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Extraction kinetics and insecticidal activity of volatile components isolated from rue by supercritical CO₂

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Rue (*Ruta graveolens* L., Rutaceae), is a traditional medicinal plant, also known as a flavouring agent for spirits and foods. Its isolates can be used as botanical insecticides, due to the fact that it prevents the attacks of fleas and other noxious insects. Phytochemical investigations have attributed this biological activity to the presence of coumarins and alkaloids, particularly, quinolines, furocoumarins and furoquinolines [1]. Compared to synthetic pesticides, the preparations based on the plant isolates contain a mixture of biologically active substances, which typically result in a synergistic effect, thereby preventing evolution of resistance in pests. Additionally, the residue after their application relatively quickly decomposes. Thus, the botanical insecticides are expected to be applied in the future as selective, efficacious and toxicologically-safe plant protection against insects [2].

A promising method for isolation of the botanical insecticides from rue is supercritical fluid extraction with carbon dioxide (SFE). The high biological activity of rue remains unchanged in extracts due to the application of low temperatures. SFE is an advanced separation technique which complies with green chemistry principles, and represents a valid alternative to traditional extraction methods. SFE can generate added value products without thermal degradation like in hydrodistillation (HD) or massive use of organic solvents, as in organic solvent extraction.

The aim of the work was to describe the SFE of volatile components from rue and to analyse their insecticidal effects. The objectives consisted in: (a) optimizing the SFE condition (pressure, temperature, extraction time, use of additional separator and concentration of modifier in CO₂), (b) investigating their effect on the yield, concentration of volatiles in extract and the insecticidal activity, (c) determination of the SFE kinetics of major components in the rue extracts and (c) comparing the SFE with hydrodistillation and maceration.

Using the benefit of variable solvent power of supercritical carbon dioxide, several types of extracts were prepared at temperatures from 40 to 50°C and pressures from 9 to 28 MPa. The extract enriched with polar components was extracted at pressure of 28 MPa and temperature of 40 °C with acetone added to CO₂ as modifier (2.5 – 10 wt. %). To describe the extraction kinetics of individual volatile components, the consecutively collected extract samples were analysed using gas chromatography. The biological activity of extracts was measured by means of contact toxicity test (LD₅₀, LD₉₀) and antifeedant activity on larvae of *Spodoptera littoralis*, an arthropod insect well known for its gregariousness and extreme voracity on potato, tomato, pepper plants leaves and fruits, among others.

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References

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