A Valorised Legume Protein: Aquafaba as an Encapsulation Agent for Capsaicin Systems

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Aim

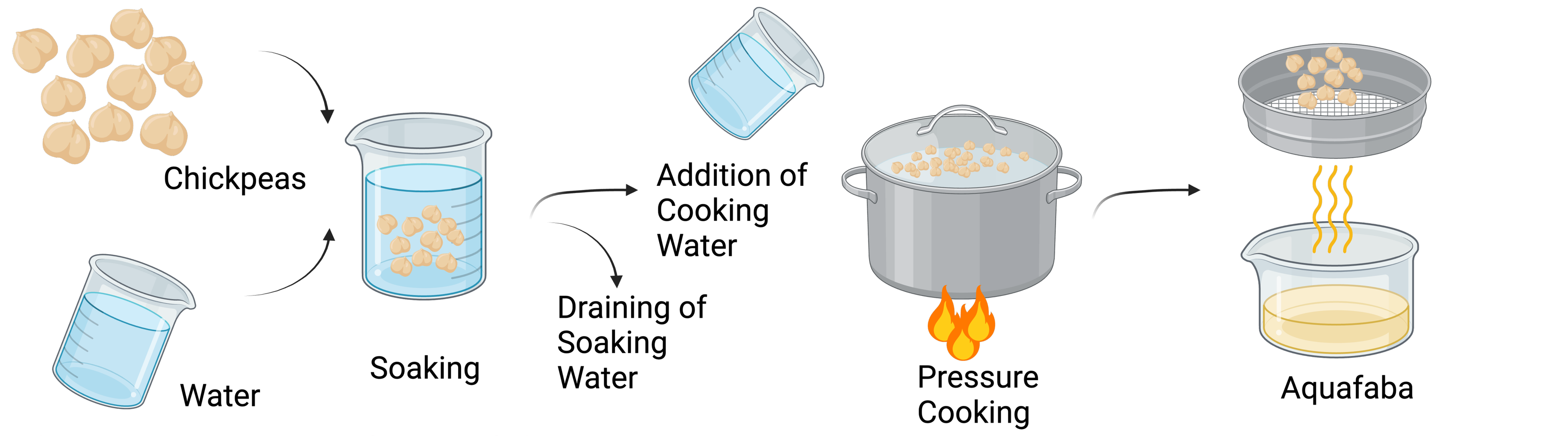
This study aims to explore the compositional characteristics of British Kabuli chickpea aquafaba and assess its applicability to produce encapsulated capsaicin systems and evaluate the optimal stability conditions.

Introduction

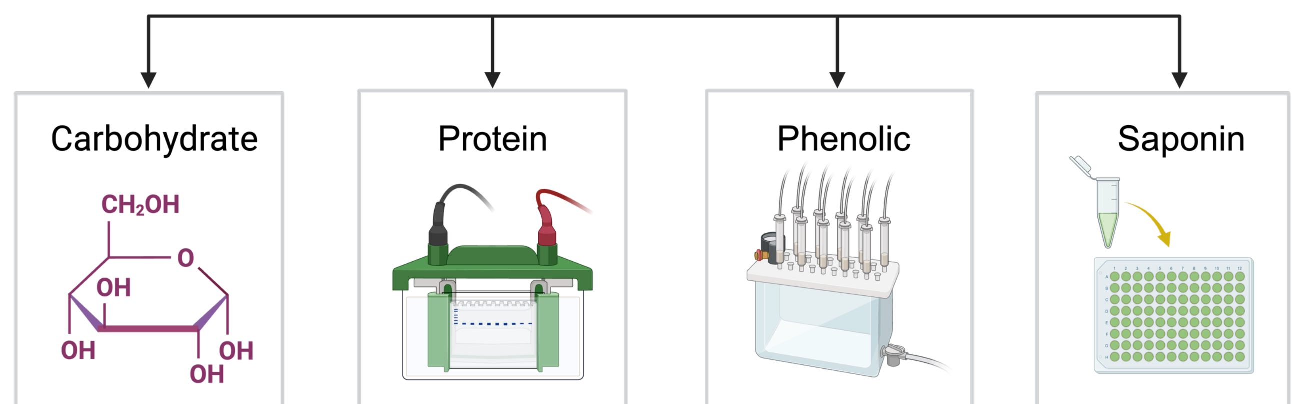
Aquafaba, a by-product of chickpea boiling, can be repurposed as a sustainable natural coating agent due to its heat-stable proteins, polysaccharides, and self-assembled nanoparticles, potentially replacing animal-based emulsifiers and synthetic surfactants. Its use as an encapsulating/emulsifying agent for bioactive compounds like capsaicin, found in chili peppers, remains untapped. To address capsaicin's limitation of toxicity, pungency, and poor water solubility, chili oleoresins extracts from ground chili powder, can be employed.

