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Nanotechnology in Floriculture: Enhancing Vase Life and Postharvest Quality of Cut Flowers

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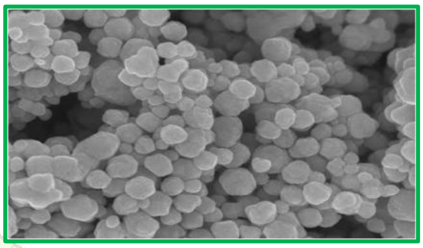
This article summarizes the importance of nanotechnology in floriculture, particularly in enhancing vase life and maintaining postharvest quality of cut flowers. It highlights the types of nanoparticles used, their modes of action, and future prospects in sustainable postharvest management.



Introduction

Cut flowers such as rose (*Rosa hybrida*), gerbera (Gerbera jamesonii), chrysanthemum (*Chrysanthemum morifolium*), and orchids play a vital role in the global floriculture industry. However, these flowers are highly perishable and suffer postharvest losses ranging from 10–30% due to ethylene action, microbial blockage of xylem vessels, and poor water relations. Effective postharvest management is therefore essential to maintain quality and extend vase life.

Nanotechnology: Concept and Scope

Nanotechnology involves the manipulation of matter at the nanoscale (1–100 nm). Nanomaterials possess unique physical, chemical, and biological properties, making them suitable for diverse applications in agriculture and horticulture, including floriculture.

Application of Nanotechnology in Floriculture

Nanotechnology is applied in floriculture through nano-fertilizers, ethylene inhibition, enhancement of stress tolerance, disease and pest management, and postharvest handling techniques such as vase solutions and pulsing treatments.

Role of Nanotechnology in Enhancing Vase Life

Nanoparticles exhibit strong antimicrobial activity, enhance water uptake, reduce oxidative stress, inhibit ethylene action, and enable targeted delivery of beneficial compounds, thereby extending vase life and maintaining quality.

Synthesis of Nanoparticles

Nanoparticles can be synthesized using mechanical, physical (evaporation-based), chemical (sol–gel), and biological methods, depending on the intended application and material type.

Mode of Action of Nanoparticles in Vase Solutions

Nanoparticles control microbial growth by disrupting cell membranes, generating reactive oxygen species, releasing antimicrobial ions, inactivating essential enzymes, and preventing biofilm formation in stem vessels.

Types of Nanoparticles Used in Floriculture

Common nanoparticles used in floriculture include silver nanoparticles (AgNPs), zinc oxide nanoparticles (ZnONPs), titanium dioxide nanoparticles (TiO_2NPs), copper nanoparticles (CuNPs), silicon nanoparticles (SiNPs), iron nanoparticles (FeNPs), gold nanoparticles (AuNPs), carbon-based nanoparticles, and chitosan nanoparticles.

Nanoparticles in Postharvest Management

Nanoparticles are incorporated into vase solutions, pulsing treatments, and packaging materials to improve water uptake, control pathogens, reduce chemical usage, and extend the vase life of cut flowers.

Conclusion

Nanotechnology offers promising and sustainable solutions for improving vase life and postharvest quality of cut flowers. Metal and biopolymer nanoparticles effectively reduce microbial growth, delay senescence, and enhance flower longevity.

Future Prospects

The development of nano-preservatives, smart packaging systems, and nanosensors can revolutionize postharvest management by improving quality, reducing waste, and minimizing reliance on synthetic chemicals.

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