

Seawater for the sustainable production of fresh water, raw materials and energy

Giorgio Micale

Dipartimento di Ingegneria, Università di Palermo, Italy

Abstract

The need to develop new processes, based on the concept of circular economy, is central to guarantee sustainable production of *water*, *energy* and *raw materials*. Research and technological developments are increasingly devoted to the identification of non-conventional resources and technologies in order to match the global sustainability challenge. In this respect, the sea certainly represents the most abundant source of "goods" on our planet, but it is also the least used.

It is well known that the increasing demand for drinking water is one of the big challenges of this century. Nowadays, state-of-the-art desalination technologies can guarantee the production of freshwater from the sea at affordable costs. Seawater also contains salts of various kinds and in different quantities, which can be recovered implementing suitable processes. Sodium chloride is the most abundant, followed by many other minerals in smaller quantities, some of them with very high economical value. Finally, brines do contain chemical energy, which can be recovered implementing salinity gradient energy (SGE) technologies. SGE is a form of renewable energy, available whenever two streams with different salinities mix together, as in the case of seawater and river water, or brine and brackish water.

All of the above processes can be suitably combined, following the typical approach of circular economy in order to exploit the resources contained in seawater. It is in fact possible and decidedly more sustainable to produce drinking water, sea salt, minerals and energy, within an integrated cycle of processes where the waste of each process becomes feed for the subsequent process.