Methodology

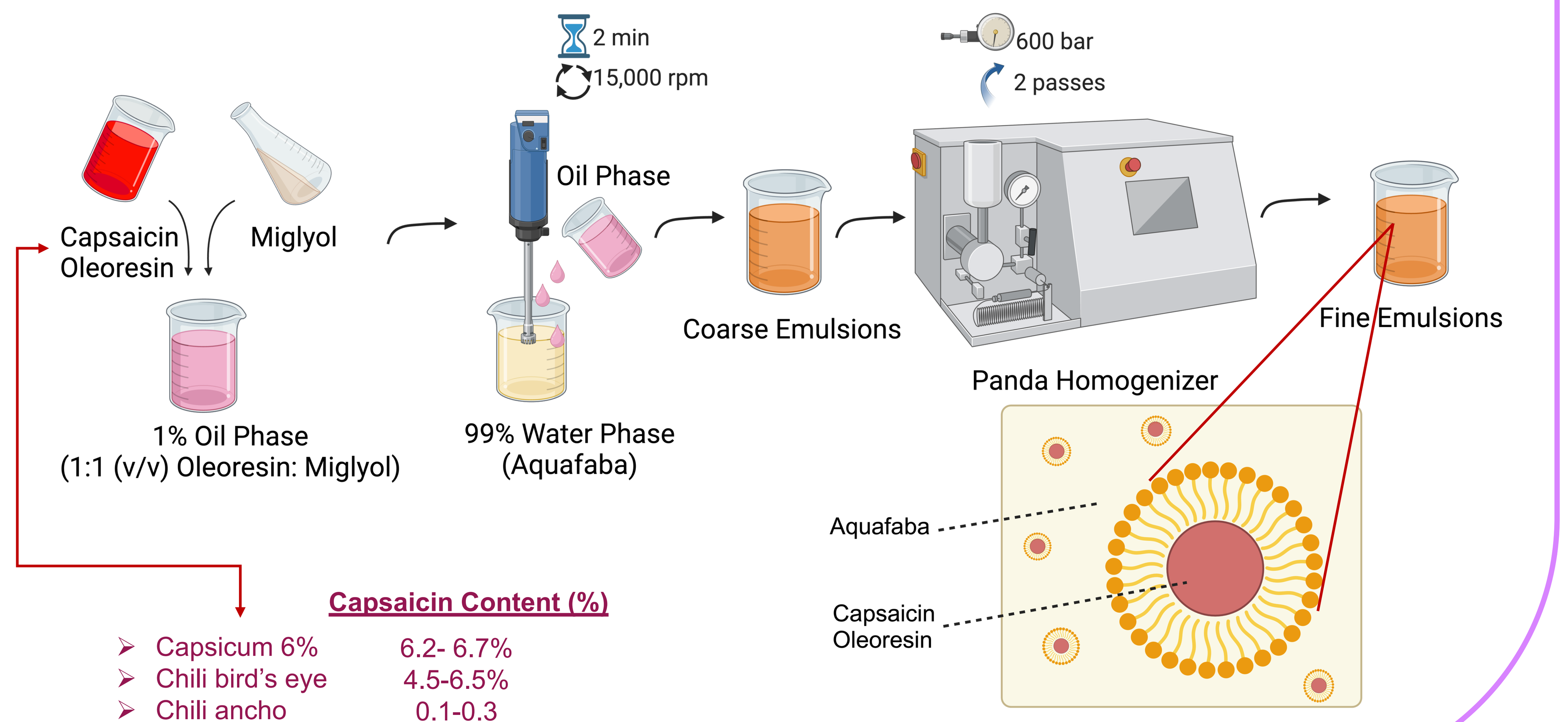
1. Production of Aquafaba



2. Characterization of Aquafaba



3. Chili Oleoresin-in-water Emulsions



Capsaicin Content (%)

