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Designing of bigels as fat alternatives in confectionery products

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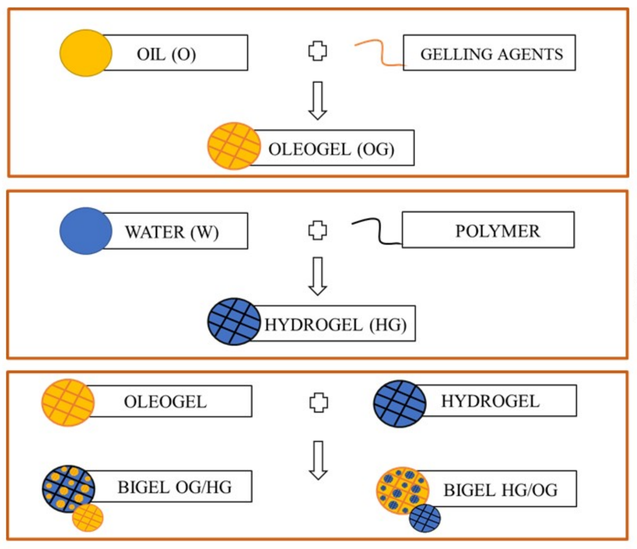
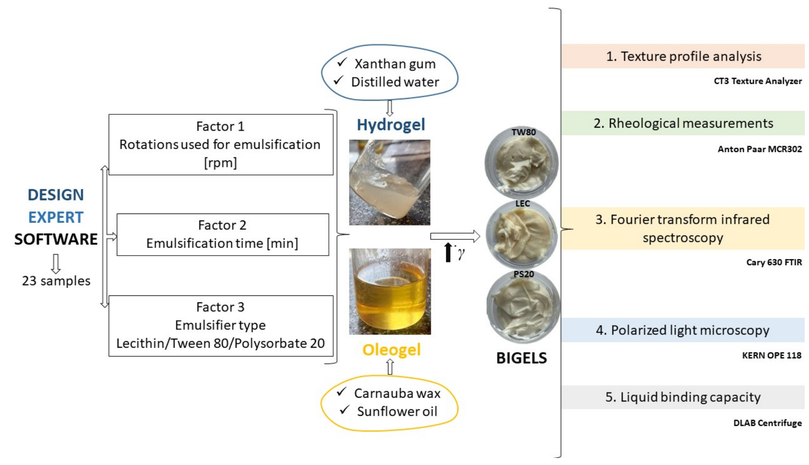
INTRODUCTION



Bigels have a structured internal and external phases and combine the advantages of oleogel and hydrogel.
The significant advantages of bigels are their improved stability while an important property is their non-thermoreversibility.

MATERIALS & METHODS



To determine the potential application, the samples were subjected to mechanical grinding for 10 minutes to simulate the mixing process with the ingredients necessary to obtain a confectionery product and the results were intercorrelated with the textural analysis results.

Block	Run	Factor 1 Emulsification [rpm]	Factor 2 Emulsification time [minutes]	Factor 3 Emulsifier type
Day 1	1	10 000	5	Polysorbate 20
Day 1	2	12 500	10	Tween 80
Day 1	3	15 000	7.5	Polysorbate 20
Day 1	4	10 000	7.5	Polysorbate 20
Day 1	5	15 000	7.5	Polysorbate 20
Day 1	6	12 500	10	Tween 80
Day 1	7	15 000	5	Lecithin
Day 1	8	15 000	10	Lecithin
Day 1	9	10 000	10	Lecithin
Day 1	10	12 500	5	Tween 80
Day 1	11	10 000	5	Lecithin
Day 2	12	15 000	7.5	Tween 80
Day 2	13	10 000	7.5	Tween 80
Day 2	14	12 500	7.5	Polysorbate 20
Day 2	15	12 500	10	Polysorbate 20
Day 2	16	10 000	7.5	Lecithin
Day 2	17	12 500	7.5	Lecithin
Day 2	18	12 500	5	Lecithin
Day 2	19	12 500	5	Polysorbate 20
Day 2	20	12 500	10	Polysorbate 20
Day 2	21	10 000	5	Tween 80
Day 2	22	15 000	7.5	Tween 80
Day 2	23	12 500	7.5	Lecithin

