Hungarian University of Agriculture and Life Sciences,
Institute of Food Science and Technology
Food technology and product development
Department of Grain and Industrial Plant Processing

Name of student: Valeria Monserrate Romero Delgado
Title of thesis: Developing low-fat oleogels based on Monoacylglycerol and Bees Wax

---

Oleogels are presented as potential healthier alternative in food industry as fat replacement. Oleogel is a solid polymer with a three-dimensional network, in which an oil phase is incorporating and trapped with gelling agents to maintain a stable and spreadable consistency. The goal of this study is to develop low-fat oleogels based on Monoacylglycerol and Bees Wax, and evaluating their effects on spreadability and rheological characteristics of the final product as a fat replacement for using in confectionary and bakery products, comparing their responses based on their gelling agent ratio. Monoacylglycerol-Bees wax (MAG-BW) based oleogels were formulated from High oleic sunflower oil (HOSO) (80%), MAG and BW at three different concentrations (5, 10, 15%). The samples were produced in 150 grams. Three sweep tests were performed to evaluated rheological behaviour in oleogel samples: amplitude, frequency and temperature sweep test. Anton Paar MCR 302 rheometer was employed in order to carry out the rheological measurements. Furthermore, a spreadability test was also applied using a textural analyser TA.XT Plus. Every analysis was repeated three times and the obtained results are presented as means ± the standard deviation. One-way analysis of variance test (ANOVA) and Tukey's method were applied to assess the results at a significance level of $p < 0.05$. And Minitab 19 statistical software was used to perform the statistical analysis. Amplitude sweep test was performed at the strain amplitude of 0.01–1000% and constant frequency of 1 Hz and temperature of 25 °C. Results obtained did not show significant difference between the three samples in the curves plotted, however all of the oleogel samples demonstrated solid viscoelastic behaviour, and MAG:BW based olegel with the ratio 25:75 got the highest result in every of the responses evaluated in amplitude sweep: shear strain and storage modulus at linear viscoelastic range and also in the flow point when storage modulus is equal to loss modulus. This result, could be associated with spreadability result's because, MAG:BW (25:75) got the highest peak in the curve indicating a greater firmness. It means with a higher BW contain, an increase in term of firmness can be gotten. Frequency sweep test was performed at the frequency sweep of 0.628 to 314 rad/s at a constant strain of 0.02% (LVE) and a temperature of 25 °C, results confirmed solid-like response in all of the oleogel samples, storage modulus and loss modulus

values were higher during the increase of frequency in this test. The temperature sweep test was performed in the temperature range of 10 – 80 °C, at a rate of 0.08 °C per minute, at the constant frequency of 1 Hz and a constant strain of 1 %. Thanks to this test we could observed a meaning difference in the oleogel with the highest MAG contain, This oleogel sample (MAG:BW 75:25) presented a significance thermal behavior, storage modulus just started to decrease in a temperature range from 50°C to 60°C because of higher contain of MAG comparing to the other oleogel samples, which decreased at lowest temperatures. Oleogel samples with highest contains of MAG also demostrated good responses in terms of spradability characteristics during the spreadability, evaluating the area under the curve. MAG:BW (50:50) and MAG:BW (75:25) presented nearly values within them but totally apart from MAG:BW (25:75). For this, applying Tukey's method after the one-way analyses of variance in spreadability results a predominant outcome was observed. Highest ratio of MAG improved rheological and spreadabality behaviour, likewise highest ratio of BW pointed out a good response in term of firmness. The incorporation of the both oleogelators selected in HOSO to develop low-fat oleogels, presented prospective results for future researchs in order to optimize them as fat substitutes.