- Capsicum 6% 6.2- 6.7%
- Chili bird's eye 4.5-6.5%
- Chili ancho 0.1-0.3

Results

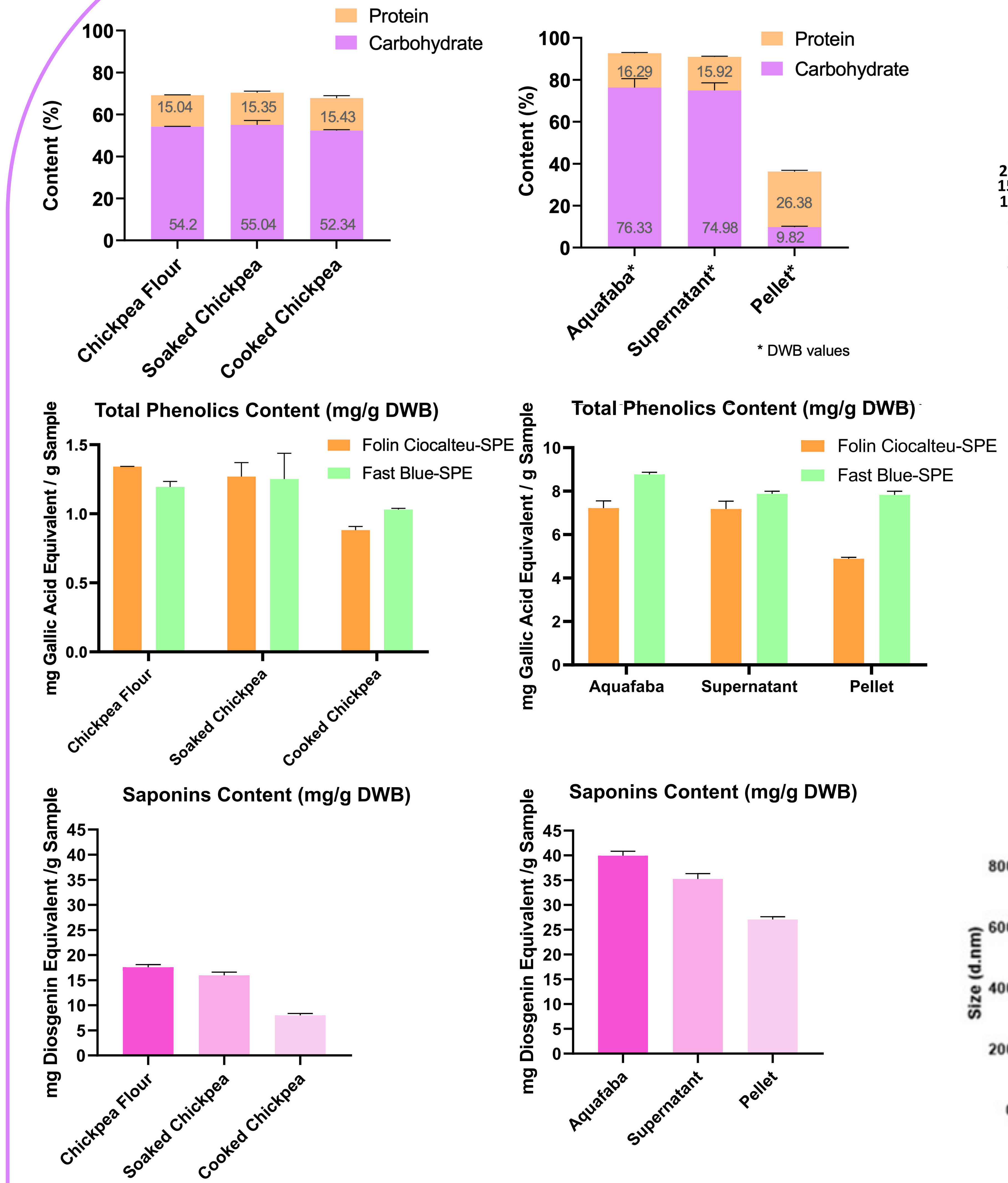


Figure 1. Carbohydrates, total phenolics and saponins content of chickpea samples and aquafaba fractions. (SPE, solid phase extraction; DWB, dry weight based)

