

P.C.E.N.S.O: Pomegranate Peel Crude Extract and Neem Seed Oil as a Novel, Cost-Effective and Eco-Friendly Termite Control Agent

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Termites, among the most destructive insects, cause nearly US\$50 billion in worldwide economic losses annually. For decades, the use of synthetic insecticides such as fipronil has proven highly toxic, environmentally harmful, and non-biodegradable. This research proposes Pomegranate Peel Crude Extract (PPCE) and Neem Seed Oil (NSO): P.C.E.N.S.O as a novel, cost-effective, and eco-friendly termite control agent. GC-MS and FTIR spectra showed main chemical constituents in P.C.E.N.S.O, including Punicalagin, Azadirachtin, etc. The major chemical constituents of P.C.E.N.S.O were tested *in silico* via ProTox-3.0 for toxicity. Main constituents of P.C.E.N.S.O also had a higher binding affinity to AChE compared to ACh as shown by molecular docking results. The effect of P.C.E.N.S.O on mortality and attraction against *Coptotermes gestroi* and *Macrotermes gilvus* was studied. The experiment consists of 154 bioassays, testing treatments ranging from 50 ppm to 150 ppm, which were introduced to 50 workers and 2 soldier *Coptotermes gestroi* and 10 *Macrotermes gilvus*. As a result, P.C.E.N.S.O showed 100% mortality rate ranging from 130 ppm to 150 ppm at 48 hours. Isobologram Analysis showed that P.C.E.N.S.O presents a synergistic effect and achieved a higher mortality rate at lower concentrations compared to PPCE and NSO individually. The LC₅₀ and LC₉₀ against *C. gestroi* and *M. gilvus* were 54.95 ppm, 95.5 ppm, 48.76 ppm and 89.54 ppm, respectively. 2-way ANOVA against treatment types and concentrations resulted in $p < 0.001$, $F(2,18) = 12.869$, demonstrating P.C.E.N.S.O is effective. This study shows that P.C.E.N.S.O is a novel, cost-effective, and eco-friendly termite control agent that eradicates termites without harming the environment.

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