficient solar water distillation unit to produce distilled water. Major components of this unit were water basin, water circulation system and pre-heating system. After series of preliminary trails a prototype unit with 0.5m² water basin was fabricated. The performance of the distillation unit was tested with five treatments namely; a black painted basin/ control (T1), a basin with pre-heater (T2), a basin with a sand layer (T3), a basin with sponge cubes (T4) and a basin with all components together (T5). Temperatures of the basin water, basin air and ambient air, wind velocity, solar radiation and volume of distilled water were measured in 30 minute intervals for 12 hours (6.00 am to 6.00 pm) for each treatment in three days as replicates. Data of each treatment were statistically analyzed using ANOVA. Results revealed that T5 has performed significantly better than other treatments ($p < 0.05$) in all aspects. Maximum temperature of basin water and air was observed as 59°C and 65°C respectively in T5. Results showed that pre-heater elevates the temperature of basin air and water which increased the distilled volume by 72.9% over the control. Applying a sand layer has contributed to increase distilled volume by 19.9% retaining the heat after 12.00 pm. Sponge cubes have increased the volume by 48.2% providing higher surface area. Maximum total capacity within 12 hours was given by T5 and it was observed as 2,256 mL. Thus, it can be concluded that, all the new features introduced have significantly contributed to increase the performance of a solar distillation system.

Keywords: Distilled volume, Distilled water, Pre heater, Solar distillation