

Evaluation of the Performance of Solar Stills as an Alternative for Brine Treatment Applying the Monte Carlo Ray Tracing Method

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Abstract : Desalination offers solutions for the shortage of water in the world, however, the process of eliminating salts generates a by-product known as brine, generally eliminated in the environment through techniques that mitigate its impact. Brine treatment techniques are vital to developing an environmentally sustainable desalination process. Consequently, this document evaluates three different geometric configurations of solar stills as an alternative for brine treatment to be integrated into a low-scale desalination process. The geometric scenarios to be studied were selected because they have characteristics that adapt to the concept of appropriate technology; low cost, intensive labor and material resources for local manufacturing, modularity, and simplicity in construction. Additionally, the conceptual design of the collectors was carried out, and the ray tracing methodology was applied through the open access software SolTrace and Tonatiuh. The simulation process used 600.00 rays and modified two input parameters; direct normal radiation (DNI) and reflectance. In summary, for the scenarios evaluated, the ladder-type distiller presented higher efficiency values compared to the pyramid-type and single-slope collectors. Finally, the efficiency of the collectors studied was directly related to their geometry, that is, large geometries allow them to receive a greater number of solar rays in various paths, affecting the efficiency of the device.

Keywords : appropriate technology, brine treatment techniques, desalination, monte carlo ray tracing

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