

INTRODUCTION & AIM

Emamectin benzoate is a highly effective insecticide against lepidoptera. Its conventional commercial presentations include emulsifiable concentrates (EC), which use toxic organic solvents such as xylene, toluene, acetone, and methanol, and water-dispersible granules (WD), whose main disadvantage lies in their low thermodynamic stability and high production costs.

In this study, an aqueous suspension emulsion (SE) of emamectin benzoate was formulated using soy lecithin as a natural emulsifier. The aim was to develop a sustainable and stable alternative that eliminates the use of organic solvents, offering an alternative that responds to the growing demand for agricultural practices that balance productivity with environmental protection. A suspoemulsion is a complex colloidal system that combines a suspension and an emulsion in the same aqueous continuous medium [1].

METHOD

The aqueous suspoemulsion of emamectin benzoate was formulated following a three-stage sequential process, using soy lecithin as a natural emulsifier and a synergistic blend of anionic and nonionic surfactants.

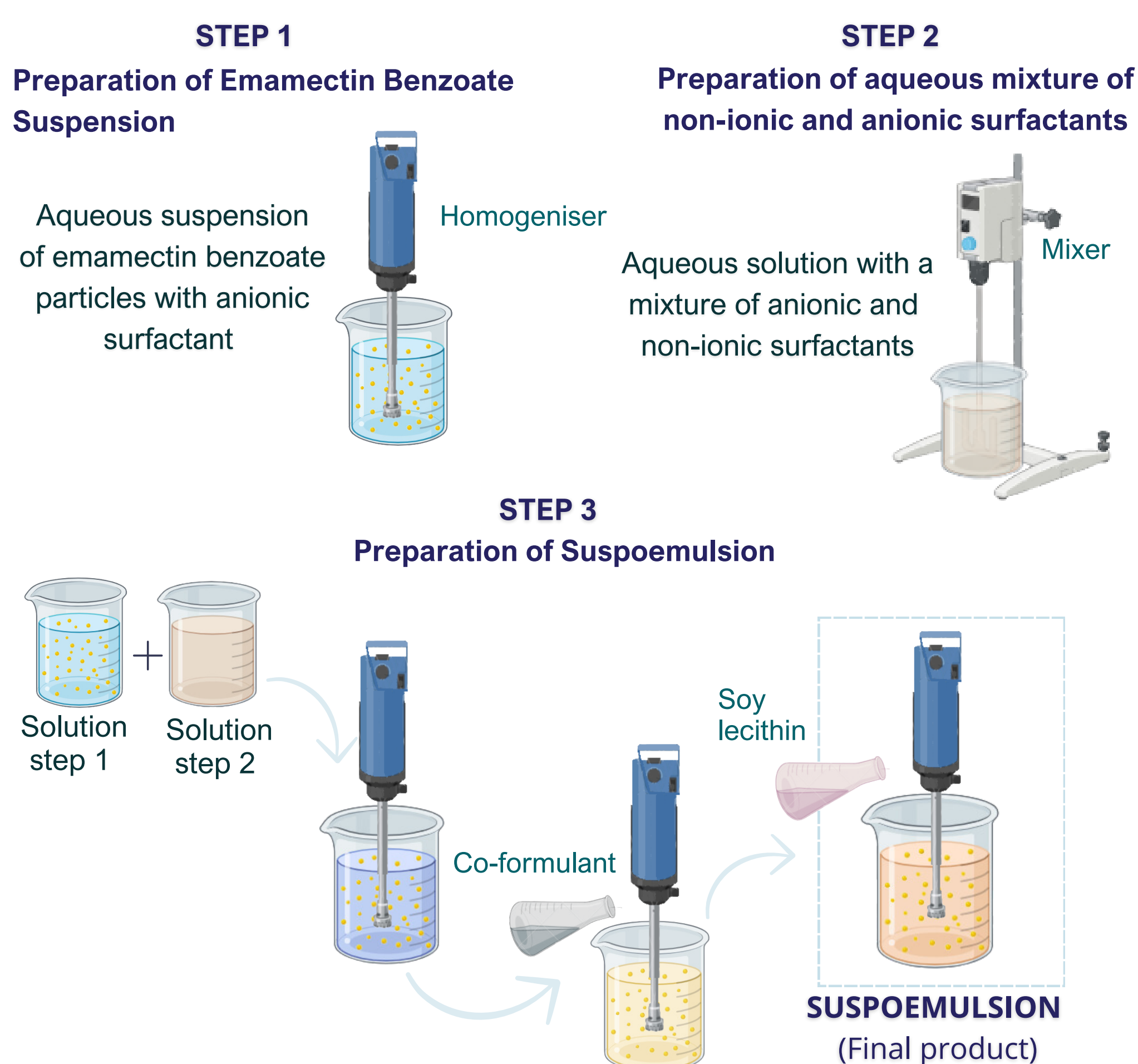


Figure 1. Graphical Summary of Preparation Methodology of Emamectin Benzoate

Stability Characterization and Evaluation:

- **Physicochemical Properties:** The density, pH, and dynamic viscosity of the concentrated suspension were measured.
- **Stability of the superemulsion:** It was evaluated using the CIPAC MT-180 method, measuring the volumes of cream, free oil, and sediment at 0,5 h and 24,5 h after initial dispersion and subsequent redispersion, respectively [2].

RESULTS & DISCUSSION

Stability of the suspension emulsion (CIPAC MT-180)

The results in Table 1 show values significantly lower than the 2 mL limit established by CIPAC, demonstrating the homogeneity, stability and resistance to phase separation of the suspoemulsion, corroborated by the total absence of sedimentation throughout the test.

Table 1. Stability Parameters of suspoemulsion samples according Standard MT-180 (CIPAC)

