Skeletonema pseudocostatum as a bioindicator of heavy metal-polluted waters: potential of holographic tomography for real-time assessment.

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Résumé

Microalgae are currently considered promising candidates for heavy metal (HM) removal, offering a viable alternative to conventional methods - often relying on costly chemicals and producing hazardous by-products - due to their high surface-to-volume ratios and consequent sorption capacity, rapid growth rates and high biomass yields. However, beyond certain critical thresholds, HMs may affect physiological processes and impair microalgal cell morphology. In the present work, we analyzed the impact of cadmium (Cd) and copper (Cu) on the subcellular structures of the diatom *Skeletonema pseudocostatum* using holographic tomography (HT), to obtain a detailed visualization and quantitative analysis of diatom subcomponents, including frustules, protoplasm, vacuoles, and chloroplasts, under varying metal concentrations. Results show that this species exhibit significant variations in refractive index (RI) and internal cell density when exposed to scalar metal doses. Lower RI values observed at higher metal concentrations, can be considered as a sign of stress due to cytoplasm extrusion and/or vacuolization. The results highlight 1) the potential of using *S. pseudocostatum* as a bioindicator for monitoring water metal pollution; 2) the effectiveness of HT as a useful tool for fast, non-invasive, and high-resolution cellular imaging of phytoplankton in environmental studies.

Mots-Clés: bioremediation, heavy metal pollution, microalgae

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