EXPLORING DIFFERENT APPROACHES TO OBTAIN PIPER ADUNCUM NANOFORMULATIONS

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In Brazil, combating insect pests in agricultural crops is one of the main drivers for pesticide use. Plant essential oils have been recognized as important natural resources for prospecting new biopesticides. However, botanical compounds have limitations such as low aqueous solubility, photosensitivity, and high volatility, which restrict their broad application. Nanoencapsulation of botanical compounds is a significant strategy to enhance the efficiency of these compounds, reducing losses and adverse effects on non-target organisms. However, depending on the specificities of the plant species and characteristics of the nanoparticles (such as size, surface charge, and chemical composition), phytotoxic effects can occur. *Piper aduncum*, an abundant plant in the Amazon region, displays insecticidal and fungicidal properties due to secondary metabolites, primarily the phenylpropanoid dillapiole, its major component. In this study, nanoformulations containing the essential oil of *Piper aduncum* were prepared using two protocols: poly (ε-caprolactone) (PCL) containing Tween 80 as a stabilizer, and Zein protein using Pluronic (poloxamer) copolymer as a stabilizer. The obtained nanoformulations were characterized by size, polydispersity, zeta potential and encapsulation efficiency measurements. The phytotoxic effects of both nanoformulations were evaluated on germination of *Phaseolus vulgaris* seeds by spraying the nanoformulations on the substrate (germination paper). The experimental setup followed a factorial scheme with two formulations and five dilutions (0%, 10%, 25%, 50%, and 100%) of the stock formulation. Water was used as a positive control. In summary, PCL nanoparticles exhibited an average size of 232 nm, PDI of 0.161, and a negative charge. The Zein nanoparticles showed a similar size to PCL nanoparticles, with a PDI of 0.390 and a positive charge. PCL nanoparticles exhibited fewer phytotoxic effects (satisfactory germination) than Zein nanoparticles in all studied dilutions. The Zein nanoformulations yielded satisfactory results for only for the 10% dilution of the stock solution. The PCL encapsulation approach proved to be a successful strategy for use as a nanocarrier of active compounds for agricultural

applications. It can contribute to more effective and environmentally friendly pest management in agricultural systems.