

SPYDE PROJECT REPORT

Development of Smart SPraYable Medical DEvices to Alleviate Skin Diseases: One idea for Multiple Purposes

WP3: Evaluation of biocompatibility and prediction of extracts' biological properties

Overview of Experimental Activities

The SPYDE project (Smart SPraYable Medical DEvices) is part of a multidisciplinary research framework aimed at developing intelligent and biocompatible medical devices, with a particular focus on the use of natural extracts from *Vitis vinifera* for dermatological applications. This report documents the progress of the experimental activities carried out within Work Package 3, which is focused on evaluating the biocompatibility and predictive biological properties of plant extracts through an integrated approach combining ecotoxicological and phytotoxic tests.

The research was conducted in three main phases. The first phase involved the use of the Brine Shrimp Lethality Test (BSLT) on *Artemia salina* nauplii, an invertebrate model widely used for acute toxicity assessment. *Vitis vinifera* extracts, obtained from stalks, pomace, and fruits using solvents of varying polarity, were tested at concentrations up to 2.0 mg/mL. The results showed high toxicity attributable more to the plant matrix than to the extraction solvent. The aim of this experimental phase was to identify the most biocompatible extracts, providing a knowledge base for subsequent biological investigations.

The second phase focused on allelopathic assay models to assess the phytotoxic effect of the extracts on seed germination and seedling growth of various plant species. The extracts were tested at different concentrations and exhibited dose-related inhibitory activities, which were also influenced by the original plant matrix. Seedling elongation analysis confirmed, with some differences, variable biological activities depending on both the matrix and extract concentration.

The third phase focused on developing a cardiotoxicity assay using *Daphnia magna*, a standard aquatic model for assessing the sublethal effects of environmental contaminants. In this phase, the experimental protocol was developed and optimized, defining the experimental variables and selecting appropriate standards for the positive and negative controls. The dynamics of the agents to be used as positive controls are still under evaluation. Data analysis will determine the corresponding LC₅₀ values, guiding the choice of the most suitable positive control. This result represents a key step in integrating the *Daphnia magna* model into the ecotoxicological assessment of plant extracts.

In line with the project's multi-level experimental approach, the use of invertebrate and plant models for characterizing the biocompatibility of *Vitis vinifera* extracts proves to be both applicable and efficient. The results highlight key differences related to the extraction matrix and solvent, providing essential data for selecting the most promising extracts for use in sprayable medical devices. This contributes to the development of natural, effective, and safe therapeutic solutions for the treatment of skin conditions.

The new experimental findings significantly enhance the understanding of the biological properties of *Vitis vinifera* extracts, with implications in both pharmacological and environmental contexts. The integration of rapid and highly sustainable tests will allow for effective evaluation of the safety and ecotoxicological impact



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of extracts and fractions, supporting a sustainable, evidence-based approach to research and development of new biotechnological products.

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