16th Euro Fed Lipid Congress. Fats, Oils and Lipids: Science, Technology and Nutrition in a Changing World; 16-19 September 2018, Belfast, UK

Enhancing the Unsaturated Fat Content and Techno-Functional Properties of Whipped Creams by Designing New Structured Fats – Blends of Rice Bran Wax Oleogel and Butter as Fat Model Systems

Vlad Mureșan[1]*, Sabine Danthine[2], Raul F. Petruț[2], Emil Racolța[1], Sevastița Muste[1], Andruța E. Mureșan[1], Carmen Socaciu[1], Christophe Blecker[2]

[1]Food Engineering Department, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj, Romania
[2]Food Science and Formulation Department, Gembloux Agro-Bio Tech, University of Liege, Gembloux, Belgium
*Contact e-mail: vlad.muresan@usamvcluj.ro

Introduction

The use of vegetable oils in cream formulation presents nutritional advantages (e.g., reduction of cholesterol consumption, high levels of essential fatty acids), while reducing also the raw material costs in comparison to milk fat; however, challenges arise when considering the structure and stability of final product. Consequently, the current work aimed to improve the nutritional and techno-functional properties of recombined whipped creams by designing edible fat model systems (FMSs), containing anhydrous milk fat mixed with various amounts (15%, 30%, 45%) of rice bran wax (RBW) oleogel.

Materials and Methods

The anhydrous milk fat (AMF) was used for obtaining the recombined dairy whipped cream taken as control sample (WC), while the FMS consisting of oleogel (10% rice bran wax in sunflower oil), was used to **obtain the first oleogel whipped cream (WO)**. The ***thermal behavior*** was studied for all bulk FMSs by differential scanning calorimetry (Q1000 DSC, TA Instruments), after maturation at 4°C, 24h. A pNMR spectrometer (MinispecMQ20, Bruker) was used to measure the ***solid fat content (SFC)***. A previously used recipe for recombined whipped cream emulsions was used (6.69% skimmed milk powder, 30% fat and 63.31% water). The milk powder was dissolved in water, each FMSs melted, all ingredients being homogenized 1 min, at 90°C by means of Ultra-Turrax T-45 laboratory homogenizer at 10,000 rpm (circumferential velocity of 20 m s^{-1}). Immediately after production all emulsions were transferred at 4°C and maturated 24h. ***Particle size distribution by laser diffraction*** (Malvern Mastersizer 2000 Malvern Instruments) was assessed for all freshly manufactured emulsions, as well as after maturation. The ***colloidal stability*** of all emulsions was monitored during one week storage at 4°C by a Vertical Scan Macroscopic Analyzer, Turbiscan MA 2000. For all matured ***emulsions thermal analysis*** was performed. The ***flowing behavior*** at 20°C (share rates from 1–1800 s^{-1}) of all emulsions was assessed by an Anton Paar MCR302 Rheometer. For whipped creams production, emulsions (100 mL) at 6°C were poured into vessels, immersed in an ice bath and whipped at 1400 rpm for 2 min with a laboratory stirrer Janke-Kunkel RW20 equipped with a whisk. The ***overrun*** of each whipped sample was determined after production, the ***stability*** being assessed after 24h storage at 4°C. ***Oscillatory rheology*** was used to assesses the new FMSs whipped creams rheological properties.

Designing the studied systems

FAT MODELs

- **C100**: 100% AMF
- **O15:** 15% OG-85% AMF
- **O30:** 30% OG-70% AMF
- **O45:** 45% OG-55% AMF
- **O100**: 100% Oleogel

