SWMOF

A smart process for water harvesting from air and water distribution based on eco-friendly MOFs

Water4All
Water security for the planet

Abstract

The climate change prospects for the Mediterranean region points towards a general rise in temperature with more and longer periods of higher temperatures. Furthermore, changes in precipitation and distribution of water are expected. Indeed, the Mediterranean is one of the most vulnerable regions to climate change and is predicted to become even warmer and drier than it already is. Forecasts indicate a Mediterranean temperature will increase between 2 to 4ºC and a decrease in rainfall between 4% to 30% by 2050. In the Mediterranean region, more than 70% of water resources are used for agriculture.

The Mediterranean area is composed mainly by scattered small villages, where the conditions of water availability and distributions are poorly efficient. Water distribution systems in small villages typically have higher rates of water losses (around 5% or 10% higher) than big cities. The main reason is that the lower concentration of population makes water loss interventions less efficient. Hence, it is urgent to take actions to preserve the water availability and to optimize the water distribution in those regions.

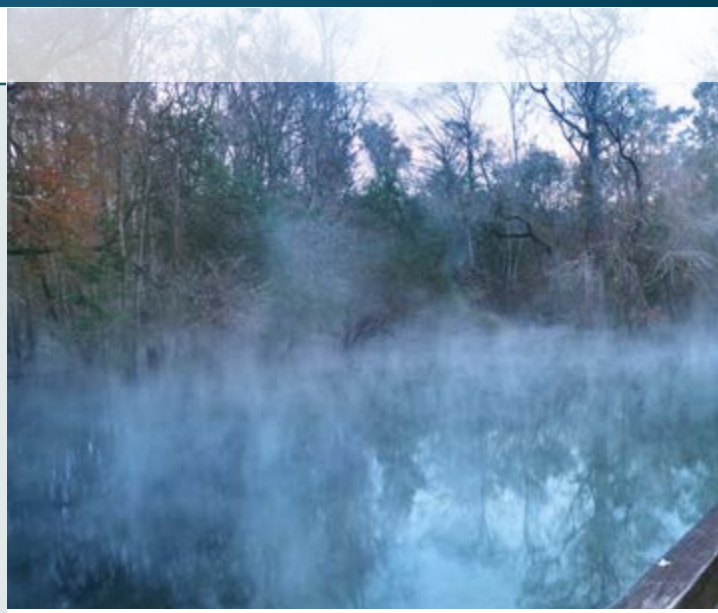
At a planning level, reducing water losses will contribute to reduce or stabilize future water withdrawals and therefore guarantee water supply partially. For this means, recent technology breakthroughs such as the Internet of Things and Artificial Intelligence (AI) can allow achieving higher standard of efficiency on water distribution systems.

Thus, one of our objectives is to apply the cutting-edge developments on control system, real-time optimization and AI on the water distribution system in order to operate it close to the optimal while integrating efficiently water harvesting technology, as here proposed, into the distribution system.
One pillar of this work is the development of a smart water distribution system to optimize the water distribution and do real-time prediction of the water demand in accordance with the local requirements; also, able to recognize abnormal consumption and problems.

On the other hand, Mediterranean water resources are limited and often of low quality, fragile and unevenly distributed in space and time.
Access to safe drinking water is one of the United Nations "Millennium Development Goals". Most approaches for generating new sources of fresh water focus on desalination techniques. Even though it is expected that shortage of surface and/or groundwater will increase with extension of arid regions, where often considerable amounts of water are present in the air that can be utilized as an alternative drinking water resource.

The possibility to extract water from air has been known since ancient times. Cost effective adsorption of atmospheric moisture and low dependency on ambient relative humidity and temperature must be the breakthrough characteristics of an effective technology enabling the utilization of this invaluable water resource.

Therefore, the other pillar of this work is the development of the mentioned water adsorption technology to produce water from the air moisture through eco-friendly adsorbent and energy-integrated process design. Indeed, our second objective is to develop an innovative concept to extract water from atmospheric air by adsorption processes, harvesting the recent developments in porous material science, and integrate it in the water supply systems, as main or complementary water source.



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- NORGES TEKNISK-NATURVITENSKAPELIGE UNIVERSITET NTNU - NORWAY
- UNIVERSIDADE FEDERAL DA BAHIA - BRAZIL
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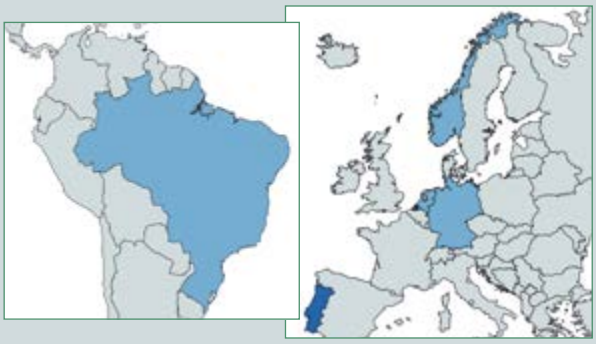

KEYWORDS

Water distribution,
SMA Smart maintenance systems,
Water harvesting,
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