IOCG 2025 Conference

The 1st International Online Conference on Gels

03–05 December 2025 | Online

MDPI

# Structural, Textural, and Rheological Attributes of Emulgels for Cocoa Butter Replacement

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## INTRODUCTION & AIM

Cocoa butter is the main saturated fat in chocolate that contributes to the sensory characteristics, texture, crystallization, thermal qualities, and rheological properties [2]. Due to its fatty composition, high production costs, sustainability concerns, and health issues, a search for alternatives to partially replace this fat in chocolate has been initiated [1]. Previous studies have shown that gels enhance the physical and functional properties in the confectionery industry, as in chocolate [2]. Understanding the rheological and textural characteristics of cocoa butter is essential to ensure the stability and quality of the final product. This research aimed to evaluate the structural, rheological, and textural attributes of emulgels for partial cocoa butter substitution in chocolate production.

## METHOD

**Table 1.** Emulsion formulations with hydrocolloid solution and oleogel (8:2 w/w)

| Treatment | Rice Bran Wax (g) | Monoglycerides (g) | Pectin (g) | Gelatin (g) | Xanthan Gum (g) |
|---|---|---|---|---|---|
| RB6MG1 | 4.8 | 0.8 | 0 | 0 | 0 |
| RB6MG1-G1 | 4.8 | 0.8 | 0 | 0.2 | 0 |
| RB6MG1-P1 | 4.8 | 0.8 | 0.2 | 0 | 0 |
| RB6MG1-X1 | 4.8 | 0.8 | 0 | 0 | 0.2 |
| RB4MG3 | 3.2 | 2.4 | 0 | 0 | 0 |
| RB4MG3-G2 | 3.2 | 2.4 | 0 | 0.4 | 0 |
| RB4MG3-P2 | 3.2 | 2.4 | 0.4 | 0 | 0 |
| RB4MG3-X2 | 3.2 | 2.4 | 0 | 0 | 0.4 |
| RB2MG5 | 1.6 | 4 | 0 | 0 | 0 |
| RB2MG5-G3 | 1.6 | 4 | 0 | 0.6 | 0 |
| RB2MG5-P3 | 1.6 | 4 | 0.6 | 0 | 0 |
| RB2MG5-X3 | 1.6 | 4 | 0 | 0 | 0.6 |

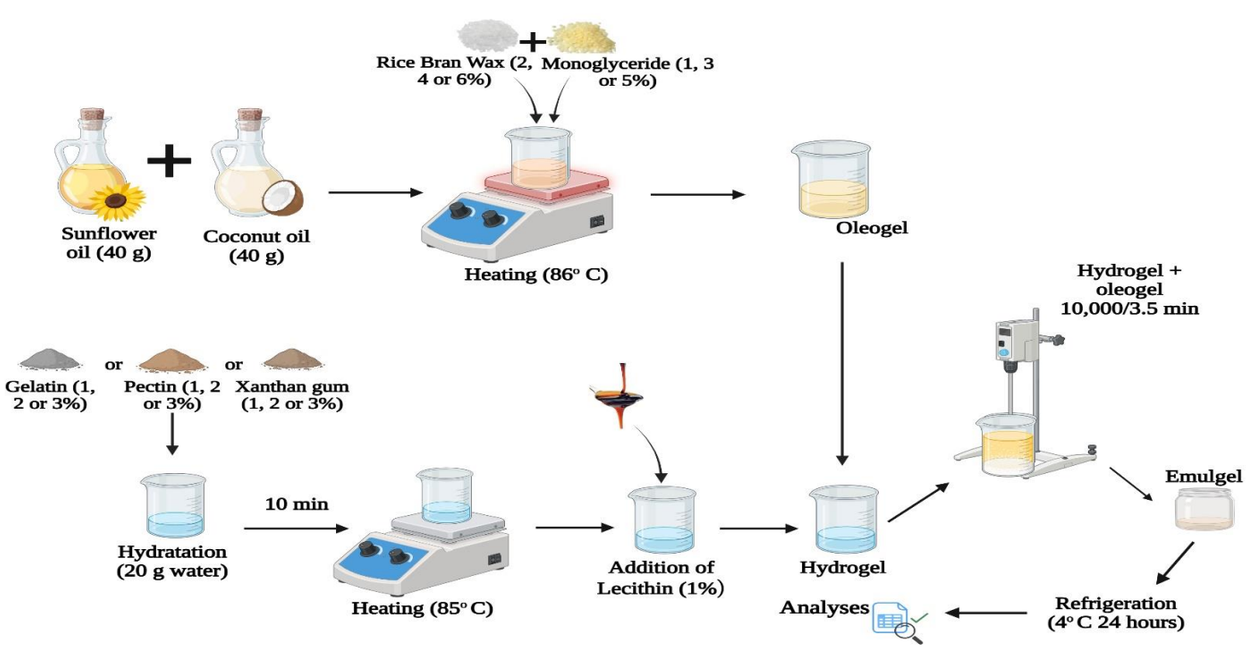
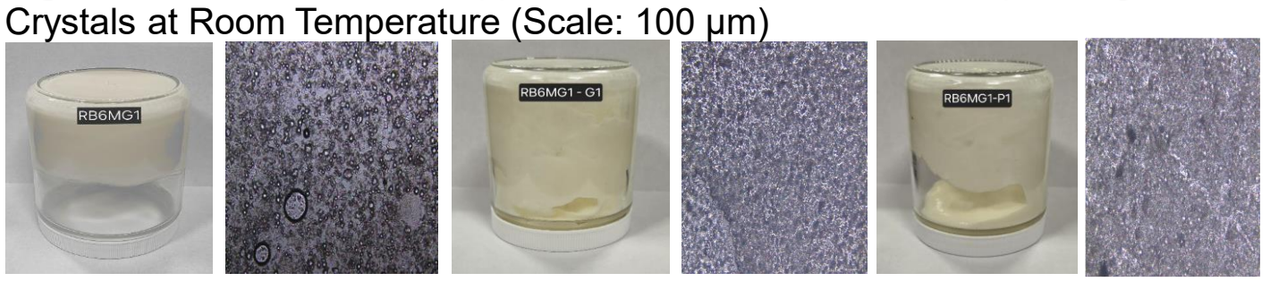



