Proposed Forced Air Triple Chamber Solar Distiller of Humidifier-Dehumidifier Type

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INTRODUCTION

The Humidification/Dehumidification type still (SDHD) humidifies air mass and subsequently removes its humidity. It is not often seen in production except in small stills where it has gainedacademic attention. According to Alnaimat (2012) (5) it is the most efficient type of still. Goosen (2000) (6) ascribes a 30% efficiency to the SDHD type. As it requires little maintenance, the SDHDstill is both reliable and cheap to run.

PROPOSED DESIGN

The proposed design is based on a desalination system as shown (drawings to be supplied) which maximizes output per day. Sea water and solar energy are the input. Output is fresh water and brine (or, optionally, crystallized salt).

Consulted articles suggest the following for improvement for distilling efficiency:

- Flow through basin instead of a single fill per day (Yakav 7)
- Cooling of the condenser area/unit (Tiwari 8)
- Use of heat retaining material on the basin surface (Tiwari 8)
- Multiple wick water feed increases overall performance by 4% (Orfi 9)
- Double basin design increases single basin design output by 52% (Kabeel 10)
- Preheated water (Alnaimat 11)

Overall, the conclusion from the consulted literature is, that efficiencies can be stretched. The final “tuned” distiller is an amalgamation of the improvements listed above and is a compromise between basic design and potential improvements to output. It follows that production level is dependent on ambient heat, humidity and solar irradiance (sec 4.2). According to Hermosillo (2012) theoretical efficiency of a still which incorporates these improvements is in the 50-85% range, in the laboratory. Hermosillo's claim has to be quantified and improved by field testing of variables, as they are too many for a conclusive predetermination theoretically or in the laboratory. In the field, input of heat is subject to change due to the sun's daily movement and the seasonal variations. Hermosillo also controlled the humidity retention by an air mass which, in the field, constantly changes due to temperature and pressure. Proposed additional improvement to the production process consist of the following additional features:

- A cooling unit inside the condenser to draw humidity
- A water pool/heat compressor which retains heat beyond the sun hours

The design is simple enough for small scale production. It improves on the efficiency of a still and will be usable where no electrical service or piping exist. The introduction of forced air and a cooling unit will result in increasing the movement of air mass in order to draw out the maximum heat utility and by changing the temperature of the air on the downdraft to draw out the vapor will yield improved results. Next step: field testing is necessary. The design is intended to be pre-packed as a ready to ship pallet for ease of shipment and reduction of shipping costs.