Effect of the use of reduced graphene modified "black {001}TiO_2" nanosheets on ethylene removal and quality attributes of storage tomatoes

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This work aimed to evaluate the performance of a novel synthesized nanocomposite based on reduced graphene oxide (rGO) modified anatase {001} black TiO_2 nanosheets (rGO-B-TiO_2 NSTs) on ethylene removal efficiency and its effect on quality attributes of stored tomatoes. Tomatoes were stored in hermetically sealed glass desiccators at 12°C in darkness at a relative humidity of 88%. Four treatments were applied (control, photolysis, adsorption, and photocatalysis). In typical experiments, a constant flow (1.3 dm^3 min^{-1}) was continuously extracted from the storage containers and recirculated over quartz packed-bed flow annular reactors loaded with glass beads covered with rGO-B-TiO2 NSTs and uncovered (control) in the presence and in the absence of light irradiation (UV-C). Respiration rate was determined daily by monitoring the concentration of ethylene, O_2 and CO_2 using a respirometer during the storage time. Quality fruit parameters (size, weight, skin color, texture characteristics, titratable acidity, soluble solids, moisture content, and lycopene content) were analyzed at the beginning of the experiments, and after 6 days and 12 days of tomato storage. The novel photocatalytic process using rGO-B-TiO_2 NSTs favored ethylene removal and delayed tomato fruit ripening to values higher than those obtained when single adsorption and single photolysis were applied. Reduced graphene oxide (rGO) modified anatase {001} black TiO_2 nanosheets appears as a new photocalytic material with a great opportunity to be implemented as a postharvest technology to slow down ripening, aging and spoilage during storage and transportation of fresh fruit destined for far markets.

Keywords: adsorption, black TiO_2 NSTs, ethylene scavenging, photocatalysis, photolysis, postharvest quality, reduced graphene oxide, tomatoes.