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(57) Abstract :

A novel pharmaceutical nanotechnology composition comprising chitosan-based nanoparticles encapsulating Syzygium samarangense ethanolic extract for enhanced antimicrobial and anti-inflammatory therapeutic applications. The invention provides systematically optimized nanoparticles with particle sizes of 38-89 nm, 10 encapsulation efficiency up to 82.14%, and superior therapeutic efficacy. The optimized formulation SS4 demonstrates exceptional antimicrobial activity with MIC values of 14-18 µg/mL against pathogenic bacteria, representing 2-2.5 fold enhancement over standard antibiotics. The nanoparticles exhibit controlled release characteristics with 84-89% cumulative release over 60 minutes and excellent 15 stability profiles. When formulated as topical gel, the composition shows significant anti-inflammatory activity (33.90% inhibition) comparable to standard drugs. This innovation addresses critical limitations in herbal drug delivery through nanotechnology approach, providing enhanced bioavailability, targeted delivery, and sustained therapeutic action with broad applications in pharmaceutical and 20 cosmeceutical industries.

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