A more affordable, accessible material for seawater desalination

October 5 2012

Composite pipes for seawater desalination. Credit: Fraunhofer IFAM

There are vast quantities of seawater available; drinking water, on the other hand, is in scarce supply. Desalination plants can convert seawater to drinking water. Yet these plants require pipelines made of a special kind of steel or titanium – expensive material that is growing increasingly difficult to procure. Heat-conducting polymer composites may soon replace titanium altogether.

Drinking water is a scarce commodity – a fact no longer limited to the desert regions of the world. During the hot summer months, drinking water is rare in Mediterranean countries such as Spain and Portugal, too. As a result, industrial plants that can desalinate seawater and convert it to drinking water are on the rise. Here's how the principle of desalination works: seawater is sprayed on pipes heated by pumping hot gas or hot water through them. Pure water evaporates from the seawater, leaving a salty sludge behind. This process subjects the material and its properties to a diverse array of demands: the material from which the pipes are made must conduct heat and be particularly robust in resisting corrosion and the formation of deposits – and these properties must be durable over a long period of time. And for the water to evaporate properly, the piping must also be easily coated with seawater. This is why manufacturers to date have used only titanium and high-alloy forms of steel. Yet these materials are very costly. The demand for titanium is also constantly on the rise – as a result of the increase in lightweight construction, the aviation industry is also competing for this material. The results are delivery delays and further increases in price.

Researchers at the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM in Bremen are now developing an alternative to the titanium tubes: pipelines made of polymer composites. The special thing about this method: the polymer composites are a plastic, and yet they conduct heat. Another benefit: they can be produced in continuous lengths and are correspondingly more economical than their metal counterparts. But what did researchers do to make a polymer heat-conducting? "We introduced metal particles into the material - or more precisely, we add up to 50 percent copper microfibers by volume. This does not change the processing properties of the composite, and it can still be processed as any other polymer would," notes Arne Haberkorn, a scientist at IFAM.

The researchers have already developed the material itself; now they want to optimize its thermal conductivity. To accomplish this, they are installing the piping in a pilot seawater-desalination plant: here, they are testing its thermal conductivity, checking to see how much of a microorganism-based coating forms on the pipes, and how heavily the material corrodes in its salty surroundings. They then optimize the composite properties based on the results. The researchers have set the evaporation process to run at a temperature of 70 degrees Celsius – so there is hot gas heated to 70 degrees pumped through the pipelines. This offers several advantages: fewer deposits congregate on the pipes, the material doesn't corrode as quickly, and the pressure differential between the inside and outside of the piping is not as dramatic.

The usages for the material are not confined to seawater desalination, either. "We developed the pipes for desalination plants because they place the highest demands on the material. Designed with these constraints in mind, it will be no problem using it in the food or pharmaceuticals industries," Haberkorn points out.

More information: Researchers will present this heat-conducting plastic at the Composites trade fair, October 9-11, 2012, in Düsseldorf (Hall 8a, Booth A11).

Provided by Fraunhofer-Gesellschaft

Citation: A more affordable, accessible material for seawater desalination (2012, October 5) retrieved 26 April 2024 from
https://phys.org/news/2012-10-accessible-material-seawater-desalination.html