IECAG 2021
The 1st International Electronic Conference on Agronomy
03–17 MAY 2021 | ONLINE

Chemical characterization of *Rosa canina* L. rosehip seed: application of Raman spectroscopy and gas chromatography

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Introduction

Agri-food wastes are rich in bioactive compounds and nutrients that can add value to different fields of agriculture and food production. Due to its nutritional value and sensory properties, as well as the abundance of bioactive compounds, rosehip takes a significant place in the human diet and food industry [1, 2]. Rosehip fruits contain about 30–35% of seeds [3], which are considered as the waste material in the in food industry [4]. However, seeds are good source of essential fatty acids such as linoleic and α-linolenic [4].
Raman spectroscopy *in situ* analysis is a rapid and non-destructive method that may provide chemical and structural information with minimum requirements for sample pre-processing [5,6].
The aim of this study was to assess the chemical composition of seeds from *Rosa canina* L. hips using Raman spectroscopy and gas chromatography, with the focus on seed oil fatty acid composition.

Material and methods

Plant material
About 50 rosehip (*Rosa canina* L.) specimens were collected from the rural area near Čačak city (locality Gornja Trnava, Moravica district, Central Serbia) in the autumn of 2018.
Raman Instrumentation
Raman microspectroscopy was focusing on direct analysis of seeds which were longitudinally cut at room temperature prior to analysis. Spectra were recorded in the range 200-1800 cm^{-1}, using XploRA Raman spectrometer (Horiba Jobin Yvon), following literature procedure [6].

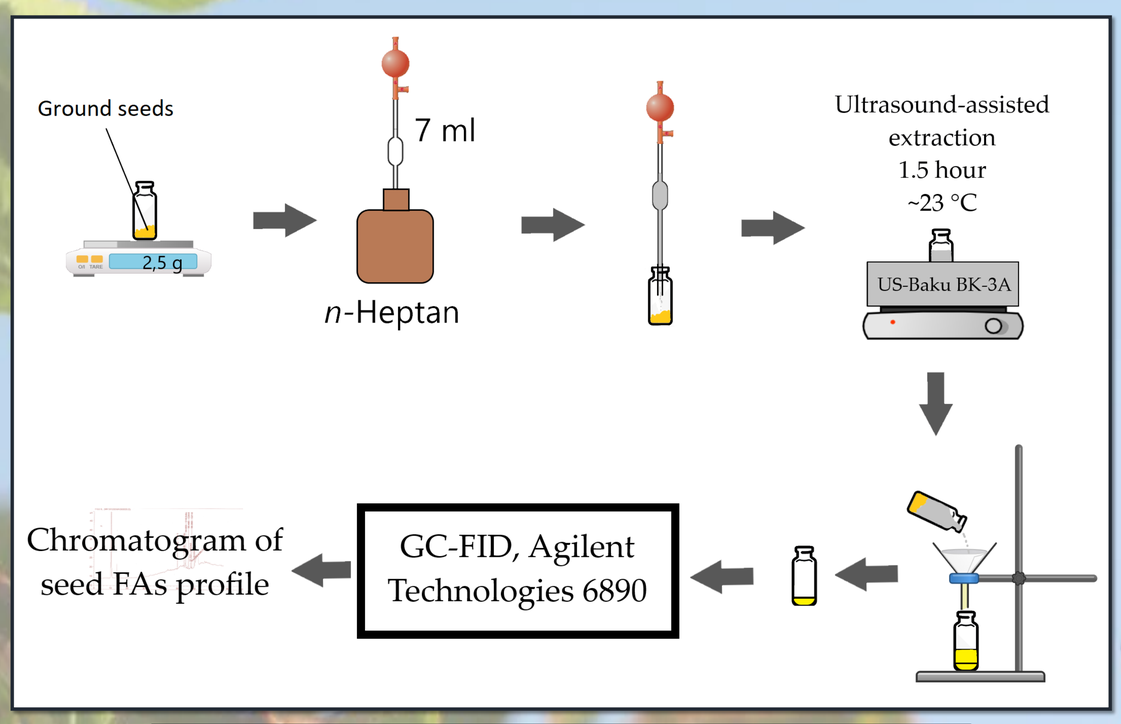

Figure 1. Extraction of oil fraction and fatty acids analysis

Fatty acids (FAs) analysis
FAs in a form of fatty acids methyl esters (FAMEs) were analyzed by gas chromatography with a flame ionization detector (GC-FID). The content of FAs was identified by comparing the retention times with the peaks of the analytical standard acid mix containing 37 acids (Supelco, Bellefonte, SAD) [7].

Results

- The bands in the spectrum clearly indicated the presence of *cis* unsaturated fatty acids (UFAs).
- Raman spectroscopic analysis also detected phenolic compounds and polysaccharides in seeds (Figure 2).

