

Supercritical fluid-based analysis of secondary metabolites in herbal drugs and commercial preparations from *Rhodiola rosea*

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The global demand for dried roots and rhizomes of *Rhodiola rosea* – also known as roseroot – and the popularity of products advertised as adaptogen experience a continuous increase. To characterize the secondary metabolite composition of herbal drugs and commercial preparations, fast and reliable analytical methods are needed. Although a number of studies have been published dealing with analytical methods for the quantitation of roseroot constituents, environmentally neutral CO₂ based supercritical fluid (SFx) methods are still underrepresented. SFx techniques include supercritical fluid extraction (SFE) as well as analytical or semi-preparative supercritical fluid chromatography (SFC).

In this study, seven characteristic roseroot secondary metabolites, i.e. p-tyrosol (**1**), rosin (**2**), rosiridin (**3**), salidroside (**4**), rosarin (**5**), rosavin (**6**), and tricic-5-O-β-D-glucopyranoside (**7**) were extracted and quantitated in 24 herbal drugs and seven commercial preparations using a newly established SFx workflow.

The developed protocol includes an exhaustive extraction of compounds **1-7** and their analysis on a UHPSFC instrument in less than four minutes. For their quantitation, reliable results in terms of selectivity, linearity ($R^2 \geq 0.99$), precision (intraday $\leq 3.03\%$, interday $\leq 5.17\%$) and accuracy (recovery rates 96.6-102.4%) were achieved using selected ion recording on a single quadrupole mass spectrometer.

As a result, a highly differing metabolite pattern was observed for both the investigated herbal drugs and commercial products. Interestingly, none of the commercial dietary products met the declared content of rosavins and salidroside. In conclusion, the developed and validated protocol offers an environmentally friendly and fast alternative for the evaluation of the secondary metabolite pattern of roseroot herbal drugs and preparations.

[1] Langeder J, Grienke U. A supercritical fluid workflow for the quality assessment of herbal drugs and commercial preparations from *Rhodiola rosea*. *Phytochem Anal.* (2021) 32(6):982-991. doi: 10.1002/pca.3040.