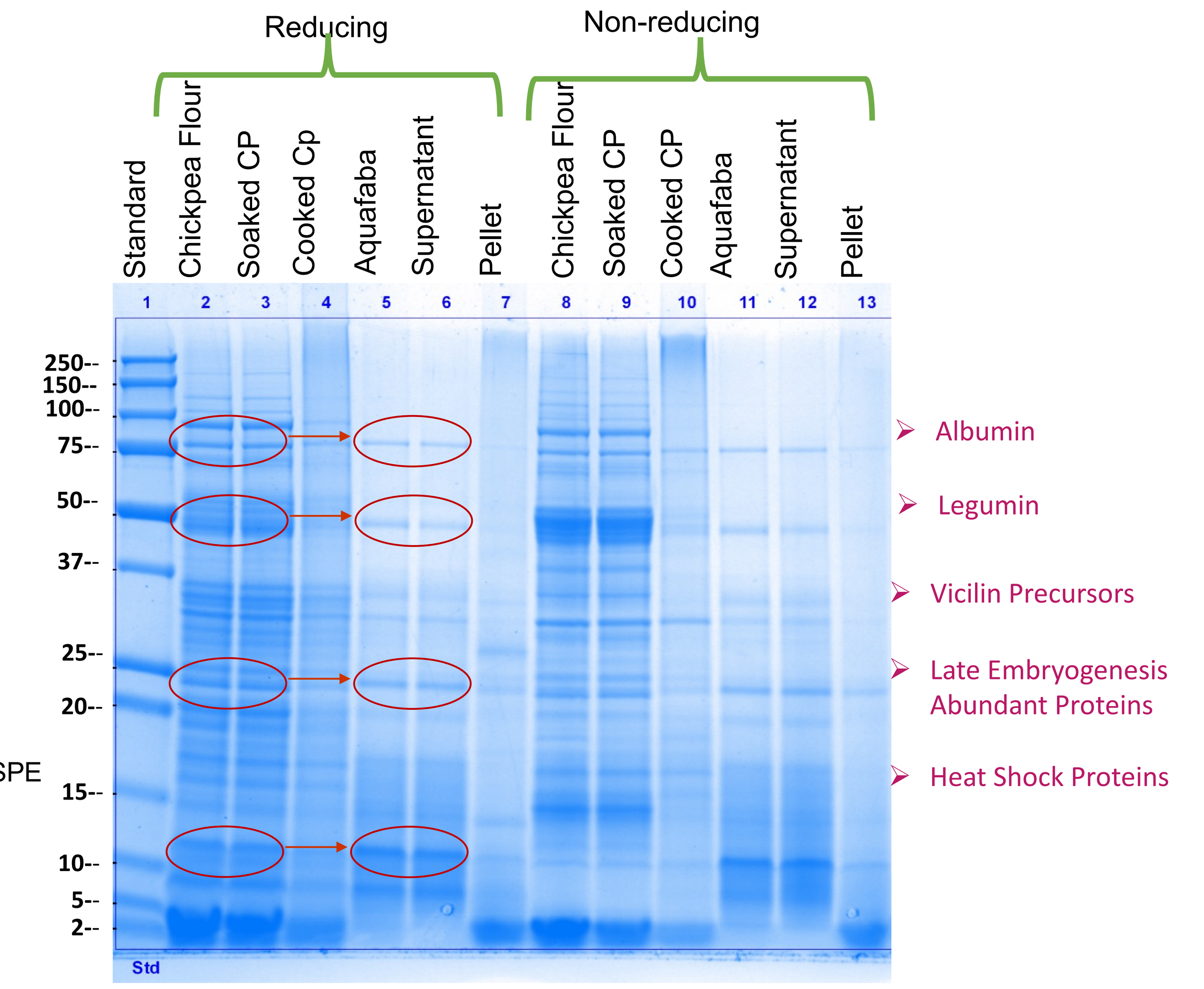


Figure 2. SDS-PAGE analysis of chickpea samples and aquafaba fractions (20 µg of protein loaded per line).

