

Microencapsulated *citronella* oil: A novel antifeedant and repellent for managing house rats (*Rattus rattus*)

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This study presents an innovative, eco-friendly approach to rodent deterrence through sodium alginate-based microencapsulation of citronella oil, designed to enhance its stability, longevity, and efficacy against house rats (*Rattus rattus* Linnaeus). Microcapsules containing 3%, 4%, and 5% oil were incorporated into bait at 5%, 10%, and 20% concentrations and assessed for antifeedant and repellent activity under controlled laboratory and simulated storage conditions. The 5% oil microcapsules, delivered at 20% bait concentration, demonstrated the highest and most sustained antifeedant response, achieving 90.62% deterrence maintained across all 7 days. Repellency consistently ranged from 77.05% to 92.23%, with the 5% formulation outperforming the others throughout the exposure period. Maze assays confirmed a strong behavioural avoidance, as rats markedly reduced their presence in treated zones. Under simulated storage conditions, jute bags containing wheat grains and sprinkled with 5% oil microcapsules showed significant reductions in grain loss, spillage, and bag damage for up to 10 days. Effects peaked on day 2 and remained functionally effective thereafter. This work highlights microencapsulated citronella oil as a promising, sustainable, and non-toxic alternative to chemical rodenticides, offering an innovative strategy for protecting stored commodities and mitigating rodent-related losses.

Keywords: Behavioural avoidance, Eco-friendly rodent management, Essential oil formulation, Plant-derived bioactive compounds, Sustained release technology