Properties of chemical interesterified mixtures of tomato seed oil with coconut oil

Joanna Bryś[1,*], Rita Brzezińska[1], Olga Giers[1], Agata Górska[1], Ewa Ostrowska-Ligęza[1], Magdalena Wirkowska-Wojdyła[1], Andrzej Bryś[2]

[1] Department of Chemistry, Institute of Food Science, University of Life Sciences; Nowoursynowska st. 159c, 02-787 Warsaw, Poland
[2]Department of Fundamental Engineering, Institute of Mechanical Engineering and Energetics, University of Life Sciences; Nowoursynowska st. 164, 02-776 Warsaw, Poland
*Correspondence: joanna_brys@sggw.edu.pl; Tel.: +48 22 5937615

WARSAW UNIVERSITY OF LIFE SCIENCES

Introduction and aim of work

Tomato seeds contain about 20 % of oil in dry matter. This oil is characterized by a high content of unsaturated fatty acids, which constitute about 80%. Coconut oil, on the other hand, is characterized by a high content of saturated fatty acids (about 90%) and good oxidative stability.

Interesterification is one of the methods of obtaining structured triacylglycerols, the nutritional and physicochemical properties of which are modified in relation to the naturally occurring ones. An important aspect of this reaction is that it changes the structure and composition of triacylglycerols, but does not affect the natural structure of fatty acids. This is very beneficial as it allows all fatty acids with a health-promoting effect to remain intact. Another advantage of this process is that it does not produce trans fatty acids.

The aim of this work was the analytical evaluation of structured lipids synthesized by chemical interesterification of vegetable oil blends.

The mixtures of tomato seed oil and coconut oil at weight ratio 1:3 (1T:3C), 1:1 (1T:1C) or 3:1 (3T:1C) respectively were interesterified for 2 hours at the temperature of 60°C in the presence of chemical catalyst – sodium methoxide.

WARSAW UNIVERSITY OF LIFE SCIENCES

Methods

- The determination of **fatty acid composition** was carried out by gas chromatographic analysis of fatty acid methyl esters (FAME). FAME were prepared according to the standard ISO method 5509 and injected into a gas chromatograph equipped with an FID detector according to ISO method 5508.

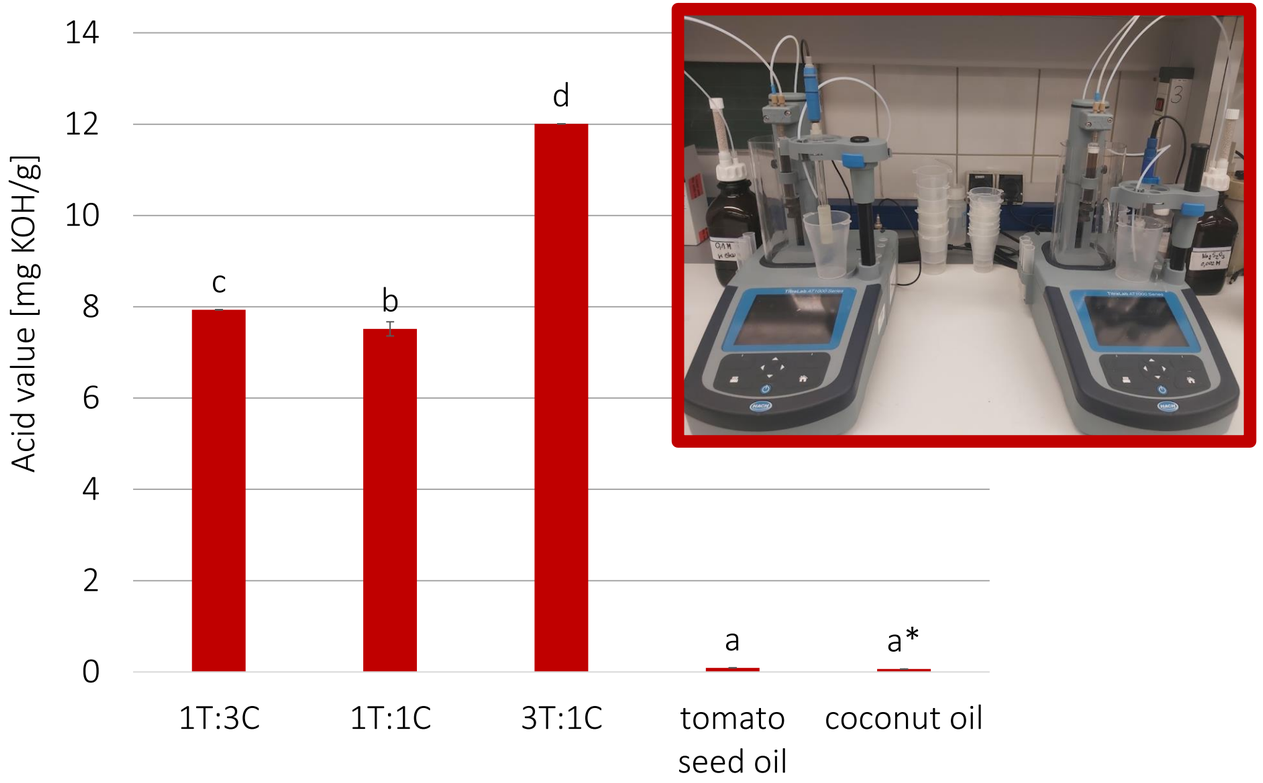
- The **positional distribution of fatty acids** in the sn-2 and sn-1,3 positions of triacylglycerols was based on the ability of the pancreatic lipase to selectively hydrolyze ester bonds in the sn-1,3 positions.

