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

See, Yi Zhe (School: Chung Ling High School Penang)
How, Teng Way (School: Chung Ling High School Penang)

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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