

COMPARISON OF EFFICIENCY OF EUTECTIC MIXTURE AND CONVENTIONAL SOLVENTS FOR THE EXTRACTION OF HYDROXYCINNAMIC ACID DERIVATIVES FROM THE HERB OF *SATUREJA KITAIBELII* WIERZB. EX HEUFF. (LAMIACEAE)

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Hydroxycinnamic acids (HCAs), such as dimeric rosmarinic acid (RA) and higher HCA oligomers, are important active constituents of Lamiaceae plants. It was found that herb of *Satureja kitaibelii* (Rtanj tea) contains substantial amounts of RA and HCA hexamer clinopodic acid O (CAO) (1).

In this work, we compared extracting efficiencies of conventional solvents and a deep eutectic solvent, composed of choline chloride and citric acid (ChCl:CitrA), for extraction of RA and CAO from Rtanj tea. Commercial Rtanj tea sample was extracted (1:10) by sonication (room temperature, 60 min) with aqueous ChCl:CitrA (35% and 65%), ethanol 50%, ethanol 96%, and water, as well as by previously optimized procedure (ethanol 46%, digestion 60 °C, 120 min) (1). Contents of RA and CAO were determined by HPLC using RA as external standard. Extraction with ChCl:CitrA and 50% ethanol resulted in extracts rich in RA and CAO; RA concentrations in these extracts were uniform (848-873 µg/mL), while extraction of CAO was slightly more effective with ChCl:CitrA (1122-1131 µg/mL) than with 50% ethanol (925 µg/mL). These extracts contained significantly more of RA and CAO than the extract obtained under optimized conditions (666 µg/mL RA, 725 µg/mL CAO). Differently, 96% ethanol and water extracts contained substantially less RA (11-217 µg/mL) and CAO (4-10 µg/mL). Obtained results indicate potential of applied eutectic solvent in extraction of Rtanj tea, for purpose of both quality control and preparation of extracts with potential application in pharmaceutical, food or cosmetic industry, and are compliant with “green chemistry” and “green pharmacy” principles.

References

1. Mudrić J, Arsenijević J, Maksimović Z, Ibrić S, Gopčević K, Đuriš J. Tablet and capsule formulations incorporating high doses of a dry optimized herbal extract: The case of *Satureja kitaibelii*. J Drug Deliv Sci Technol 2021; 66: 102776.

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**POREĐENJE EFIKASNOSTI EUTEKTIČKE SMEŠE I KONVENCIONALNIH
RASTVARAČA U EKSTRAKCIJI DERIVATA HIDROKSICIMETNE KISELINE IZ
HERBE *SATUREJA KITAIBELII* WIERZB. EX HEUFF. (LAMIACEAE)**

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Derivati hidroksicimetne kiseline (HCK), kao što su dimerna rozmarinska kiselina (RK) i viši oligomeri HCK, su aktivni sastojci biljaka porodice Lamiaceae. Ranije je ustanovljeno da trava *Satureja kitaibelii* (rtanjski čaj) sadrži značajne količine RK i heksamera HCK klinopodinske kiseline O (KKO) (1). U radu je upoređena ekstrakciona efikasnost konvencionalnih rastvarača i duboke eutektičke smeše na bazi hlorida i limunske kiseline (ChCl:CitrA) za ekstrakciju RK i KKO iz rtanjskog čaja. Komercijalni uzorak rtanjskog čaja ekstrahovan je (1:10) postupkom sonikacije na sobnoj temperaturi tokom 60 min vodenim rastvorima ChCl:CitrA (35% i 65%), etanolom 50%, etanolom 96% i vodom, kao i prethodno optimizovanim postupkom (etanol 46%, digestija na 60 °C, 120 min) (1). Sadržaj RK i KKO određen je HPLC metodom, korišćenjem RK kao eksternog standarda. Ekstrakcija primenom ChCl:CitrA i 50% etanola rezultirala je ekstraktima bogatim RK i KKO, pri čemu su koncentracije RK u ovim ekstraktima bile ujednačene (848-873 µg/mL), dok je za ekstrakciju KKO, ChCl:CitrA bila nešto efikasnija (1122-1131 µg/mL) od 50% etanola (925 µg/mL). Pored toga, ovi ekstrakti su sadržali veće količine RK i KKO od ekstrakta dobijenog pod ranije optimizovanim uslovima (666 µg/mL RK, 725 µg/mL KKO). Sa druge strane, ekstrakti dobijeni 96% etanolom i vodom sadržali su znatno manje količine RK (11-217 µg/mL) i KKO (4-10 µg/mL). Dobijeni rezultati ukazuju na potencijal primenjene eutektičke smeše u ekstrakciji rtanjskog čaja, kako u cilju kontrole kvaliteta, tako i za pripremu ekstrakata sa primenom u farmaceutskoj, prehrambenoj i kozmetičkoj industriji, što je u skladu sa principima "zelene hemije" i "zelene farmacije".

Literatura

1. Mudrić J, Arsenijević J, Maksimović Z, Ibrić S, Gopčević K, Đuriš J. Tablet and capsule formulations incorporating high doses of a dry optimized herbal extract: The case of *Satureja kitaibelii*. J Drug Deliv Sci Technol 2021; 66: 102776.

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