- **Oxidative stability** of interesterified mixtures was determined using the calorimetric method. Raw experimental data was recorded with the use of the differential scanning calorimeter (DSC Q20 TA Instruments) equipped with a high-pressure cell (PDSC). The samples were placed in aluminium pans, filled with oxygen, pressurized in an isobaric module (1400 kPa) with temperature set on 120°C. The oxidative induction time was obtained from the PDSC curves.

- Samples were also characterized by basic quality parameter: **acid and peroxide values** by titration methods.

WARSAW UNIVERSITY OF LIFE SCIENCES

Results



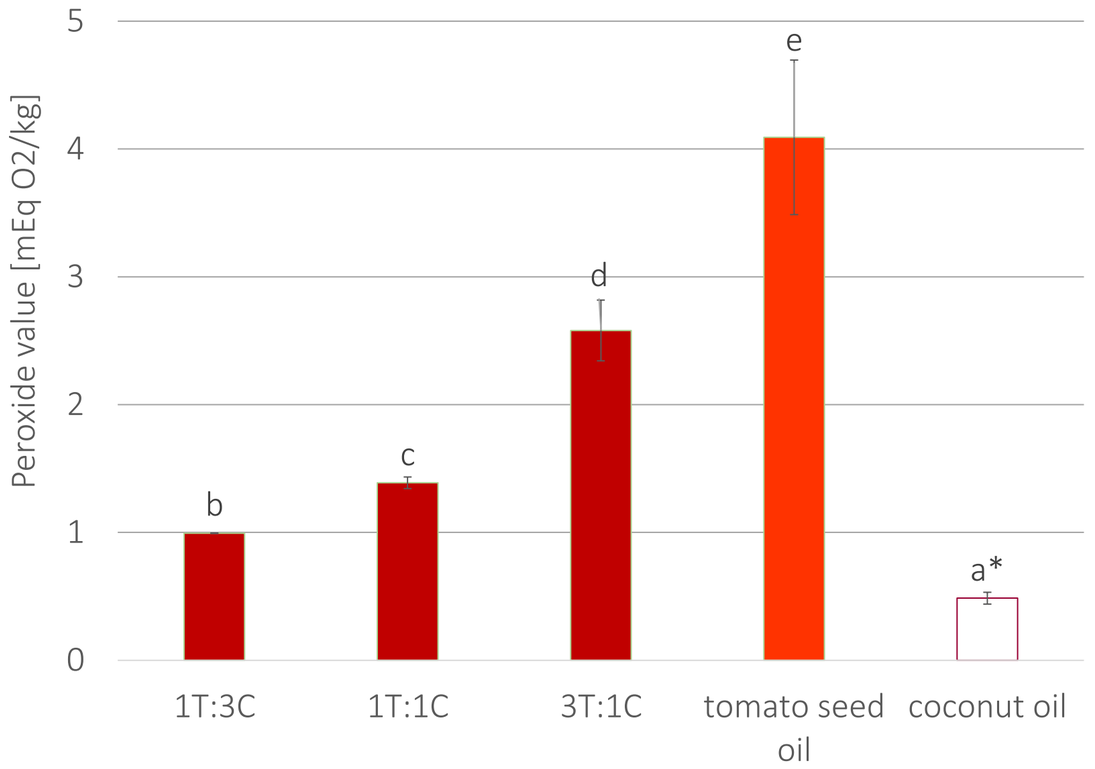


Fig. 1 and 2. Acid and peroxide values of samples

*Different letters indicate that the samples are significantly different at $p < 0.05$

