FACULTY OF BIOSCIENCE ENGINEERING

EFFECT OF TEMPERATURE DURING PRODUCTION AND STORAGE OF MONOGLYCERIDE OLEOGELS

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Introduction

Saturated fatty acids (SAFA) are widely used as an ingredient in fat-rich products and formulated foods because of their structuring and organoleptic properties. However, their intake needs to be limited from a nutritional perspective. Therefore, alternative approaches for oil structuring are necessary to produce a solid-like fat with a reduced saturated fat content (Fig. 1). This research investigates the effect of temperature during production and storage of two MAG-based oleogels.

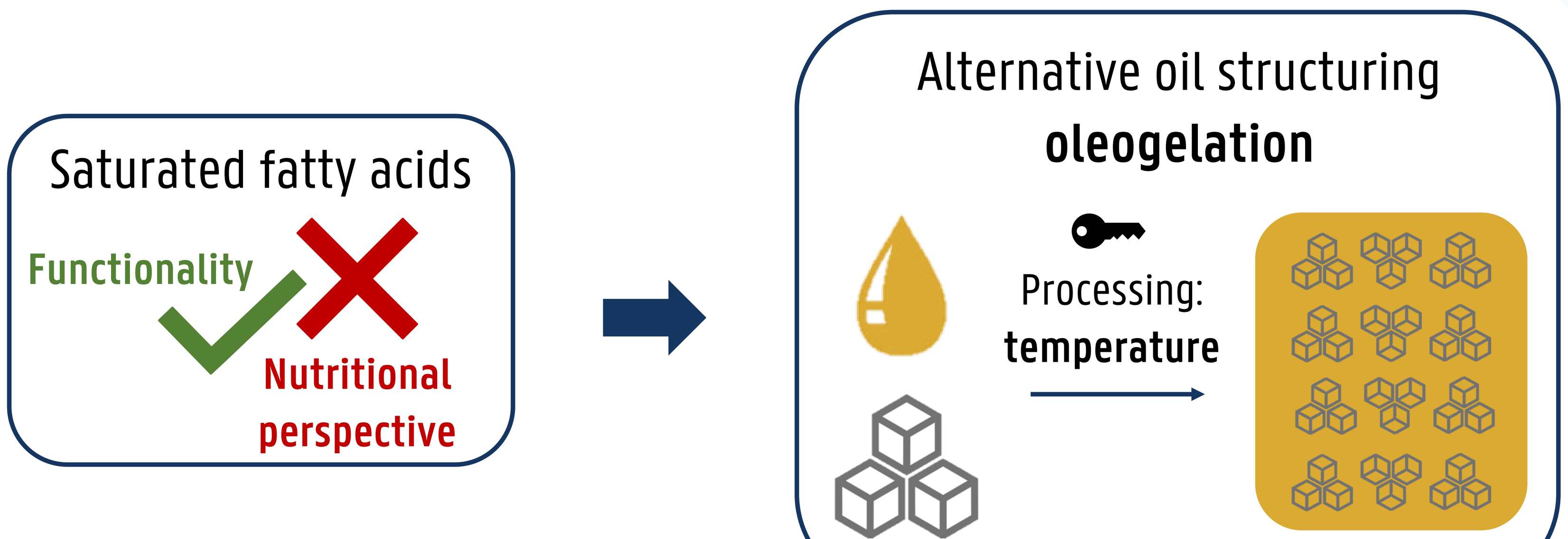


Fig. 1 Problem statement

Experimental setup

Follow-up study of two dynamically crystallized MAG-based oleogels

Samples
- 6% MAG hardstock (purity of 97.3%; 90.5% C18:0) in rapeseed oil
- M01 was produced with a lower cooling rate compared to M02
- Stored at 5, 15 and 20°C for a total time of 8 weeks