CONCLUSIONS

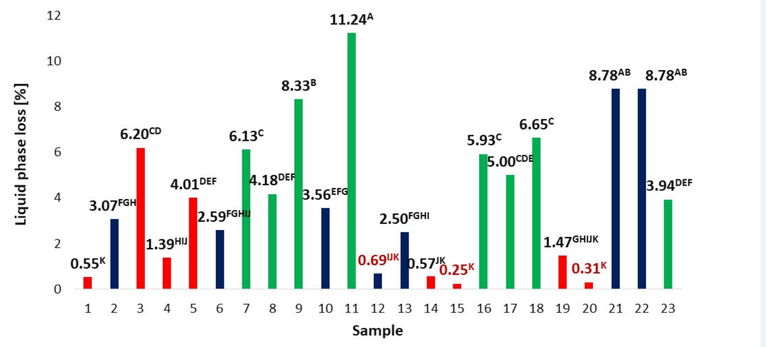
Bigels can present the **functionality** of solid fats, but with a significantly reduced content of trans and saturated fatty acids.
The **emulsification time**, **rotations** and the **type of emulsifier** used significantly influence the hardness.
Following the determinations and the **correlation** of the results of the **stability** after mechanical grinding and the **textural parameters**, sample 3 with Polysorbate 20 and sample 22 with Tween 80 were included into the study regarding the application in the food industry for the production of a cocoa cream (80% bigel, 10% powdered sugar and 10% cocoa powder).
In addition to satisfying the need for unsaturated fatty acids enrichment of food, the addition of bigels to food matrices allow the production of **low-caloric** confectionery products.

RESULTS

TEXTURE PROFILE ANALYSIS

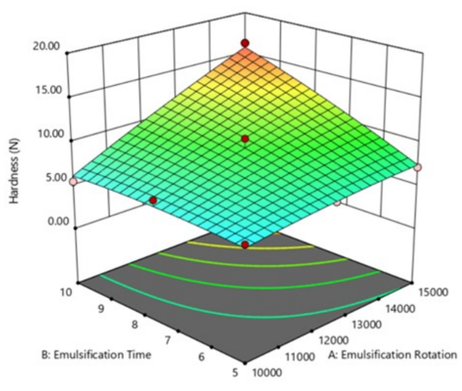
Sample	Hardness [N]
1	$2.45^{H}\pm0.12$
2	$2.43^{H}\pm0.10$
3	$2.99^{GH}\pm0.36$
4	$2.78^{GH}\pm0.11$
5	$3.25^{GH}\pm0.51$
6	$2.59^{GH}\pm0.08$
7	$7.18^{CD}\pm0.55$
8	$\mathbf{16.28^{A}\pm1.58}$
9	$5.51^{DEF}\pm0.95$
10	$2.80^{GH}\pm0.59$
11	$6.12^{CDE}\pm0.30$
12	$2.57^{GH}\pm0.38$
13	$3.16^{GH}\pm0.50$
14	$3.52^{GH}\pm0.49$
15	$\mathbf{4.01^{FGH}\pm0.40}$
16	$6.99^{CD}\pm1.07$
17	$7.72^{C}\pm0.42$
18	$6.81^{CD}\pm0.29$
19	$3.50^{GH}\pm0.47$
20	$3.91^{FGH}\pm0.64$
21	$2.77^{GH}\pm0.45$
22	$\mathbf{4.38^{EFG}\pm0.55}$
23	$10.47^{B}\pm0.81$