EMULSIONs

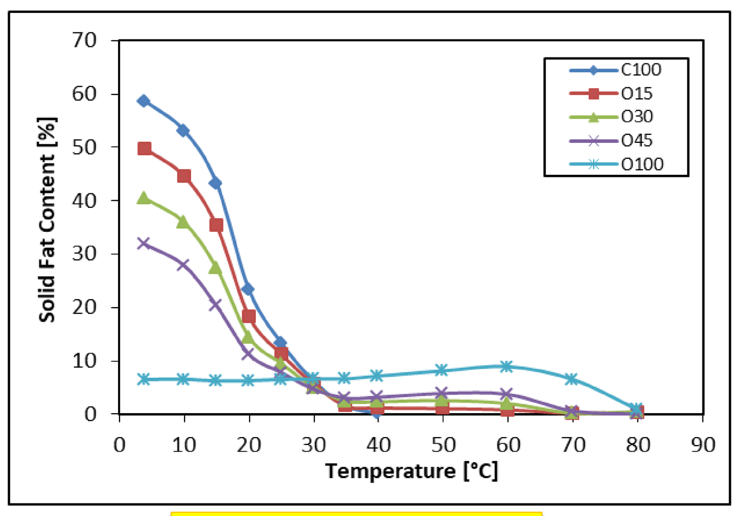
- **EC**
- **E15%**
- **E30%**
- **E45%**
- **EO**

WHIPPED CREAMs

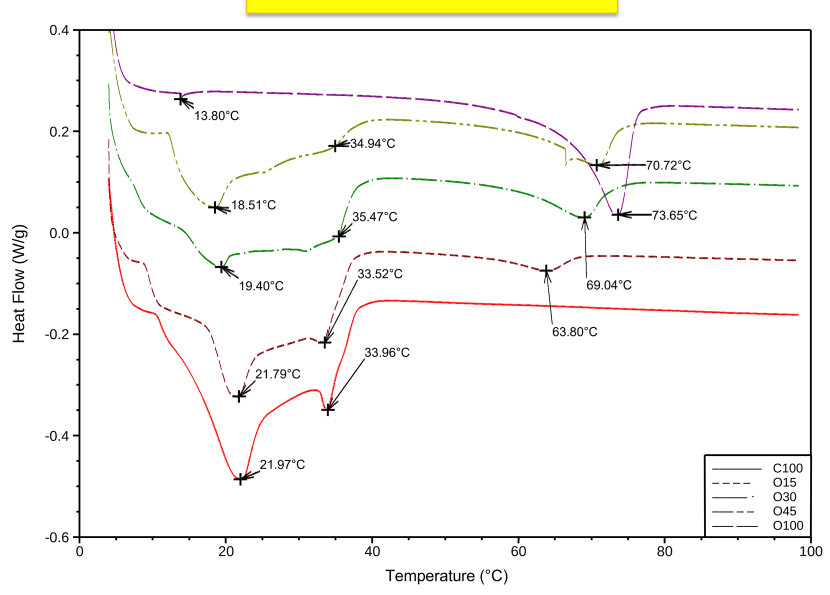
- **WC**
- **W15%**
- **W30%**
- **W45%**
- **WO**

