

Light-Dependent Biosynthesis of Silver Nanoparticles Mediated by Cell Extract of *Neochloris oleoabundans*: an Investigation on Mechanism

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While biosynthesis of precious metal nanoparticles mediated by plants, bacteria, and fungi have been widely reported to be light-independent, it was demonstrated in my Lab that the synthesis of silver nanoparticles (AgNP) mediated by the cell extract of green alga *Neochloris oleoabundans* required light to take place. Chlorophylls were demonstrated to be an essential component mediating the reduction of Ag⁺ and addition of extra chlorophyll would increase AgNP production. Rainbow tests revealed that exposure of reaction mixture to orange or red light could not lead to AgNP formation, although they are part of photosynthetic active radiance (PAR), indicating only photons of high energy levels among the PAR are capable of exciting the electrons of chlorophylls to a state that is sufficient for Ag⁺ reduction. Furthermore, results of mass balance suggest that chlorophylls need to be recycled for the reaction to complete. The ultimate donors supplying electrons for chlorophyll recycle were hypothesized to be water molecules through water splitting, which can be catalyzed by photosynthetic enzyme complexes such as photosystem II that are readily available in cell extract of *Neochloris oleoabundans*.