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# Uptake and transformation of oxybenzone in the presence of $TiO_2$: impact of nanoparticles on the plant remediation of an organic UV filter

Feiran Chen[#], Peter Schröder*

*Research Unit Comparative Microbiome Analysis, Helmholtz Zentrum München, GmbH, German Research Center for Environmental Health, Ingolstädter Landstraße 1, D-85764 Neuherberg, Germany, email: peter.schroeder@helmholtz-muenchen.de (P. Schröder)*
*[#]Present address: Institute of Environmental Processes and Pollution Control, School of Environmental and Civil Engineering, Jiangnan University, Wuxi 214122, China*

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**ABSTRACT**

Oxybenzone (OBZ) present in the environment as an emerging contaminant may occur jointly with the nanoparticle $TiO_2$ due to the typical composition of many sunscreens. Thus, potential effects caused by $TiO_2$ must be considered when investigating the environmental fate of sunscreens and also when plant performance with regard to remediation of OBZ is scrutinized. Toxicity effects of OBZ and $TiO_2$ on plant development were evaluated by recording germination rates and root lengths of tomato and barley. Results showed that OBZ significantly inhibited germination rate of tomato seeds, while no effect was observed for germination of barley seeds. Interestingly, co-exposure with $TiO_2$ lowered the toxicity of OBZ on the tomato seedlings as there were no differences on germination rate and root length between co-exposure and control treatments. Moreover, growth inhibition tests with *Lemna minor* showed that addition of $TiO_2$ even enhanced plant growth by increasing the frond area. Furthermore, influence of $TiO_2$ (3 mg/L) on removal of OBZ (5 μM) by plants was examined with respect to the variations in uptake and metabolism of OBZ in a hairy root culture system. Co-exposure to $TiO_2$ amplified the accumulation of OBZ in plants, while transient slower transformation to OBZ metabolites was recognized when $TiO_2$ had been added. Therefore, it can be concluded that Ti nanoparticles may generally reduce the phytotoxicity of OBZ and increase the uptake of this compound in phytoremediation, while the interaction with the transformation capacity should be considered when applying phytoremediation for UV-filter contaminated water.

*Keywords:* Oxybenzone; $TiO_2$; Uptake; Transformation; Hairy roots

* Corresponding author.

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