

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ НАЦІОНАЛЬНИЙ
ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ
КАФЕДРА ПРОМИСЛОВОЇ ТЕХНОЛОГІЇ ЛІКІВ ТА КОСМЕТИЧНИХ
ЗАСОБІВ КАФЕДРА АПТЕЧНОЇ ТЕХНОЛОГІЇ ЛІКІВ

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Aim: The aim of this study was to perform an integrated chemical and biological assessment of *R. tomentosum* extracts and to evaluate the influence of extraction solvents on the yield of bioactive compounds and their biological activity.

Methods: Plant material of *R. tomentosum* was collected in Ukraine. The phytochemical composition of the obtained extracts was investigated using GC–MS, HPLC–PDA and UV–Vis spectrophotometric methods.

Results: The results showed that *R. tomentosum* raw material contained γ -terpineol (23.9%), palustrol (17.2%), ledol (14.9%), and p-cymene (5.2%) as the dominant constituents of the essential oil. The non-volatile fraction was rich in triterpene acids, particularly ursolic acid. In addition, the extracts contained chlorogenic acid (1.63 ± 0.18 mg/g) and neochlorogenic acid (1.17 ± 0.13 mg/g). The studied extracts demonstrated antioxidant activity and inhibited cathepsin C *in vitro*.

Conclusions: This study provides a comprehensive analysis of the volatile and non-volatile chemical composition and the cathepsin C inhibition of *Rhododendron tomentosum* Harmaja highlighting its potential as a source of biologically active compounds.

COMPARISON OF MULTI-CRITERIA OPTIMIZATION METHODS IN PHARMACEUTICAL DEVELOPMENT

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Introduction. Multi-criteria optimization is a key tool in pharmaceutical development. It is used to optimize technological processes, predict pharmacokinetics and pharmacodynamics, ensure stability and bioavailability of dosage forms, and comply with safety, quality, and regulatory requirements. It reconciles multiple, often conflicting criteria, supporting informed decision-making in drug development. This approach is particularly important for determining the composition and manufacturing technology of pharmaceutical products. It enables quantitative identification of

effective excipient combinations and technological conditions to ensure required pharmaco-technological characteristics, including quality, efficacy, and safety. It formalizes the development process, enhances reproducibility, and reduces subjective influence, which is crucial for evidence-based pharmacy and regulatory compliance.

Aim of the study. To compare analytical, numerical–analytical, and non-mathematical multi-criteria optimization methods, with emphasis on the weighted criteria and ideal point methods, focusing on solution uniqueness and minimizing subjectivity.

Materials and methods. Three groups of methods were analyzed:

- analytical methods, using optimality conditions and scalarization;
- numerical–analytical methods, including gradient algorithms, evolutionary strategies, and hybrid approaches combining response modeling with experimental design;
- non-mathematical methods, such as expert assessments, scoring systems, and heuristics.

The analysis considered model structure, input parameters, conditions ensuring solution existence and uniqueness, and the degree of objectivity and reproducibility.

Results and discussion. Analytical methods are rigorous and provide unique solutions when conditions are met. The weighted criteria method aggregates all criteria into a single function, is simple to implement, and allows analytical optimality conditions. However, externally assigned weights introduce subjectivity. The ideal point method minimizes deviation from an ideal solution without explicit weights, reducing subjectivity. With proper normalization and convexity, the solution is unique and robust. Numerical–analytical methods handle complex, nonlinear, high-dimensional problems but may produce multiple local optima, reducing reproducibility. Non-mathematical methods are suitable for preliminary assessment only, being subjective and lacking strict mathematical foundation.

Comparative analysis shows analytical methods ensure rigor and unique, globally optimal solutions. Numerical–analytical methods are flexible but may produce

multiple optima. Within analytical methods, the difference between weighted criteria and ideal point methods is in external parameters—weights for the former, comparison rules for the latter.

Conclusions. Analytical methods are most effective for reproducible, interpretable, and regulatorily compliant pharmaceutical development. The ideal point method reduces subjectivity and ensures solution uniqueness. Weighted criteria are simple but require weight justification. Numerical–analytical methods are suitable for complex systems but do not guarantee uniqueness. Non-mathematical methods are limited to preliminary assessment.

Multi-criteria optimization is essential for establishing the optimal composition and technological parameters, enabling systematic determination of excipient proportions and production conditions for optimal pharmaco-technological characteristics. For tasks requiring unique and reproducible results, preference should be given to analytical methods with minimal external parameters and strict mathematical formulation.

STUDY OF MICROSCOPIC DIAGNOSTIC SIGNS OF THE STRUCTURE OF THE BORAGE HERB VARIETY STRUMOK

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Introduction. To expand the range of domestic herbal medicines, plants that are widely cultivated, easily adapt to certain climatic conditions, and are not demanding on soils deserve special attention. Such plants include the representative of the Borage family (*Boraginaceae* Juss.), the borage *Borago officinalis* L. There are several varieties of this plant on the Ukrainian market, but the most affordable is the Strumok variety.