

# **Impact of irradiation on silver nanoparticles mediation by H<sub>2</sub>O<sub>2</sub> in the presence of natural organic matter**

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**Abstract:** Increasing attention is paid on threat of silver nanoparticles to environmental and human health due to their spread application and subsequent release to waters. One prevalent area of research is AgNPs transformation in ecosystem in the presence of natural organic matters (NOM) since NOM is ubiquitous in natural waters. Though the fate of AgNPs in complex with NOM has been well demonstrated, there is still big knowledge gap on AgNPs behaviour under more complicated circumstances other than just NOM, such as the presence of light and naturally existing reactive oxygen species (ROS) in hydrosphere (e.g., H<sub>2</sub>O<sub>2</sub>). In order to understand relative impact of irradiation and NOM on mediation of citrate-coated AgNPs by H<sub>2</sub>O<sub>2</sub>, release of Ag(I) from AgNPs, quantification of Ag(I) binding NOM and ROS production are investigated under pH 8 in this study. Results show that interaction between AgNPs and H<sub>2</sub>O<sub>2</sub> is interfered by the presence of NOM in a way of isolating AgNPs. Irradiation promotes dissolution of AgNPs by H<sub>2</sub>O<sub>2</sub> and H<sub>2</sub>O<sub>2</sub> decay as well with hydroxyl radical (HO·) production in the presence of low concentration of NOM, while high concentration of NOM contributes to massive H<sub>2</sub>O<sub>2</sub> generation and more HO· production. Based on the experimental results, a kinetic model describing the mechanisms of AgNPs transformation by H<sub>2</sub>O<sub>2</sub> under irradiation in the presence of NOM is developed. Furthermore, implications on AgNPs toxicity to aquatic organisms and human are discussed.

Keywords: silver nanoparticles, irradiation, natural organic matters, reactive oxygen species