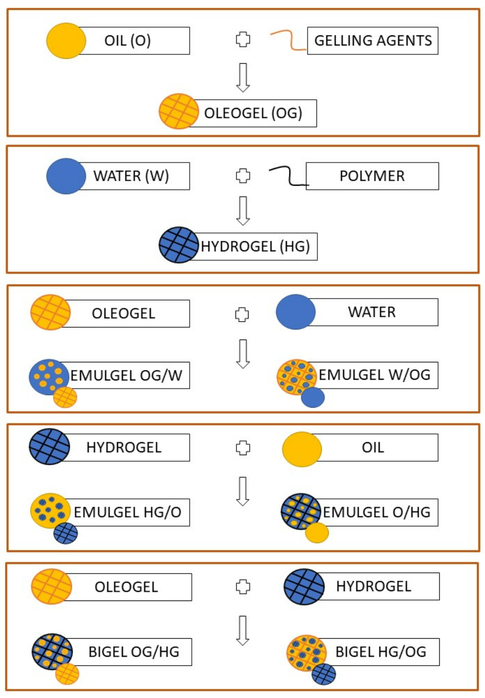
20th Euro Fed Lipid Congress and Expo. From Insight to Impact: Advancing Sustainability in Fats, Oils, and Lipids; 12-15 October 2025, Leipzig, Germany

Fat Substitution in Pastry Products: Techno-functional and Baking Optimization

Anda Elena Tanislav, Andreea Pușcaș, Cristian Szekely, Andruța Mureșan, Vlad Mureșan, Elena Mudura*
University of Agricultural Sciences and Veterinary Medicine of Cluj Napoca, Romania, Food Engineering Department
**Contact e-mail: vlad.muresan@usamvcluj.ro*

INTRODUCTION

!!! World Health Organization, Food and Drug Administration, Commission Regulation (EU) 2019/649



✓Nutritional valuable
✓Functional

MATERIALS & METHODS

- **Oleogel with 7.5% distilled monoglyceride- OG7.5%**
- **Oleogel with 10% distilled monoglyceride- OG10%**

->Texture profile analysis, Rheological determination, Oil binding capacity, FTIR, Polarized light microscopy

- **Dough with refined sunflower oil- D_RSO**
- **Dough with oleogel from sunflower oil and 7.5% distilled monoglyceride- D_OG7.5%**
- **Dough with oleogel from sunflower oil and 10% distilled monoglyceride- D_OG10%**
- **Dough with butter (82% fat)- D_BT**

->Texture profile analysis, Rheological determination, Water loss

- **Tart shells with refined sunflower oil- T_RSO**
- **Tart shells with oleogel from sunflower oil and 7.5% distilled monoglyceride- T_OG7.5%**
- **Tart shells with oleogel from sunflower oil and 10% distilled monoglyceride- T_OG10%**
- **Tart shells with butter (82% fat)- T_BT**

->Texture analysis

- **Protocol (Design expert software): baking time [minutes], baking temperature [℃], humidity [%]- 18 samples**

->Response surface , ANOVA

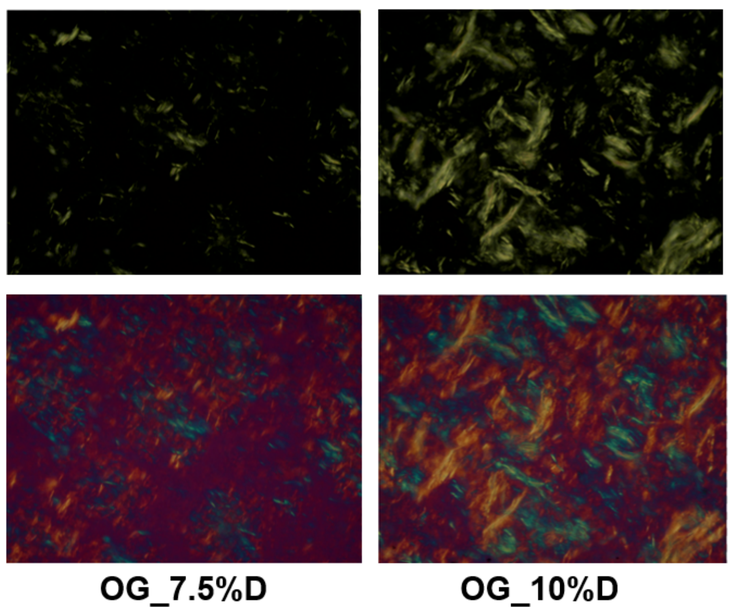
Run	Factor 1 Baking time [minutes]	Factor 2 Baking temperature [℃]	Factor 3 Baking humidity [%]
1	145	15	0
2	145	15	10
3	150	10	0
4	150	10	10
5	150	18	0
6	150	18	10
7	165	8	0
8	165	8	10
9	165	15	0
10	165	15	10
11	165	20	0
12	165	20	10
13	180	10	0
14	180	10	10
15	180	18	0
16	180	18	10
17	185	15	0
18	185	15	10

