Luminol and Silver Nanoparticles: A Brilliant Pair

Figazzolo, Chiara
Cotta Ramusino, Filippo
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The aim of this project was to synthesize silver nanoparticles (AgNPs) and to investigate their effect on the luminol–hydrogen peroxide chemiluminescent system. It is known that AgNPs could enhance the intensity of light emitted by this reaction, but their actual role is yet to be fully understood. AgNPs are believed to act by increasing the rate of generation of reactive oxygen species (ROS) from H2O2, so the effect of different ROS scavengers was studied. AgNPs were synthesized using the borohydride reduction method and characterized using UV-Vis spectroscopy: a sharp absorption band at 400 nm due to the surface plasmon resonance was the proof of a successful synthesis. In a flask, 1.5 mL of a 10 mM luminol solution and 0.3 mL of 5 mM AgNPs were diluted with water to 50 mL. Reaction was started by the addition of 0.5 mL 30% H2O2. Tiron, tert-butanol and azide were used as scavengers of superoxide, singlet oxygen and hydroxyl radical, respectively. They were added to a 10 mM final concentration before the H2O2 addition. Emission of light was evaluated by eye in a dark room. Light was emitted only in the presence of AgNPs, demonstrating their enhancing role. AgNPs were found to dissolve during the reaction until complete disappearance as checked by UV-Vis. Only in the presence of tiron, AgNPs did not dissolve and also complete quenching of chemiluminescence was observed. A plausible reaction mechanism, based on the reaction of AgNPs with H2O2, was formulated to explain the observed phenomena.

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