Time (h)	Cream (mL)	Free Oil (mL)	Sediment (mL)
0	Initial dispersion complete		
0,5	0,03 ± 0,01	0,01 ± 0,00	0,00
24	Re-dispersion complete		
24,5	0,04 ± 0,01	0,01 ± 0,00	0,00

Physicochemical properties of the concentrated suspoemulsion (25°C)

- Density: 0,95 g/mL
- pH: 7,29 favors the balance between protonated and deprotonated forms of emamectin benzoate, promoting its chemical stability [3].
- Dynamic viscosity: 170 cP, suitable for handling and storage of the concentrated suspoemulsion; after dilution, it reaches a viscosity close to that of water, ensuring excellent spray applicability.

Stabilization mechanisms

Stability is achieved by an interfacial barrier of lecithin and a synergistic effect of surfactants that prevents coalescence, suggesting effective steric stabilization.

CONCLUSION

This work develops a stable, solvent-free suspoemulsion of emamectin benzoate using a natural emulsifier, enhancing aqueous dispersion and stability compared to conventional formulations (dispersible granules, emulsifiable concentrates) that rely on toxic organic solvents. The innovation supports sustainable agriculture by aligning efficacy with environmental responsibility.

FUTURE WORK / REFERENCES

To evaluate the photostability of emamectin benzoate, its biological efficacy compared to commercial formulations, tank compatibility with other phytosanitary products, and to characterize the particle size and zeta potential to elucidate the mechanisms of colloidal stabilization.

[1] Tadros T. 6. Formulation of suspoemulsions. In: Volume 4 Agrochemicals, Paints and Coatings and Food Colloids. Berlin, Boston: De Gruyter; 2018. p.71-78. <https://doi.org/10.1515/9783110588002-007>

[2] Manual on the development and use of FAO and WHO specifications for chemical pesticides. FAO; WHO; 2022. Available from: <https://openknowledge.fao.org/server/api/core/bitstreams/6d9f7b80-e606-486f-8f999dc42cee2c5b/content>

[3] Syngenta Crop Protection LLC. Emamectin Benzoate Registration Review. EPA-HQ-OPP 2011-0483. 2018 Oct.