Results

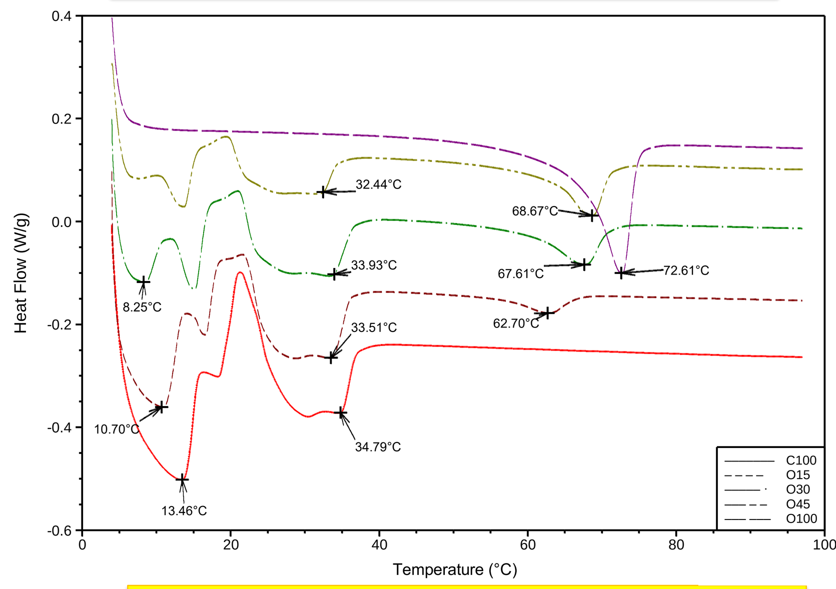
FAT MODELs



Solid Fat Content

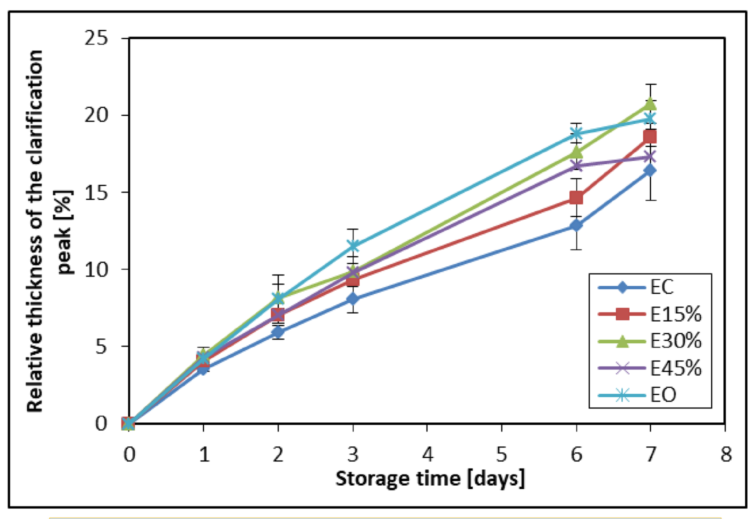


DSC 1st Melting Profiles of Fats

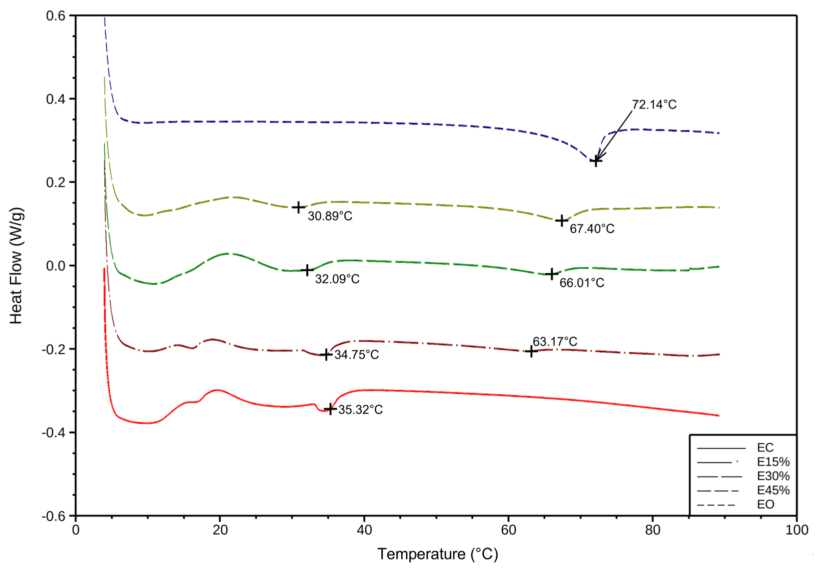


DSC 2nd Melting Profiles of Fats

