



**SEVENTH INTERNATIONAL CONFERENCE
SUSTAINABLE POSTHARVEST AND
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A NEW METHOD FOR THE PROPORTION ESTIMATION IN EDIBLE OIL BLENDS: SUNFLOWER AND RAPESEED OIL

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Edible vegetable oils are a very important part of everyday human diet. The most prominent feature of vegetable oils is that their nutritional value is higher than that of animal oils. Sunflower oil is one of the top five edible oils in the world, having a full priority in Serbia, due to the high availability of raw materials over others. Due to the presence of essential linoleic (omega 6) and oleic (omega 9) fatty acids, as well as alpha-tocopherol (vitamin E), it has a high nutritive value. On the other hand, rapeseed oil contains all three important essential unsaturated fatty acids: oleic (omega 9), linoleic (omega 6) and linolenic (omega 3) fatty acids.

Food authentication is the process by which a food product is verified as complying with its label description. The characterization and authentication of oils and fats is a subject of great importance for market and health aspects.

The aim of this paper was to determine the possibility of applying a gas chromatography device with a mass spectrometric detector (GC-MS) coupled to a newly developed mathematical model to determine the proportion of individual oils in simulated blended oil samples.

Oil samples were collected from Processing Technology of Vegetable Oils and Fats Unit at the Department of Food Preservation Engineering, Faculty of Technology Novi Sad, University of Novi Sad, Republic of Serbia. Seven oil blends with different proportions of sunflower and rapeseed oils were prepared for GC-MS analysis (20:80%, 30:70%, 40:60%, 50:50%, 60:40%, 70:30%, and 80:20%). The fatty acids present in the simulated oil blends were derivatized into corresponding fatty acid methyl esters (FAMES) using a reagent trimethylsulfonium-hydroxide (TMSH). Quantification of dominantly present fatty acids: palmitic, linolenic, linoleic, oleic and stearic, was performed using an AMDIS algorithm of the ChemStation software (Agilent Technologies). Obtained numeric values of the peak surface areas of dominant fatty acids were processed using a newly developed mathematical model, in order to estimate the proportion of individual oil in each simulated oil blend prepared. Experimentally obtained estimated values of the content of sunflower oil in the blend with rapeseed oil, were compared with the set of theoretical values for the prepared blends. Linearity across the investigated proportion range along with a very high correlation coefficient (0.955) were obtained, thus indicating a strong potential of the provided methodology in verifying authenticity of edible vegetable oils in the food market and determining the proportion of each oil in a blend.

Keywords: edible vegetable oils, sunflower oil, rapeseed oil, GC-MS, mathematical model, oil authentication and fraud detection

NOVI METOD PROCENE SASTAVA SMEŠA JESTIVIH ULJA: ULJE SUNCOKRETA I ULJANE REPICE

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Jestiva biljna ulja su veoma važan deo svakodnevne ljudske ishrane. Najprominentnija karakteristika biljnih ulja je da je njihova hranljiva vrednost veća od vrednosti životinjskih ulja. Suncokretovo ulje je jedno od pet najboljih ulja na svetu, koje ima veliki prioritet u Srbiji zbog velike dostupnosti sirovine u odnosu na druge. Zbog prisustva esencijalnih masnih kiselina, linolne (omega 6) i oleinske (omega 9), kao i alfa tokoferola (vitamin E), ima visoku hranljivu vrednost. S druge strane, ulje uljane repice sadrži sve tri važne esencijalne nezasićene masne kiseline: oleinsku (omega 9), linolnu (omega 6) i linolensku (omega 3) masnu kiselinu.

Autentifikacija hrane je postupak kojim se potvrđuje usaglašenost prehrambenog proizvoda sa njegovim opisom na etiketi. Karakterizacija i autentifikacija ulja i masti je tema od velike važnosti sa tržišnog i zdravstvenog aspekta.

Cilj ovog rada bio je da se utvrdi mogućnost primene uređaja za gasnu hromatografiju sa masenim spektrometrom kao detektorom (GC-MS) i novorazvijenog matematičkog modela za određivanje udela pojedinačnih ulja u simuliranim uzorcima smeša ulja.

Uzorci ulja su dobijeni sa odeljka Tehnologije biljnih ulja i masti na Departmanu za inženjerstvo konzervisane hrane, Tehnološki fakultet Novi Sad, Univerzitet u Novom Sadu, Republika Srbija. Za GC-MS analizu je pripremljeno sedam smeša ulja sa različitim odnosima ulja suncokreta i uljane repice (20:80%, 30:70%, 40:60%, 50:50%, 60:40%, 70:30% i 80:20%). Masne kiseline prisutne u simuliranim smešama ulja su derivatizovane u odgovarajuće metil estre masnih kiselina (FAME – Fatty Acid Methyl Ester), primenom reagensa trimetilsulfonijum-hidroksid (TMSH). Kvantifikacija dominantno prisutnih masnih kiselina: palmitinske, linolenske, linolne, oleinske i stearinske, izvršena je pomoću AMDIS algoritma softvera ChemStation (Agilent Technologies). Dobijene numeričke vrednosti za površine pikova dominantnih masnih kiselina obrađene su pomoću novorazvijenog matematičkog modela, kako bi se odredio udeo pojedinačnog ulja u svakoj pripremljenoj simuliranoj smeši ulja. Eksperimentalno dobijene procene vrednosti sadržaja suncokretovog ulja u smeši sa repičinim uljem, upoređene su sa setom teorijskih vrednosti za pripremljene smeše. Dobijena je linearna zavisnost u istraženom opsegu udela, kao i veoma visok koeficijent korelacije (0.995), što ukazuje na snažan potencijal pružene metodologije u verifikaciji autentičnosti jestivih biljnih ulja na prehrambenom tržištu i određivanju udela svakog ulja u smeši.

Ključne reči: jestiva biljna ulja, ulje suncokreta, ulje uljane repice, GC-MS, matematički model, autentifikacija ulja i otkrivanje prevara