WARSAW UNIVERSITY OF LIFE SCIENCES

Results

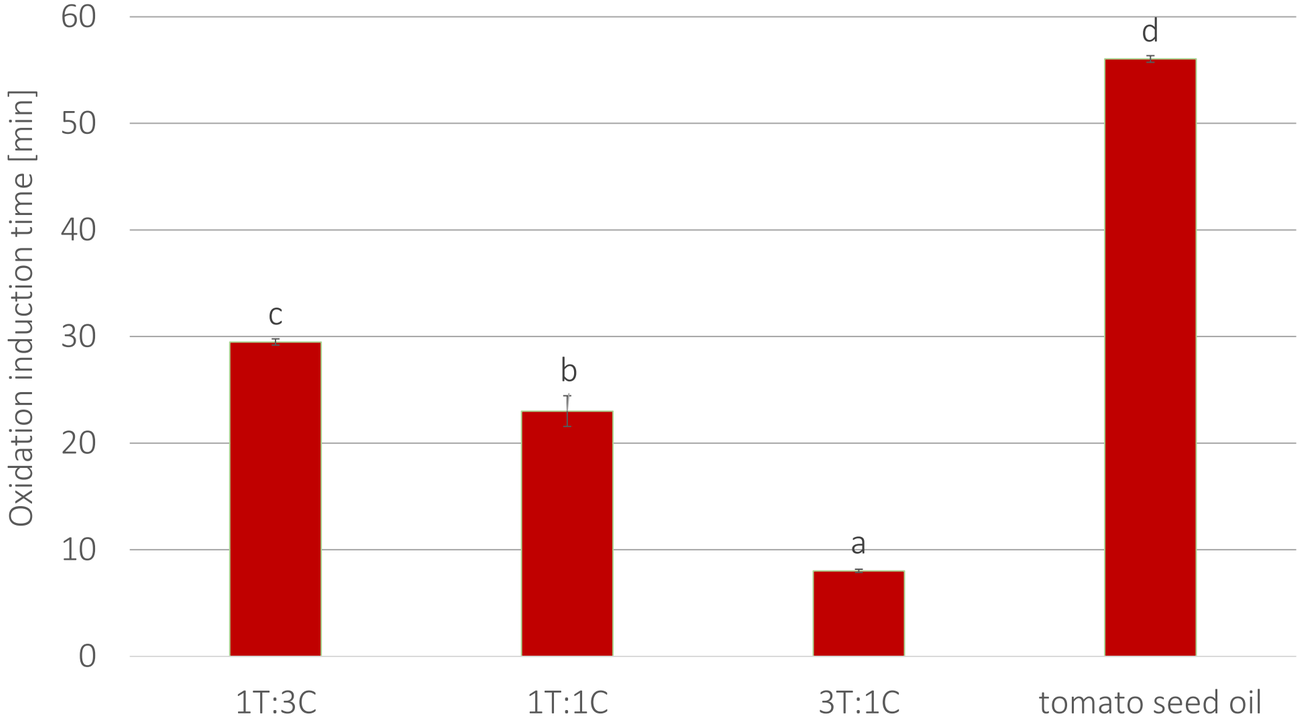
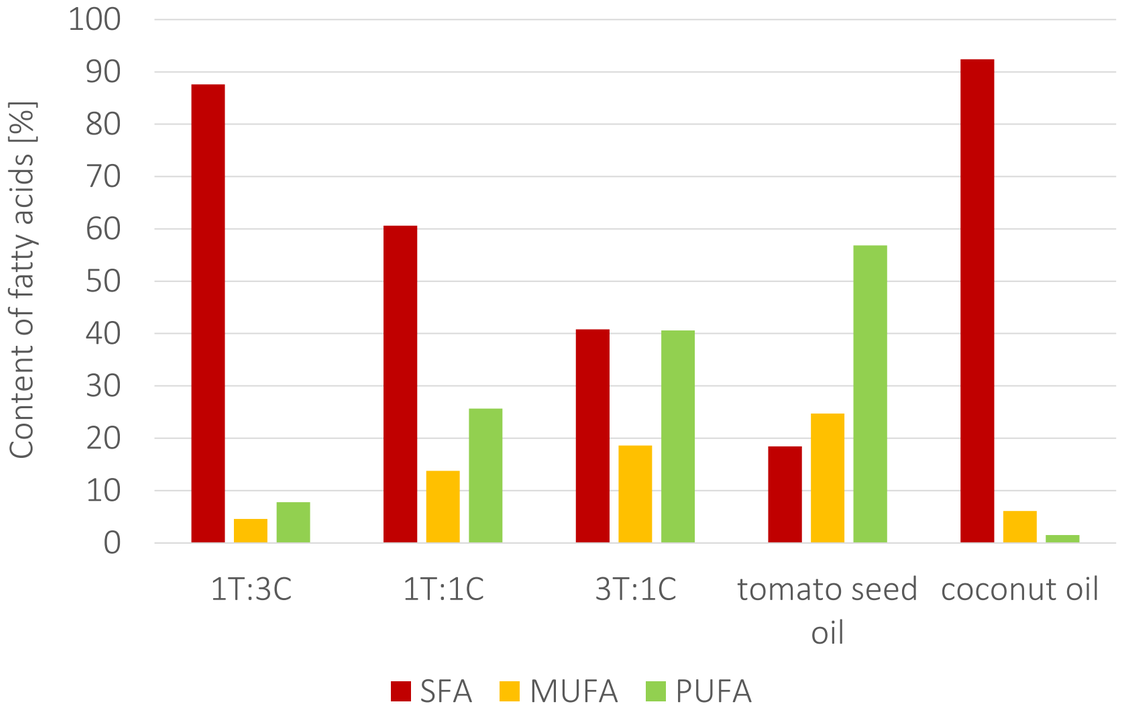


Fig. 3. Oxidation induction time of samples

*Different letters indicate that the samples are significantly different at $p < 0.05$