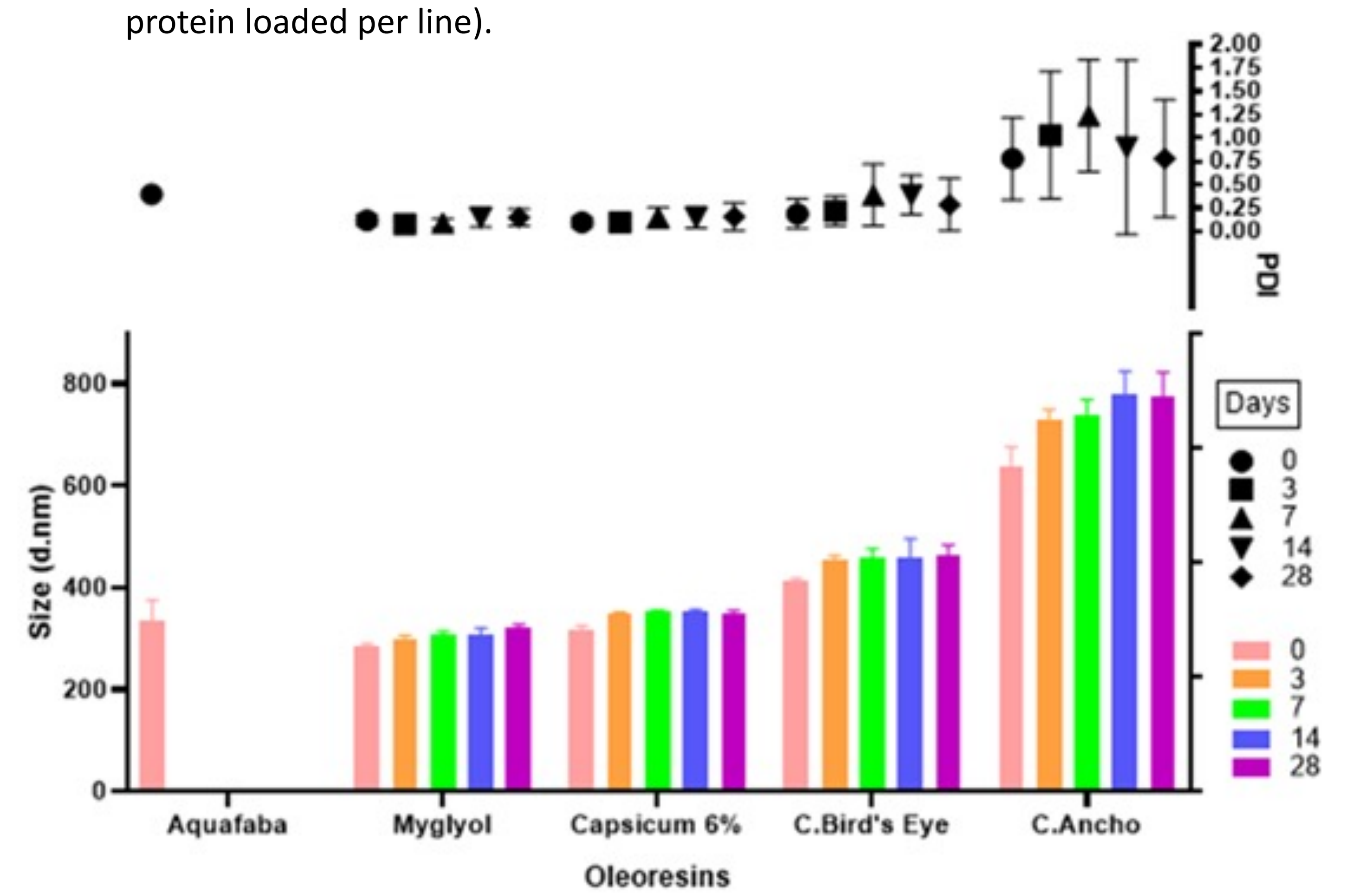


Figure 3. Evolution of the particle size measurements and PDI of capsaicin oleoresin-loaded emulsions stabilized with aquafaba.

