Preservative potential of biosynthesized silver nanoparticles: prevention of xylem occlusion and microbial proliferation at postharvest stage of preservation

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Abstract

The purpose of the current study was to determine the appropriate genotype and concentration of biosynthesized silver nanoparticles effectual in preserving mulberry leaves at the postharvest stage. The preservative effect of silver nanoparticles was determined by their potentiality to prevent xylem blockage, chlorophyll content retention and inhibition of microbial proliferation within a preservative solution. For synthesizing silver nanoparticles, a blend of 10^{-3} M silver nitrate and S1 genotype of the mulberry leaf was found to be most effective. Silver nanoparticles at 6 ppm were observed to be the least effective concentration for preserving mulberry leaves for at least 7 days at the postharvest stage, as evident from physical texture and retention of chlorophyll content. Biosynthesized silver nanoparticles showed negative microbial count during the course of preservation as evident from no colony-forming unit (CFU) until the last day of preservation, while conventional preservative silver nitrate showed traces of CFU on a nutrient agar plate. Besides, these leaves preserved in nanosilver solution showed an almost negligible number of xylem blockage in the petiole, almost equivalent to the blockage nature of fresh leaves caused by the deposition of macromolecules like protein, lignin and suberin. Nanosilver- and silver nitrate–preserved leaves also displayed insignificant accumulation of reactive oxygen species (ROS) and greater retention of membrane integrity than leaves preserved in normal distilled water. Nanosilver solution showed greater durability of preserving mulberry leaves than conventional floral preservative silver nitrate, useful for feeding silkworm larvae during the rainy season.