

EVALUATION OF CHITOSAN–CURCUMIN BIOCOMPOSITES ACTIVITY AGAINST PHYTOPATHOGENIC FUNGI

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Background

Polymeric particle formulations containing active ingredients have been developed in agriculture to protect plants from pathogens while reducing health risks and environmental impact. Chitosan (Ch), a biodegradable and non-toxic polymer, exhibits antimicrobial properties, while Curcumin (CUR), a natural turmeric compound, has recognized biocidal activity. Combining Ch and CUR may enhance antifungal performance against phytopathogenic fungi.

Methods

Biocomposite nanoparticles (CUR-loaded Ch-tripolyphosphate, CP-CUR) were synthesized via ionotropic gelation, achieving >90% CUR encapsulation. Particles were characterized by FESEM, FT-IR, XRD, and UV-Vis, revealing quasi-spherical morphology within Ch lamellar-like bundles (200 nm average). Antifungal assays were conducted on 2,500 conidia in 300 µL of *Fusarium oxysporum*, *Fusarium fujikuroi* and *Alternaria solani* using Ch, CP, CP-CUR (6.25, 12.5, 25 mg/mL) and CUR (200, 250, 300 µg/mL). Germination inhibition was assessed after three days of incubation.

Significant Findings

F. oxysporum was completely inhibited by Ch at 25 and 12.5 mg/mL, while CUR showed dose-dependent inhibition, reaching maximum at 300 µg/mL; CP and CP-CUR were ineffective. *F. fujikuroi* showed total inhibition at all Ch concentrations and with CP-CUR10, with CUR at 300 µg/mL reducing colony density. *A. solani* was resistant to Ch but inhibited by CUR from 200 µg/mL, showing no growth at 300 µg/mL; CP and CP-CUR slightly reduced colony size. These results indicate that free Ch is more effective against *F. oxysporum* and *F. fujikuroi*, while CUR is more potent against *A. solani*. High CUR release in CP-CUR could counteract chitosan's effect, indicating that optimal formulation and concentration are key for maximizing antifungal performance.

Keywords: Chitosan, Curcumin, Antifungal

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