ACKNOWLEDGEMENT

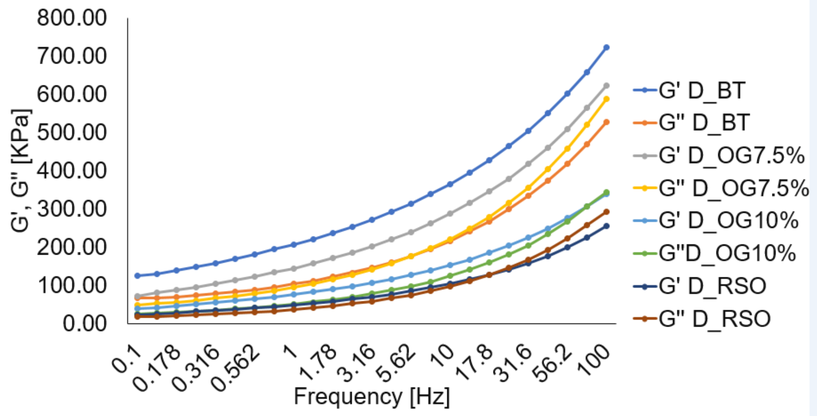
This work was supported by a grant from the Romanian Ministry of Research, Innovation and Digitization CNCS/CCCDI—UEFISCDI, project number PN-IV-P2-2.1-TE-2023-1206 within PNCDI IV.

RESULTS

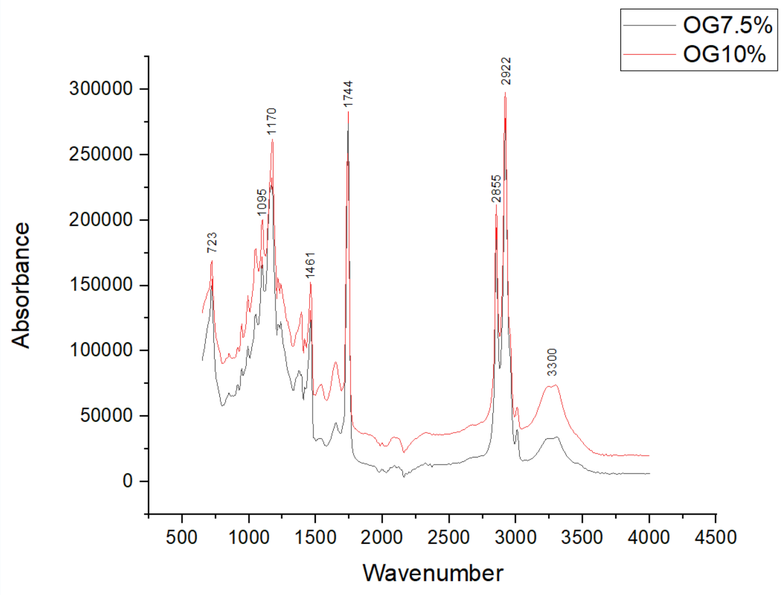
POLARIZED LIGHT MICROSCOPY OF OLEOGELS, 10x