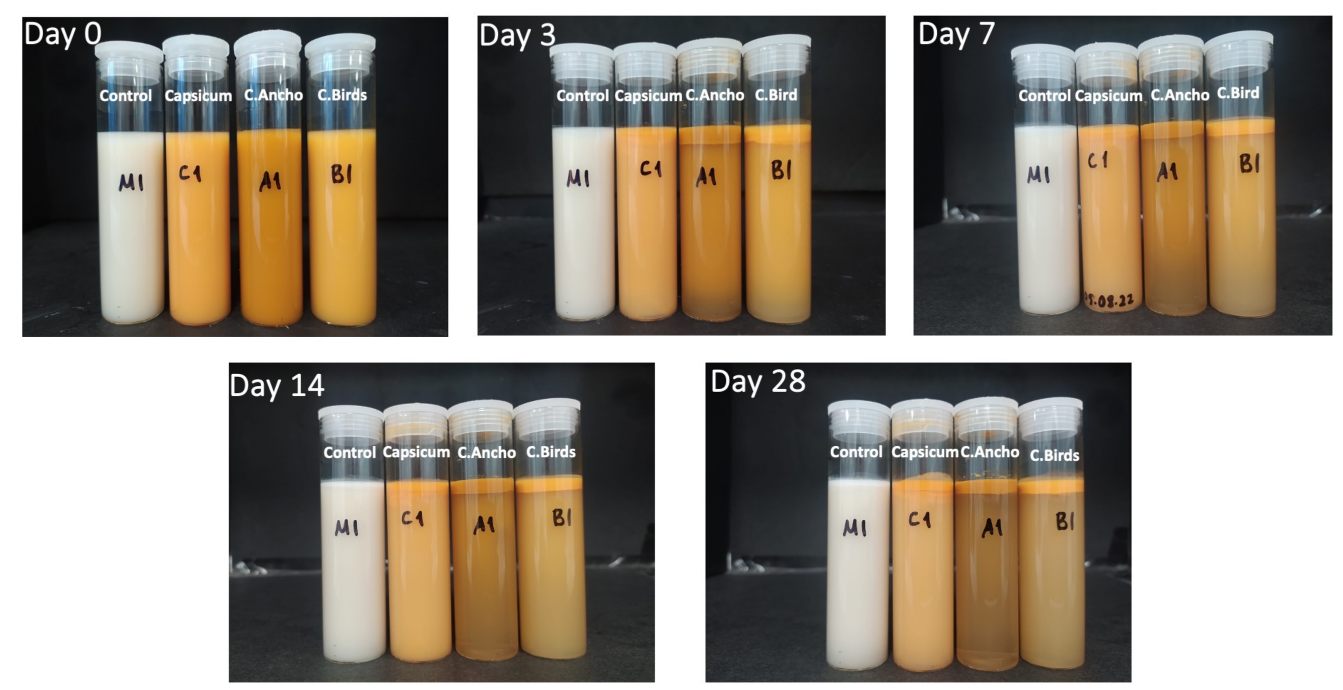


Figure 4. Physical appearance of emulsions during 28 days of storage. (M1: control (Miglyol) emulsions, C1: capsicum emulsions, A1: chilli ancho emulsions and B1: chilli birds eye emulsions).

Conclusion

- Boiling chickpeas causes structural changes and the release of components into the cooking liquor, leading aquafaba to demonstrate advantageous techno-functional qualities.
- Emulsion stability differed based on capsaicin content: highest content (capsicum 6% emulsions) remained stable, while the lowest content (chili ancho emulsions) exhibited lower stability.
- Overall, aquafaba stabilized oleoresin-loaded emulsions over 28 days of storage, even though stability levels varied by oleoresin type and creaming was observed during the final days of storage.

For further information please scan

References

He, Y., Meda, V., Reaney, M. J., & Mustafa, R. 2021. Aquafaba, a new plant-based rheological additive for food applications. *Trends in Food Science & Technology.* **111**, pp.27-42.
Buhl, T.F., Christensen, C.H. and Hammershøj, M. 2019. Aquafaba as an egg white substitute in food foams and emulsions: Protein composition and functional behavior. *Food Hydrocolloids*. **96**, pp.354–364.