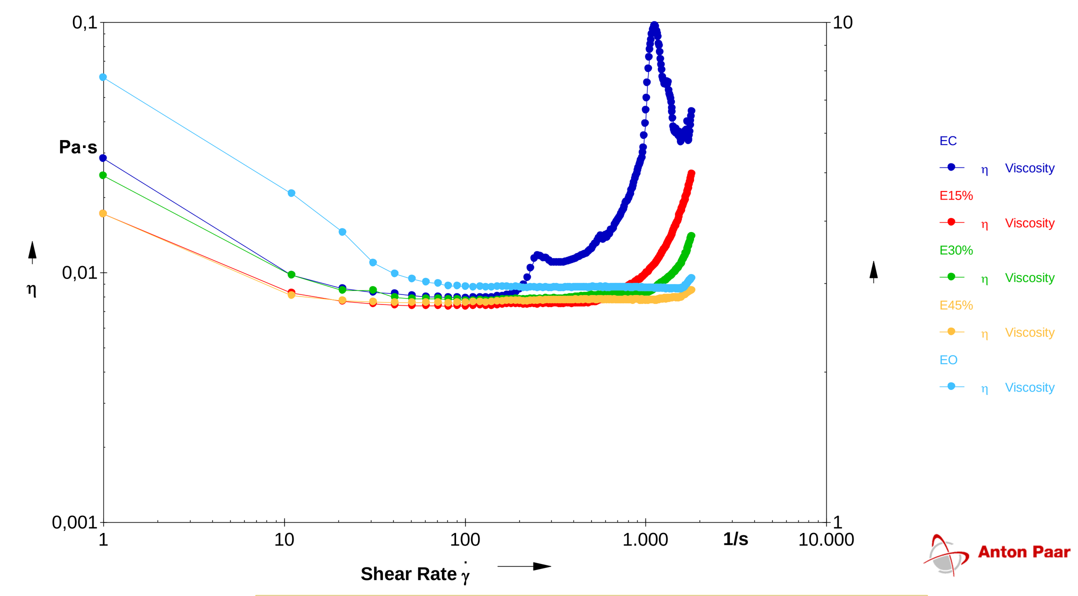
EMULSIONs



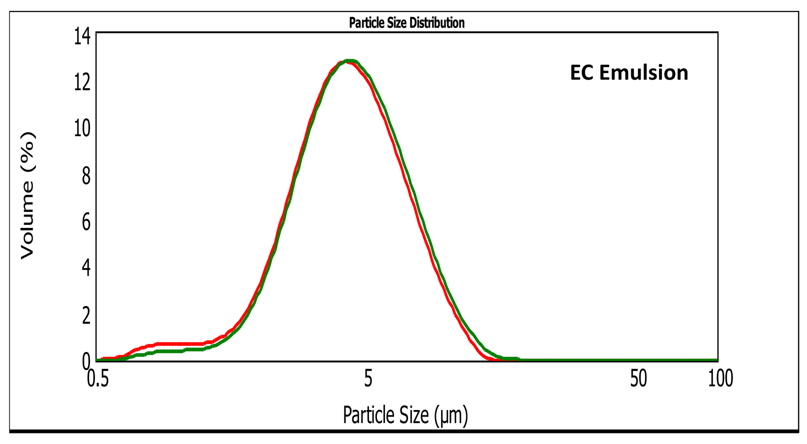
Colloidal Stability of Emulsions

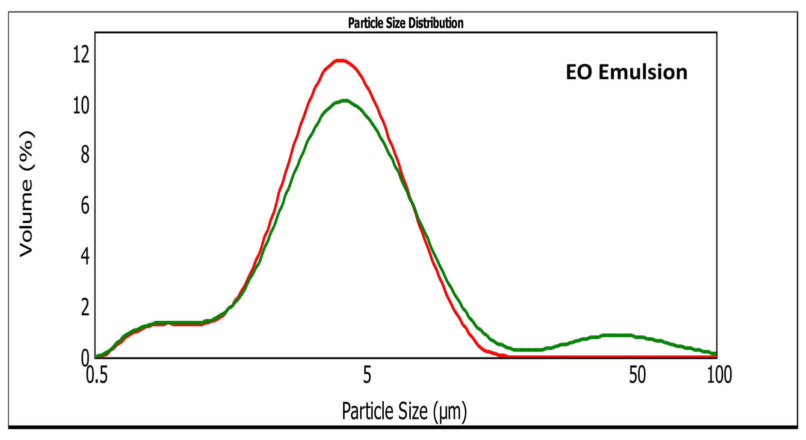


DSC Melting Profiles of Emulsions



