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Improvement of fog harvesting materials for potable water generation in arid regions

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INTRODUCTION

Half of the world's population has limited access to drinking water and in 2025 2.3 billion people will have no constant fresh water supply. In coastal areas with scarce precipitation but a frequent occurrence of fog, fresh water can be harvested from the fog. This means that the wind carrying fog is pushed against vertically set-up fog meshes. The fibers of the fog mesh intercept the fog droplets, the droplets coagulate and with reaching a significant mass, they pour down the mesh to a collecting channel and from there to a storing tank. The "Raschel"-type meshes currently in use in several fog harvesting projects around the world show several disadvantages such as a low yield and inadequate mechanical stability. The main goal of this project therefore is to identify a fog harvesting material with improved characteristics, in this case, the highest yield.

MATERIALS AND METHODS

Five different materials which may be suitable for fog harvesting were examined using experiments and modeling techniques. They range from very simple meshes used e.g. for shading to three-dimensional structures that were specifically designed for this purpose. The experiments were conducted in a climate chamber where fog was sprayed on the different materials and the yield efficiency, along with the pour-off characteristics and rest water amount were measured. Additionally, the yield was calculated from hydrodynamic theory.

RESULTS

In the experiments, all materials showed an initially rising yield followed by a steady state. Both of these states were different for every material with the highest yields being achieved by meshes with a three-dimensional structure. There was a strong agreement between the measured and modeled values, which additionally showed that there is a correlation between the openness of the meshes, the mesh fibers sizes and the yield. The models also allow investigating the effect of varying natural conditions (e.g. wind speed and fog droplet size) on expected yield. Depending on these conditions, the ranking of the different materials was shown to change.

CONCLUSION

The work done in this project contributes to the optimization of fog harvesting, a sustainable form of potable water production applicable in many arid regions. Additional tests are needed to assess the durability and chemical stability of the materials, as well as practical applicability. The German Wasserstiftung, along with several other charities and Technische Universität München as an advisor, operates a 54m² fog collector in Morocco, where these aspects are investigated. Later on, this facility will be expanded to supply several nearby villages with potable water.