

Influence of environmental factors on toxicity of ionizing compounds towards microalgae

H. Wang, K. O. Kusk, and C. Rendal

DTU Environment, Technical University of Denmark

INTRODUCTION

Antibiotics have been largely applied nowadays in water environment and they can affect the metabolism and growth behaviors of the aquatic organisms. The toxicity values of the compounds are always studied with the standardized tests, such as ISO, NOEC or USEPA. These standard tests have a wide tolerance on the conducting environments. However in the real cases, the environmental conditions can largely affect the toxicity behaviors of antibiotics, particularly most of them are ionizing, which probably present larger variances in toxicity values.

Thus in the current study, the influence of environmental factors on the toxicity of two ionizing compounds, salicylanilide (CAS no. 87-17-2) and trimethoprim (CAS no. 738-70-5), was studied. The test aquatic organism is microalgae. Three environmental factors are in focus: pH, temperature and algae cultivation system (open/ closed).

METHOD

The standardized toxicity test method ISO 8692 (2004) was applied. A method development was implemented before the algae toxicity experiments in order to identify stable pH levels, 7, 8 and 9. The pH drift was required not to exceed 1, therefore all the results were checked and only the valid data were taken into further analysis.

RESULTS

pH condition can affect toxicity of ionizing compounds. For the acid salicylanilide, the toxicity decreased when pH increased and the opposite trend illustrated for the base trimethoprim. The correlation between pH and toxicity is mainly caused by the dissociation of the compounds. Temperature and growth rate of microalgae are in the positive correlation in the algae test. It is because most metabolism processes of algae are controlled by enzymes and enzymes are highly temperature-dependent. However, the temperature did not significantly affect the toxicity results. The algae cultivation system can also affect the toxicity results as well as growth rate of microalgae in toxicity test. The closed system indicated higher toxicity of both test compounds towards microalgae and higher growth rate of algae species, compared to open system. The reason may be the higher carbonate concentration in the aqueous phase. However more study needs to be conducted to clarify the question.

CONCLUSION

Three environmental factors in focus can affect the results of algae toxicity test. Influence of pH correlates with the dissociation behavior of the compounds and temperature alter the growth rate of algae species. For different algae cultivation systems, closed system shows higher toxicity of the compounds and higher growth rate of algae, when compared to open one.