RHEOLOGICAL BEHAVIOR OF DOUGH SAMPLES



OLEOGELS FTIR SPECTRA

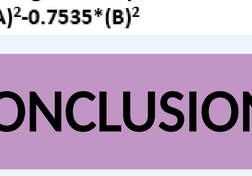


TEXTURE PROFILE OF DOUGH SAMPLES

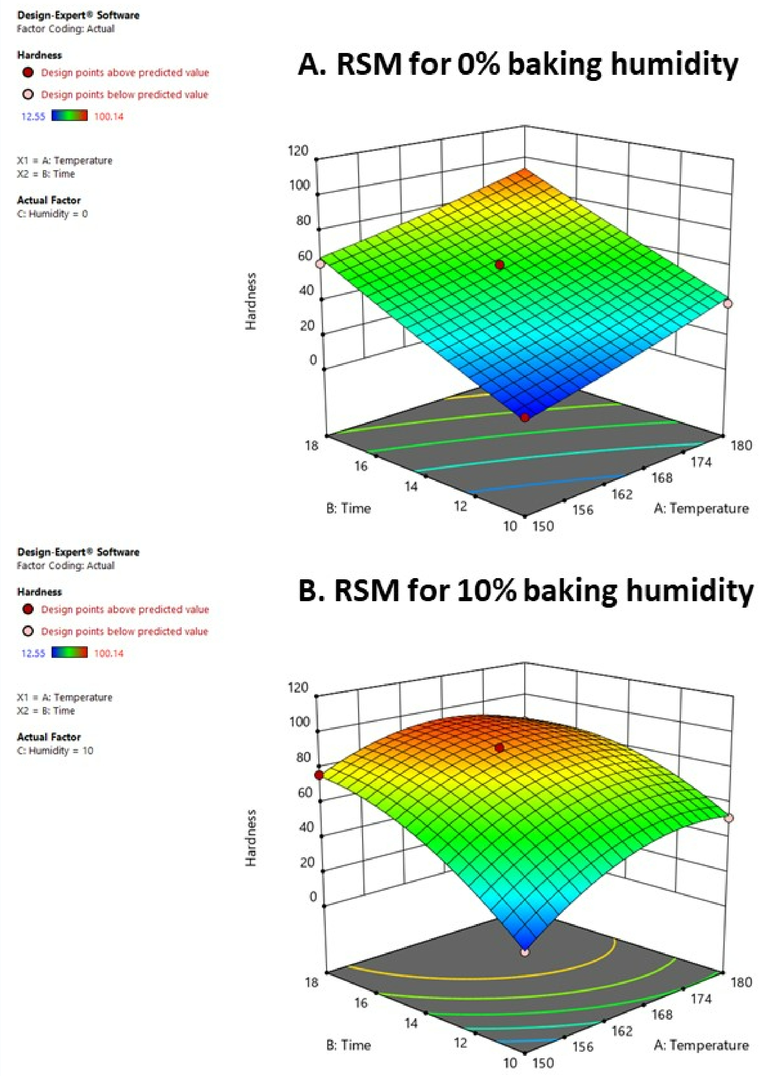
	D_RSO	D_OG7.5%	D_OG10%	D_BT
Texture profile analysis				
Hardness [N]	$33.16^{B}\pm1.76$	$37.16^{A}\pm1.34$	$32.33^{B}\pm0.60$	$23.51^{C}\pm1.78$
Adhesiveness [mJ]	$7.53^{B}\pm1.29$	$7.07^{B}\pm1.07$	$8.83^{B}\pm0.95$	$15.57^{A}\pm3.55$
Resilience [-]	$0.01^{A}\pm0.00$	$0.01^{A}\pm0.00$	$0.01^{A}\pm0.00$	$0.02^{A}\pm0.01$
Cohesiveness [-]	$0.13^{C}\pm0.01$	$0.12^{C}\pm0.00$	$0.17^{B}\pm0.01$	$0.23^{A}\pm0.02$
Springess index [-]	$0.12^{B}\pm0.02$	$0.09^{B}\pm0.01$	$0.13^{B}\pm0.01$	$0.26^{A}\pm0.02$

TEXTURE PROFILE OF TART SHELLS

	T_RSO	T_OG7.5%	T_OG10%	T_BT
Texture analysis				
Hardness[N]	$33.02^{C}\pm0.84$	$67.65^{A}\pm1.80$	$55.85^{B}\pm3.74$	$37.14^{C}\pm0.34$



THE EFFECT OF FACTORS ON THE HARDNESS OF THE TART SHELLS TROUGH RESPONSE SURFACE METHODOLOGY



THE INFLUENCE OF FACTORS AND THEIR INTERACTIONS ON HARDNESS OF THE TART SHELLS- ANOVA

Model	Sum of Squares	p-value
A-Temperature	2671.85	< 0.0001
B-Time	10503.10	< 0.0001
C-Humidity	2402.51	< 0.0001
AB	136.46	0.0397
AC	36.32	0.2615
BC	43.31	0.2221
A^2	491.47	0.0007
B^2	475.98	0.0008
ABC	92.83	0.0824
A^2C	709.76	0.0001
B^2C	650.83	0.0002

Final Equation in Terms of Actual Factors

1. Hardness for 0% Baking humidity= -64.2333-0.7564*A+6.9115*B-0.0118*(A*B)+0.0058*$(A)^2$+0.0588*$(B)^2$

2. Hardness for 10% Baking humidity= -2296.1442+23.5386*A+47.3265*B-0.1238*(A*B)-0.0636*$(A)^2$-0.7535*$(B)^2$

CONCLUSIONS

Oleogel with 7.5% distilled monoglyceride presented ↓ **hardness** and significantly ↓ **adhesiveness** compared to butter -> potential applicability in confectionery products, due to **easy handling and processing.**

Elastic behavior of the oleogels, with ↑ values of the elastic modulus -> reflects a well-organized three-dimensional network, giving the product increased **structural stability** and **improved resistance to deformation**.

Harder tart shells obtained with oleogels -> three-dimensional network formed by the oleogels that contributed to **improved mechanical cohesion**, essential for maintaining the **structural integrity** of the finished product.

The results indicate that **temperature, time, and humidity significantly influence** the hardness, with higher values obtained at increased temperature and time, particularly under higher humidity conditions.