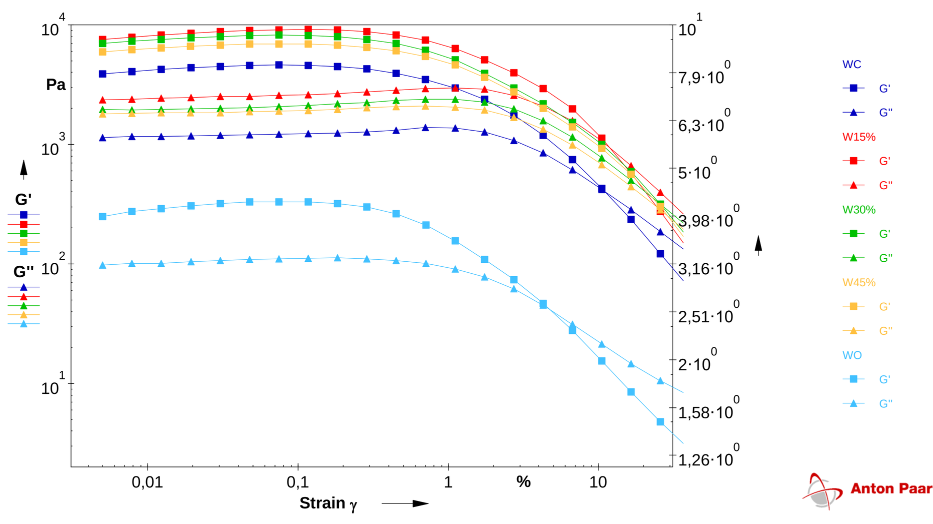
Flow Curves [η] of Emulsions



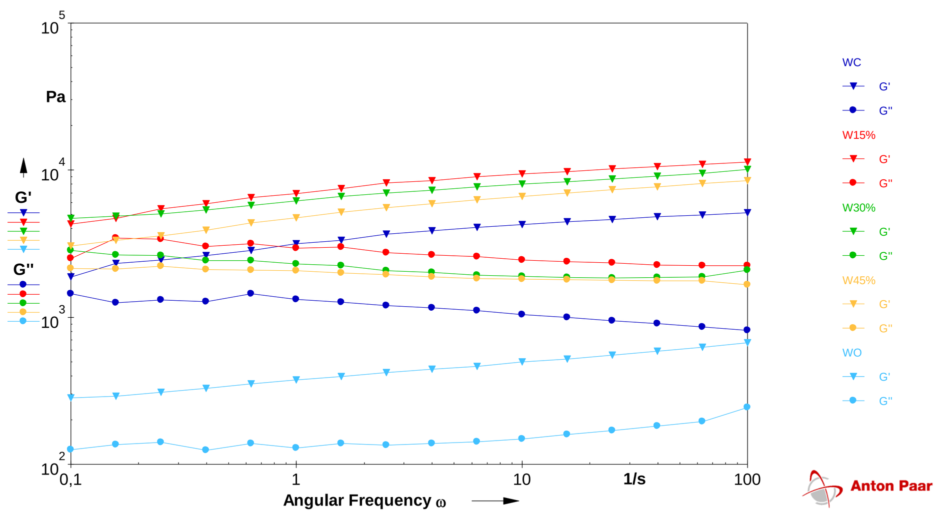


Particle Size Distributions of Emulsions (EC and EO) after Production (red line) and after 24h Maturation at 4°C (green line)