WARSAW UNIVERSITY OF LIFE SCIENCES

Results



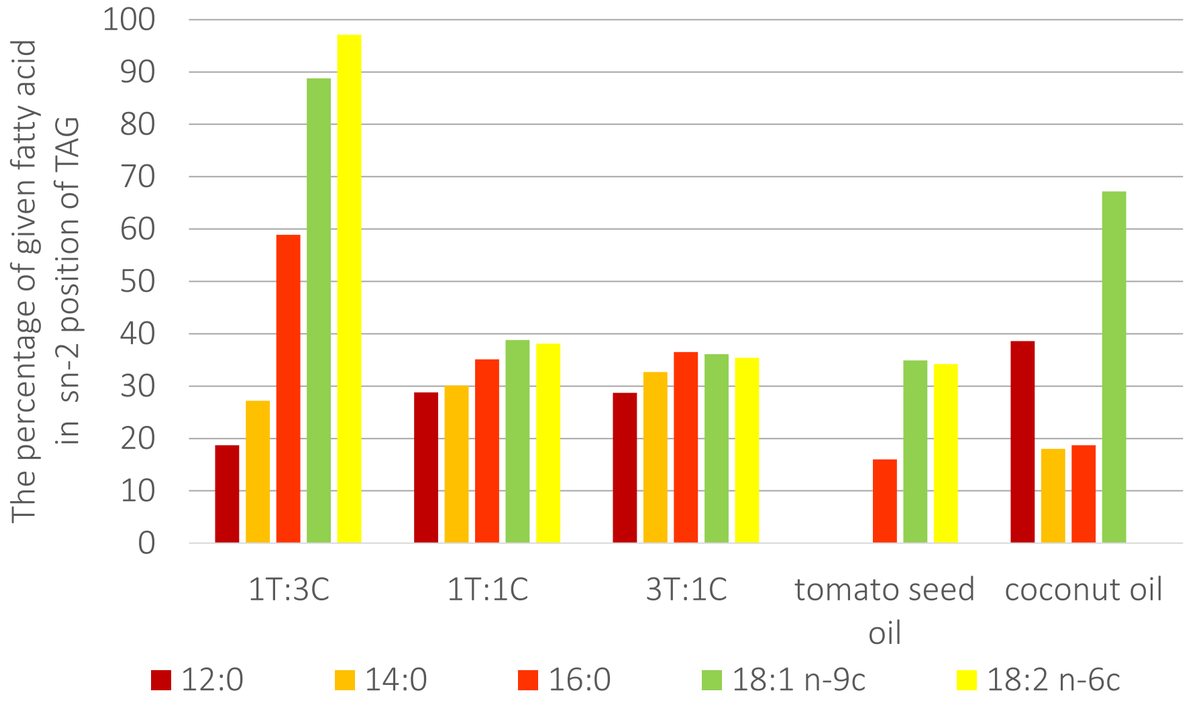


Fig. 4 and 5. Fatty acid composition and distribution in triacyclglycerols (TAG)

PUFA – polyunsaturated fatty acids, MUFA – monounsaturated fatty acids, SFA – saturated fatty acids

WARSAW UNIVERSITY OF LIFE SCIENCES

Conclusions

- The interesterification of mixtures of tomato seed oil and coconut oil has influence over reduction of oxidation induction time. Obtained interesterified mixtures were characterized by lower induction time (8.0-29.5 min) that initial oils.
- The higher the peroxide value, the shorter the oxidation induction time and therefore the lower the oxidative stability of the interesterified samples containing more tomato seed oil.
- Blends esterified at the presence of sodium methoxide were characterized by higher acid values (7.5-12.0 mg KOH/g) than the starting oils.
- The fatty acids that were present in the highest amounts in the mixtures tested were: lauric, myristic, palmitic, oleic and linoleic acids.
- The distribution of fatty acids in the mixtures after interesterification was different from that in the analyzed oils. The essential fatty acids from tomato seed oil were incorporated into triacylglycerol structures of coconut oil after modification.
- Palmitic acid occurs mainly in the internal position of esterified mixtures in contrast to the starting oils in which palmitic acid is present in the external positions of triacylglycerols. This is advantageous in terms of the digestibility of the resulting structured lipids.

WARSAW
UNIVERSITY
OF LIFE SCIENCES

Thank you for your attention!

Research equipment was purchased as part of the "Food and Nutrition Centre - modernisation of the WULS campus to create a Food and Nutrition Research and Development Centre (CŻiŻ)" co-financed by the European Union from the European Regional Development Fund under the Regional Operational Programme of the Mazowieckie Voivodeship for 2014-2020 (Project No. RPMA.01.01.00-14-8276/17).

WARSAW UNIVERSITY OF LIFE SCIENCES