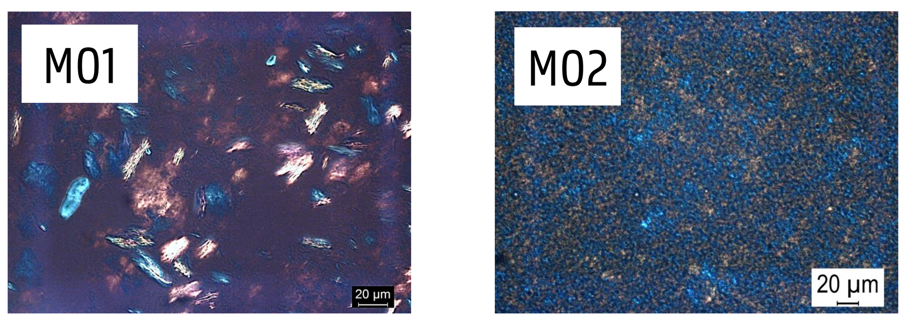
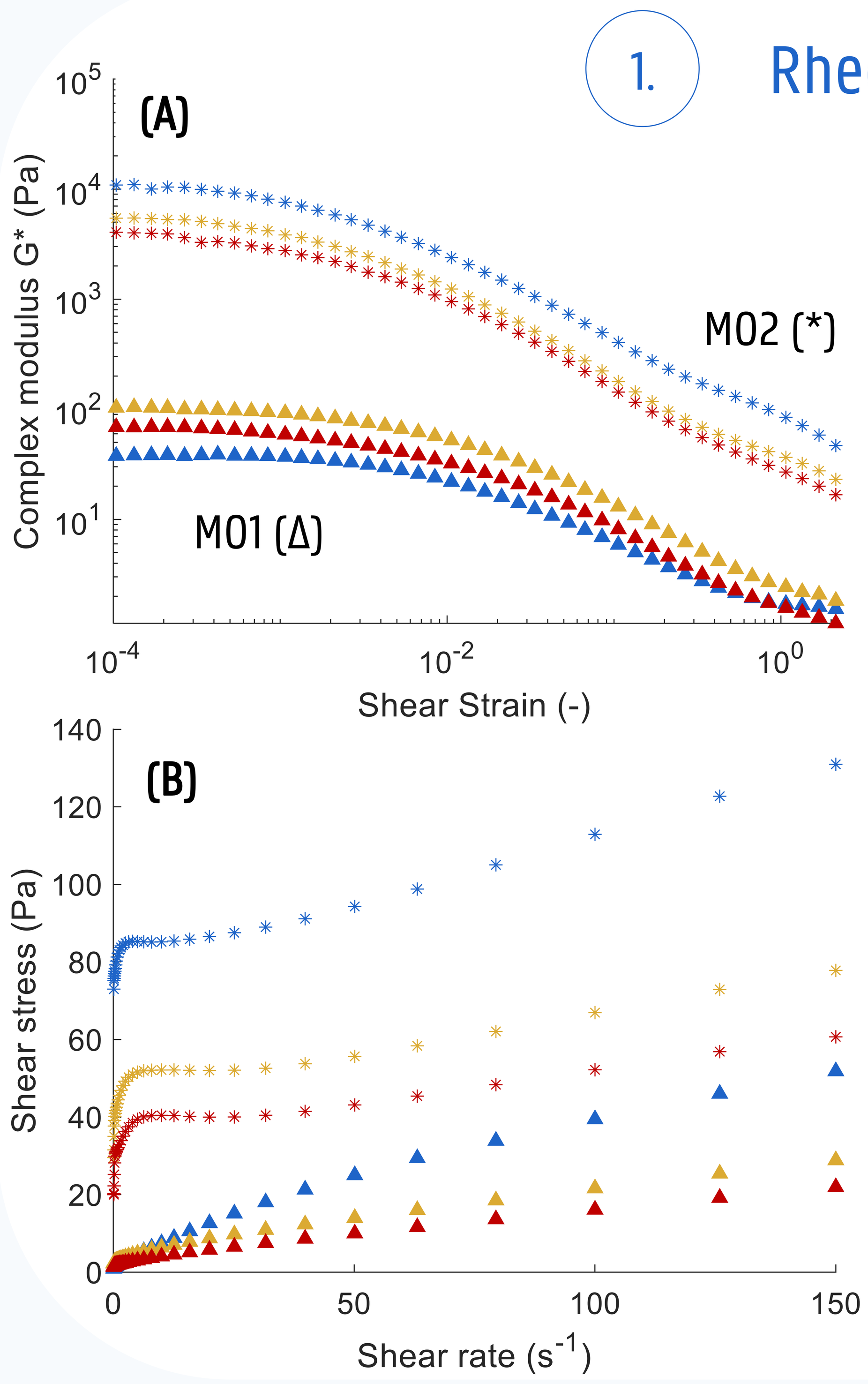