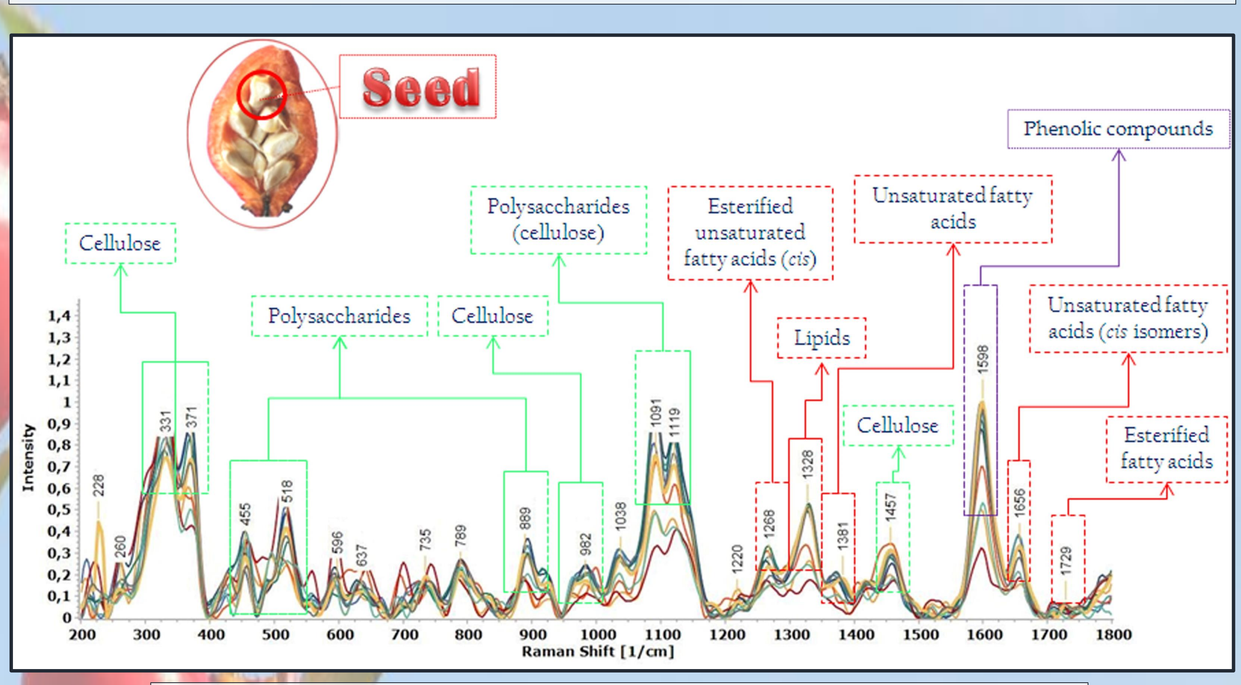

Figure 2. Average Raman spectrum of rosehip seeds and band assignments (200 to 1800 cm^{-1})

- The yield of seed lipid fraction obtained by the application of ultrasound-assisted extraction (UAE) was 5.6 % (0.14 g /2.5 g of seeds).
- The most abundant UFA in studied rosehip seed oil sample was linoleic acid (29.72%), followed by palmitoleic acid (7.02%), α-linolenic acid (4.20%), oleic acid (4.01%).
- Among saturated FAs, arachidic had the highest content (32.93%), followed by heneicosanoic and behenic acids with 19.27& and 2.85%, respectively (Figure 3).

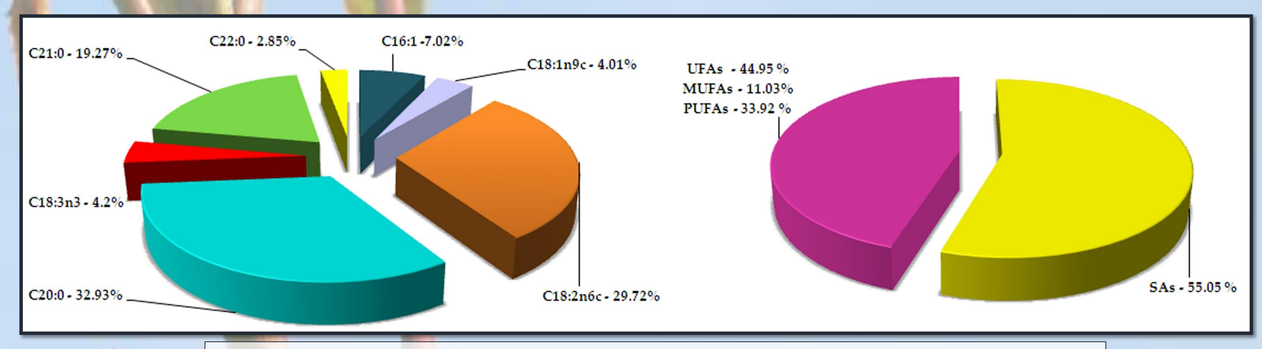

Figure 3. Fatty acids percentage and the saturated and unsaturated FAs ratio in rosehip seed

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