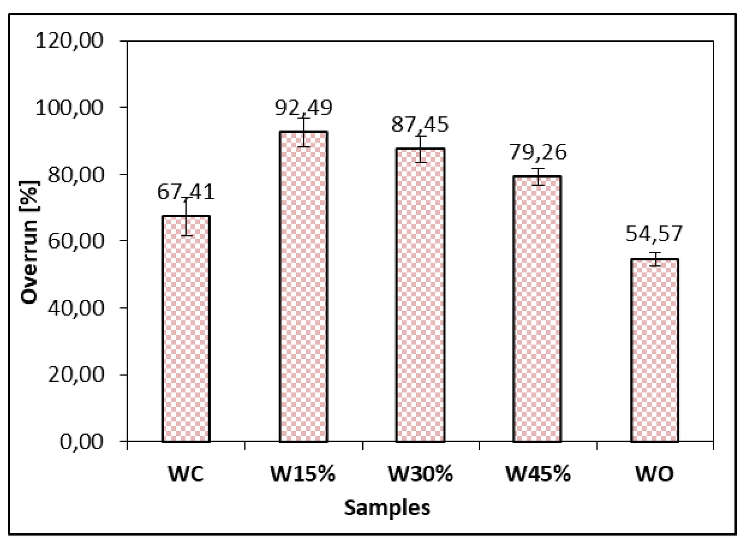
WHIPPED CREAMs



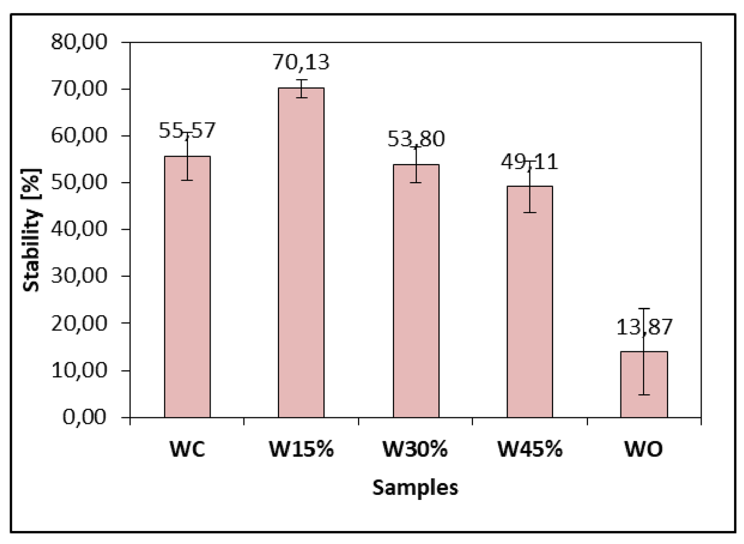
Amplitude Sweep of Whipped Creams



Frequency sweep (G', G'') of Whipped Creams



Whipped Creams Overrun



The Stability of Whipped Creams

Conclusions

The emulsions obtained showed different flowing behavior, partial coalescence occurring for EC at lower shear rates (~200s^{-1}), as compared to E15% (~600s^{-1}); however EO sample showed no increased in viscosity, irrespective of shear rates applied. After one-week storage at 4°C, the emulsions stabilities followed the same trend; however, sample EC showed the lowest clarification peak (16.44%), while E30% the highest value (20.73%). Encouraging results were obtained when emulsions were whipped, the overrun (92.49%) and stability (70.13%) of WC15% being well improved as compared to control sample WC (overrun 67.41%, stability 55.57%), **strengthening the potential of using oleogels in whipped cream production**. However, further increasing to O100, resulted in products (WO) with low overrun (54.57%) and low stability (13.87%).

Acknowledgements. This work was supported by a grant of Ministry of Research and Innovation, CNCS – UEFISCDI Project number PN-III-P1-1.1-PD-2016-0113, within PNCDI III.