Fig. 2 PLM of the two MAG-based oleogels stored at 20°C for 8 weeks. Scale bar is 20 µm.

Methods
- M01 and M02 were analyzed after 1 week, 4 weeks and 8 weeks of storage with polarized light microscopy (PLM), amplitude sweep, flow measurements and oil binding capacity test

Results

1. Rheology



M01 and M02 had a gel-like structure where the rigidity (G*, shown in Fig. 3A) and yield stress (Table 1) were higher for M02 compared to M01. The flow curves of M02 showed an overshoot after which the sample starts to flow while M01 showed a traditional shear thinning behavior (Fig. 3B).

Fig. 3 (A) Complex modulus (G*) as function of the shear strain and (B) flow curves after 8 weeks of storage at 5°C (blue), 15°C (yellow) and 20°C (red).

	Yield stress (Pa)	
	M01	M02
5°C	0.07 ± 0.03 [a,A]	2.2 ± 0.6 [b,A]
15°C	0.12 ± 0.03 [a,A]	1.2 ± 0.2 [b,A,B]
20°C	0.07 ± 0.02 [a,A]	0.9 ± 0.2 [b,B]

Table 1 Yield stress obtained from the amplitude sweep of M01 and M02 after 8 weeks of storage at 5, 15 and 20°C. Significant differences (α=0.05) are indicated with letters a-b for differences between M01 and M02 and with letters A-B for differences between the storage temperatures.

2. Oil binding capacity

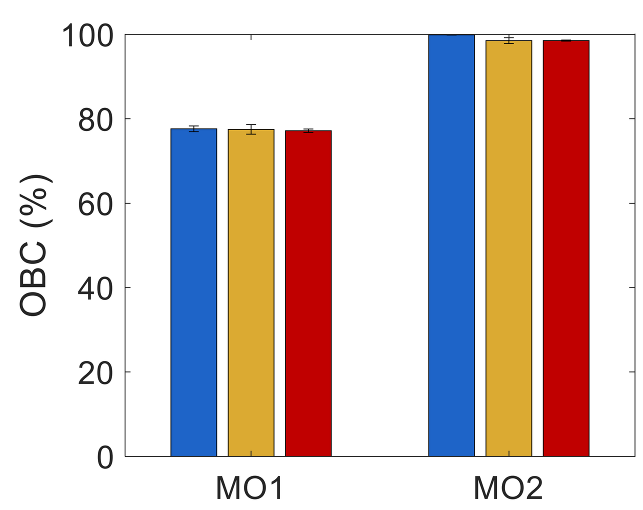


Fig. 4 Oil binding capacity after 8 weeks of storage at 5°C (blue), 15°C (yellow) and 20°C (red).

An important stability characteristic of oleogels is the ability to hold the high amount of liquid oil inside its fat crystal network. Hereby, the oil binding capacity was significantly higher for M02 (highest when stored at 5°C) compared to M01 after a storage time of 8 weeks (Fig. 4). There were no significant differences between the three storage temperatures for M01.

Conclusion

This research clearly illustrates the effect of temperature during the production of monoglyceride oleogels. The lower cooling rate during the production of M01 resulted in a weak oleogel with large crystals and a lower oil binding capacity compared to M02. The effect of storage temperature was less pronounced.

Acknowledgements

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