LIQUID BINDING CAPACITY- EXPRESSED AS LIQUID PHASE LOSS AFTER CENTRIFUGATION AND DRAINAGE

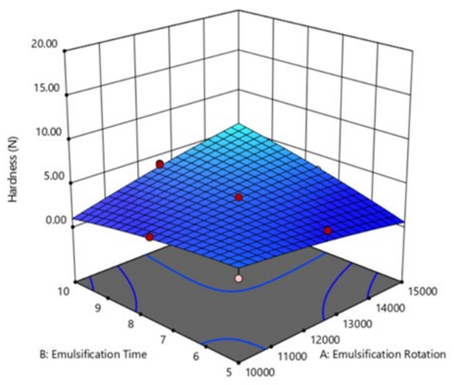


THE EFFECT OF EMULSIFICATION TIME AND ROTATIONS ON THE HARDNESS OF THE BIGELS

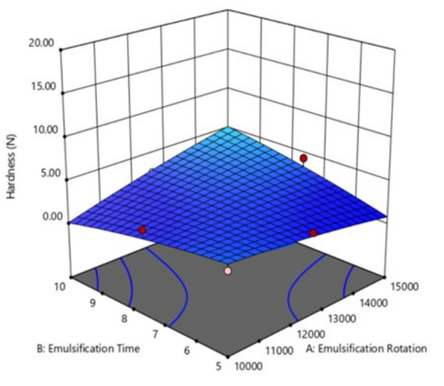
Bigels with Lecithin



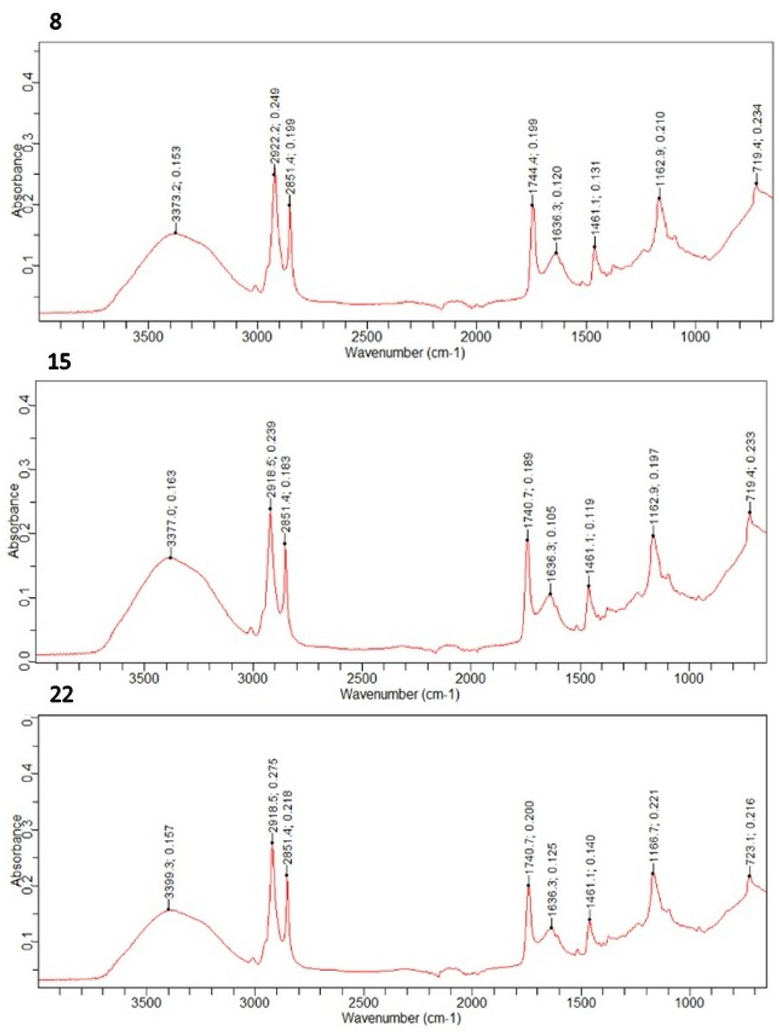
Bigels with Polysorbate 20



Bigels with Tween 80



FTIR SPECTRA FOR SAMPLE 8, 15 AND 22



FREQUENCY SWEEP TEST

Sample	Storage modulus G'	Loss modulus G''
1	$8465.17^{IJ}\pm479.13$	$1061.94^{JK}\pm69.64$
2	$11412.00^{GHI}\pm467.72$	$1396.57^{GHIJK}\pm33.04$
3	$24268.67^{AB}\pm1215.31$	$2480.37^{AB}\pm182.38$
4	$16484.33^{EF}\pm798.10$	$1891.23^{DEF}\pm126.07$
5	$20750.33^{CD}\pm1655.62$	$2355.33^{BC}\pm107.02$
6	$11130.67^{HI}\pm444.72$	$1455.43^{FGHIJ}\pm96.46$
7	$10959.00^{HIJ}\pm633.22$	$1463.40^{FGHIJ}\pm92.00$
8	$23088.33^{BC}\pm522.58$	$2348.60^{BC}\pm280.19$
9	$16936.00^{EF}\pm997.70$	$1767.60^{DEFG}\pm139.65$
10	$10108.03^{IJ}\pm200.36$	$1204.50^{HIJK}\pm69.55$
11	$14427.67^{FG}\pm100.96$	$1642.23^{EFGH}\pm23.11$
12	$16150.00^{EF}\pm2533.39$	$1816.20^{DEFG}\pm382.16$
13	$\mathbf{7736.80^{J}\pm332.19}$	$\mathbf{952.05^{K}\pm8.41}$
14	$18501.33^{DE}\pm37.61$	$2062.60^{BCDE}\pm130.11$
15	$23026.33^{BC}\pm204.65$	$2423.47^{BC}\pm119.35$
16	$14208.67^{FGH}\pm1175.85$	$1516.80^{FGHI}\pm93.62$
17	$18367.67^{DE}\pm965.08$	$2012.73^{CDE}\pm95.83$
18	$14724.67^{F}\pm150.40$	$1769.53^{DEFG}\pm7.50$
19	$8351.40^{IJ}\pm675.30$	$1000.48^{K}\pm20.08$
20	$\mathbf{27141.00^{A}\pm2612.08}$	$\mathbf{2906.83^{A}\pm258.25}$
21	$8419.30^{IJ}\pm890.92$	$1116.41^{IJK}\pm110.09$
22	$14810.67^{F}\pm695.27$	$1715.43^{EFG}\pm78.60$
23	$14810.67^{F}\pm695.27$	$2210.27^{BCD}\pm45.75$

NUTRITIONAL COMPARISON BETWEEN CONVENTIONAL COMMERCIALLY AVAILABLE AND BIGEL BASED COCOA-CREAMS