

Polyhydroxyl fullerene can mitigate toxicity effects of cadmium on yeasts

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With inception of nanotechnology, nanomaterials are currently in the prime-line of research. Polyhydroxyl fullerene is one of the widely commercialized nanomaterials and applied in electronics and biomedical fields. Unlike fullerene, polyhydroxyl fullerene is known to be biocompatible, and recent studies reported its antioxidant properties. On the other hand, cadmium toxicity has been often attributed to the ability of this metal to induce oxidative stress. To assess antioxidant properties of polyhydroxyl fullerene, the model yeast *Saccharomyces cerevisiae* was exposed to cadmium (≤ 5 ppm, 3 levels) in the presence or absence of polyhydroxyl fullerene (≤ 500 ppm, 3 levels) at different pH values (5.8, 6.3 and 6.8). The size distribution and dispersion of polyhydroxyl fullerene in the stock suspension were measured with DLS (z-average 143 nm, Pdl 0.365). Yeast growth, plasma membrane integrity and accumulation of reactive oxygen species (ROS) were investigated in the presence or absence of Cd^{2+} and/or polyhydroxyl fullerene. Yeast growth was inhibited up to 34% by exposure to Cd^{2+} , but was not affected by polyhydroxyl fullerene. At pH 5.8, the exposure to the highest concentration of Cd^{2+} (5 ppm) and polyhydroxyl fullerene (500 ppm) stimulated yeast growth by 59 and 61% at the exponential and late exponential growth phases, respectively. Growth increased even more when pH increased to 6.8. Severe plasma membrane disruption and ROS accumulation were observed after exposure to the highest concentration of Cd^{2+} in the absence of polyhydroxyl fullerene. Membrane disruption and ROS accumulation decreased with increasing concentration of polyhydroxyl fullerene and with the increase in pH to 6.8. Overall, results indicated that polyhydroxyl fullerene is not toxic to yeasts and may potentially trigger antioxidant defense mechanisms to mitigate metal-induced toxicity.

Keywords: Polyhydroxyl fullerene, cadmium, yeast, antioxidant.

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