

# PHARMACEUTICALS IN WASTEWATER: EFFECTS OF CARBAMAZEPINE ON MARINE PHYTO AND ZOOPLANKTON

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## **Abstract**

Pharmaceuticals present in wastewater (as they are not effectively eliminated by the purification plants) end up in the sea, where they can persist for a long time (as they are poorly biodegradable due to their high chemical stability). Unlike other types of chemicals, these are designed, tested and used specifically to induce effects on organisms, at very low concentrations. A report of 2017 shows as many substances, commonly used in medicine to treat the most varied diseases, are present in the Baltic Sea. However, little is known yet about the effects of these molecules on marine organisms. Among these there is carbamazepine, a substance commonly used in medicine to treat various neurological and psychiatric diseases. In this study, this active substance was tested both on marine phytoplankton (*Dunaliella tertiolecta* and *Rhodomonas salina*) and on marine zooplankton (*Acartia bifilosa*), with the aim of investigating the effects on these organisms. As hypothesized, deleterious effects were found on zooplankton (given that, even if the molecule was tested and marketed for its properties to induce benefits in humans suffering of epilepsy, is toxic): the highest concentrations tested were those that induced higher mortality in the copepod. However, it has also been seen to have effects on phytoplankton: in this case, but only on one of the two species considered (*Dunaliella tertiolecta*), the lower concentrations are those which induced significant effects, as strongly stimulate cell division (this observation could indicate an its possible role as an eutrophic factor). These results suggest the importance of the elimination of this substance from water. A help could derive from the use of GMOs to be used in sewage treatment plants: to create a selective "biological filter" by inducing the expression on the surface of *Saccharomyces cerevisiae* of high affinity molecules for carbamazepine.

**Keywords:** wastewater, pharmaceuticals, carbamazepine, Baltic Sea, marine phytoplankton, *Dunaliella tertiolecta*, *Rhodomonas salina*, marine zooplankton, *Acartia bifilosa*, GMO, sewage treatments plants, *Saccharomyces cerevisiae*