TOXICITY MECHANISMS OF AG AND CUO NANOPARTICLES TO THE YEAST *SACCHAROMYCES CEREVISIAE*

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The wide-spread use of nanotechnologies in various industrial and commercial fields from agriculture to medicine is causing the release of synthetic nanomaterials to the environment and raises the question of their biosafety. Silver nanoparticles (Ag NPs) are among nanomaterials used in the biggest number of consumer products mainly due to antimicrobial properties. Copper oxide nanoparticles (CuO NPs) are a low-cost alternative to Ag NPs that have similar antimicrobial effect. The aim of this research was to identify the toxicity mechanisms of Ag and CuO NPs to the yeast *Saccharomyces cerevisiae*. The unicellular yeast *S. cerevisiae* was used as a eukaryotic model organism. The impact of the nanoparticles` intrinsic properties, such as primary size and surface coating was studied, as well as the influence of biological media to the stability and dissolution of the NPs and thus, their bioavailability and toxicity. Growth inhibition test in the organic-rich medium (YPD) and cell viability test in deionized water were performed. Our unique approach included the use of *S. cerevisiae* BY4741 deletion mutants, selected to address the prevalently suggested toxicity mechanisms of metal-based NPs, namely the release of metal ions, induction of oxidative stress (OS), membrane interruption, and endocytosis as the possible uptake mechanism.

Results showed that Ag and CuO NPs expressed acute effects on the viability and growth of *S. cerevisiae*, whereas the toxicity was mainly driven by the release of Ag^{+} and Cu^{2+} ions. OS-sensitive mutant strains did not show induction of oxidative stress by Ag or CuO NPs. However, absorbance of NPs on the cell surface and further release of toxic ions in the close vicinity of the cell, or disturbance of the functioning of cell wall or membrane may contribute to the toxicity of Ag and CuO NPs [1]. In addition, we proposed a novel approach to test the biocidal potency of metallic NPs, which was based on exposing yeast, bacteria and algae to the NPs in deionized water [2].

References:

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