
Toxicity of microplastics and released chemicals from single-use surgical face masks to the model aquatic organism, *Daphnia magna*

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Abstract

The COVID-19 pandemic has caused significant increase in the production, usage, and disposal of single-use face masks. It is estimated that more than 1.5 trillion single-use face masks are used per year. While these face masks have played an important role to curb the spread of the coronavirus, their indiscriminate disposal in the environment is becoming a cause for concern. Several studies have shown that the masks can release millions of microplastics and nanoplastics, as well as other harmful chemicals when exposed to environmental conditions. However, the knowledge on the impacts of the released microplastics and chemicals to aquatic organisms is still limited. This study investigates both the acute and chronic impacts of the microplastics and chemicals on *Daphnia magna*. The test material was obtained via a simulated laboratory weathering experiment, and divided into three groups (microplastics alone, chemicals alone and mixture of microplastics and chemicals). The acute tests were conducted over a 48-h period on three different life stages of *Daphnia magna* (neonates, juveniles, and adults) while the chronic tests were conducted on neonates over a 21-day period. Chemicals alone and mixture of chemicals and microplastics decreased the survival rate of neonates and juveniles. However, microplastics alone had no effects on the survival of the neonates and the chemicals alone had no impacts on the adults. Also, chemicals alone and mixture of chemicals and microplastics significantly decreased survival during 21-day chronic exposure while microplastics alone caused significant sublethal impacts on growth, reproduction, heartbeat rate and swimming behavior. The released chemicals were analyzed using LC-MS and ICP-MS to understand how the chemical composition impacts the observed toxicity. This study shows that the released plastics and chemicals may have different impacts on *Daphnia*, depending on the type of tests and life stages of *Daphnia* tested

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