
Research Training Proposal

Essential oil-based insecticide: formulation and analysis

Team : Arome, Parfum, Synthèse, Modélisation (APSM), Institut de Chimie de Nice (UMR CNRS 7272)

Key words: Essential oil, encapsulation, chromatographic analyses, biological activity

Project :

Tomato has a very high social and economic relevance in Europe. Nevertheless, several insect pests (e.g. *Tuta absoluta*, and the whiteflies) and fungal diseases (e.g. *Fusarium spp.*, *Oidium lycopersici*) affect the tomato industry in the Mediterranean basin. The StomP (Sustainable Tomato Production) project aim at developing and implementing environmental friendly methods for the management of tomato key pests and pathogens. One part of this project, carried out by Institute of Chemistry of Nice, is to find new bio-insecticides derived from Mediterranean plants.

Extensive studies on aromatic and medicinal plants have already led to the identification of bioactive essentials oils. However, botanical extracts can have phytotoxic effects on crops and a variable toxicity towards targeted and untargeted insects; both flaws can be reduced by the development of new carriers and formulations which are major hurdles in developing new biopesticides¹.

The aim of this internship will be to set-up new carriers and formulations for increased pest control efficacy and minimized phytotoxicity and non-target toxicity. Different encapsulation and formulation techniques will be evaluated to improve control and reduce phytotoxicity as well as to minimize evaporation, increase shelf live and control release of essential oils. Conventional encapsulation techniques such as spray drying, liposomes and nanoencapsulation will be promoted. Microemulsion with emulsifiers and water plus the essential oils will be also tested. Lastly eco-friendly solvent such as NADES will be also emphasized. NADES have several important advantages, particularly the high solubilizing capacity of both polar and non-polar compounds². The solubility of poorly soluble metabolites in aqueous media will be significantly increased using NADES. The strong hydrogen bonding between NADES and the solutes also contributed to the stability of secondary metabolites under various conditions such as high temperature, light and storage time. Therefore, they could replace organic solvents in agrochemical formulations.

¹ Isman et al 2011 Phytochemical reviews 10:197-204

² Mouden et al 2017 Phytochemistry Rev 16:935-951

Chemical analyses of essential oil and formulated essential oil will be performed by gas-chromatography coupled with mass spectrometry (GC-MS) or with flame ionization detector (GC/FID). Vesicle characterization will be performed by optical microscopy and by dynamic light scattering to obtain zeta potential values, Z-average size, and polydispersity index. Encapsulation yield will be calculated spectrophotometrically or by chromatography techniques.

Biological evaluation of formulated essential oil will be done on infested tomato plants with our partners from Institute Sophia Agrobiotech (INRA).

→ Hire applicant should have strong background in formulation, encapsulation and chromatographic techniques. Knowledges in plant secondary metabolism and ecology will be appreciated.

→ Every application needs to include: a curriculum vitæ, a letter of motivation and score reports from Master 1 and bachelor's degrees, and should be sent to Thomas MICHEL (thomas.michel@unice.fr, 04.92.07.61.69)