**Figure 1.** Methodology for the emulsions preparation

## RESULTS & DISCUSSION

**Figure 2.** Emulsions Visual Appearance and Optical Microscope Images of Crystals at Room Temperature (Scale: 100 µm)




## RESULTS & DISCUSSION




**Graph 1.** Textural properties of emulsions at different ratios

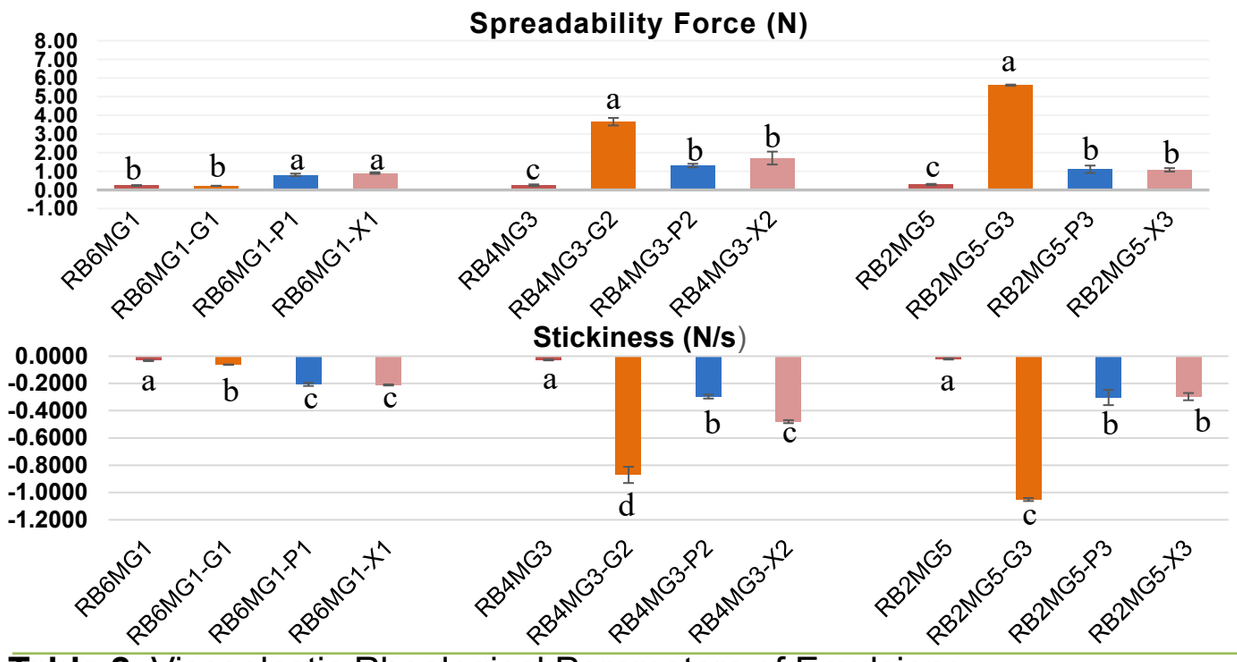



**Table 2.** Viscoelastic Rheological Parameters of Emulsions

| Treatment | G'(kPa) | G"(kPa) | Tan δ (G"/G') |
|---|---|---|---|
| RB6MG1 | 0.49 ± 0.11$^{c}$ | 0.16 ± 0.03$^{c}$ | 0.326 |
| RB6MG1-G1 | 4.89 ± 0.39$^{a}$ | 1.37 ± 0.11$^{a}$ | 0.280 |
| RB6MG1-P1 | 2.23 ± 0.46$^{b}$ | 0.85 ± 0.13$^{b}$ | 0.381 |
| RB6MG1-X1 | 2.72 ± 0.34$^{b}$ | 0.92 ± 0.07$^{b}$ | 0.338 |
| RB4MG3 | 1.62 ± 0.04$^{b}$ | 0.36 ± 0.01$^{c}$ | 0.222 |
| RB4MG3-G2 | 3.36 ± 0.08$^{a}$ | 0.86 ± 0.00$^{b}$ | 0.255 |
| RB4MG3-P2 | 1.46 ± 0.01$^{b}$ | 0.45 ± 0.00$^{c}$ | 0.308 |
| RB4MG3-X2 | 4.03 ± 0.55$^{a}$ | 1.26 ± 0.17$^{a}$ | 0.312 |
| RB2MG5 | 3.86 ± 0.10$^{b}$ | 0.86 ± 0.06$^{b}$ | 0.222 |
| RB2MG5-G3 | 5.46 ± 0.14$^{a}$ | 1.22 ± 0.13$^{a}$ | 0.223 |
| RB2MG5-P3 | 1.44 ± 0.03$^{d}$ | 0.45 ± 0.00$^{c}$ | 0.312 |
| RB2MG5-X3 | 2.48 ± 0.34$^{c}$ | 0.74 ± 0.11$^{bc}$ | 0.298 |

## CONCLUSION

Emulgels with hydrocolloids showed a cream-colored appearance and formed a well-structured network with higher viscoelasticity, requiring more force to spread and showing greater stickiness. The RB2MG5-G3 showed the best potential as a partial replacement for cocoa butter

## REFERENCES

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