The 5th International Electronic Conference on Foods

28–30 October 2024 | Online

Foods 2024 Conference

Exploring Phenylalanine Gels: Innovations in Food Gelling Agents

*Lorena Pepa[1], Cristina Dos Santos Ferreira[2], María del Pilar Buera [1, 2, 3]

[1] Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Departamento de Industrias, CABA, Argentina.

[2] Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Departamento de Química Orgánica, CABA, Argentina.

[3] Consejo Nacional de Investigaciones Científicas y Técnicas – UBA, Instituto de Tecnología de Alimentos y Procesos Químicos, CABA, Argentina.

*lorenaspepa@gmail.com

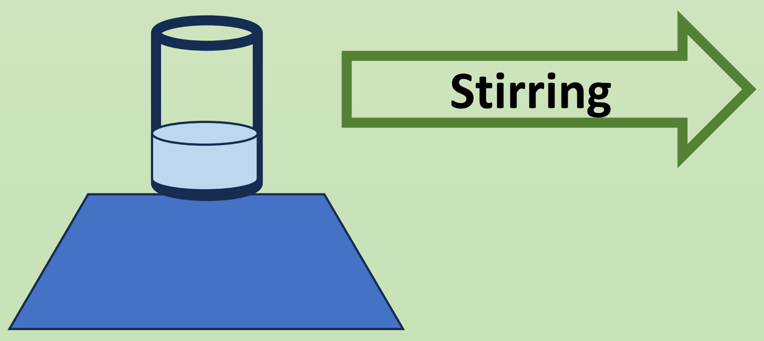
INTRODUCTION & AIM

Low-molecular-weight gelators, like phenylalanine (PHE), yield supramolecular gels and are being investigated for their potential use in pharmaceuticals, bioremediation, and cosmetics. PHE's structural properties allow for the formation of three-dimensional networks through hydrogen bonding and π–π stacking interactions. However, most of the present applications for pharmaceutical, water or residue treatments include PHE derivatization and use of organic solvents, which limit their use in food products. This study proposes new formulations of PHE gels using GRAS substances, making them suitable for consumption. In this way, the aim of this work was gel preparation and characterization, using different PHE concentration in water and propylene glycol 1:1 as solvent. Transition temperature was obtained using rheological methods and non-enzymatic browning kinetics was analyzed.

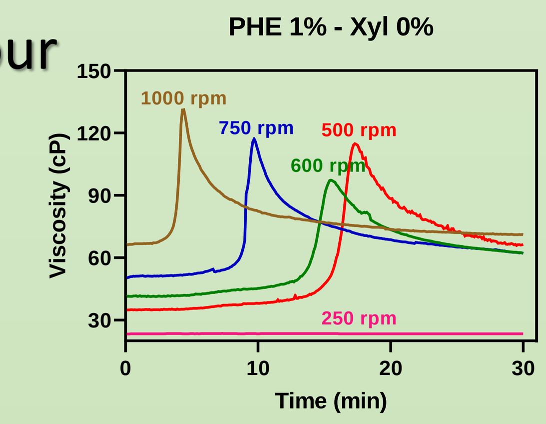
METHODS

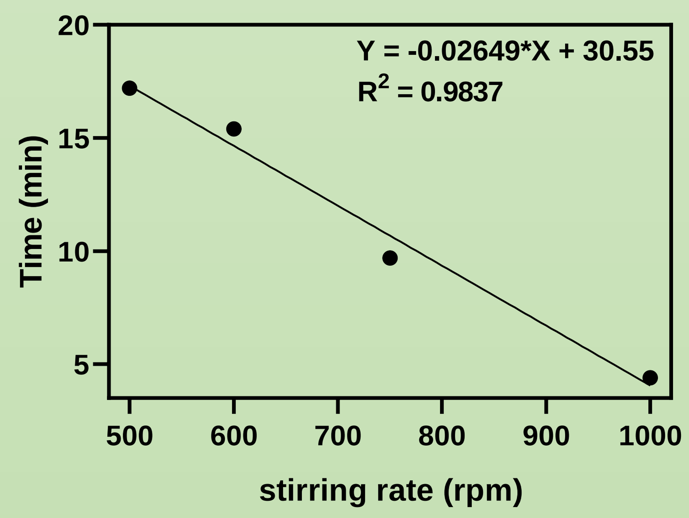
Gel Formulation and Rheological Behaviour

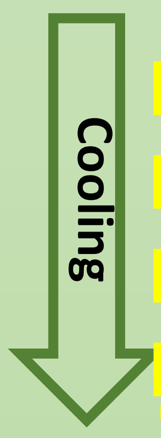
Propylene glycol



Phenylalanine – water solution

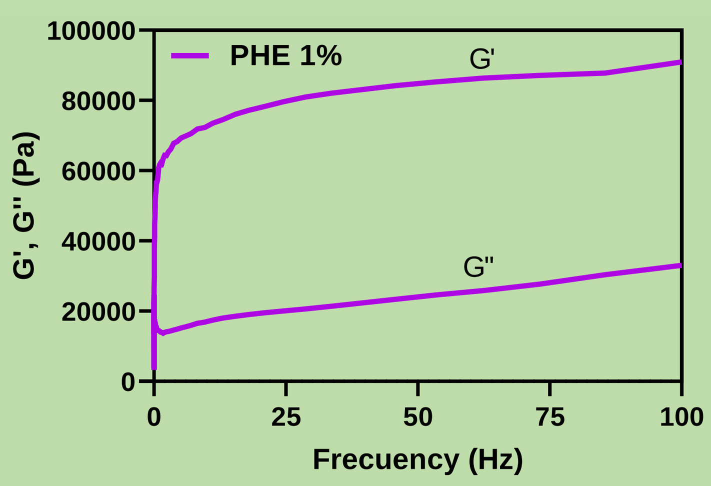


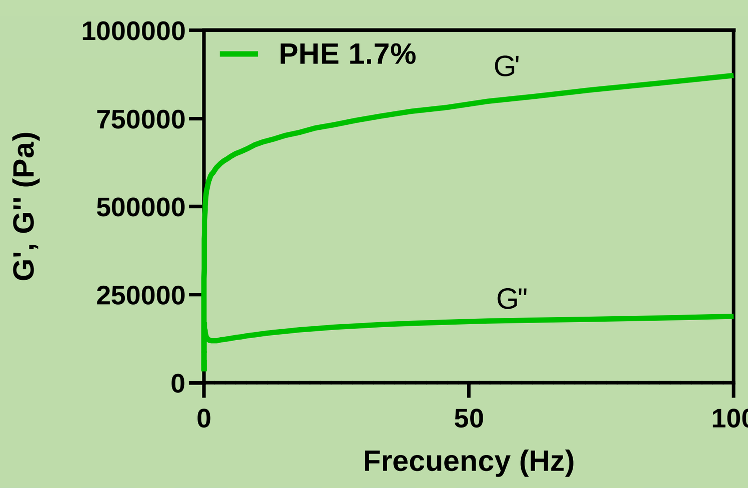




- Sol viscosity ↑ with stirring time until it reaches a maximum (gel formation).
- Stirring speed linearly accelerates gel formation.
- Very low stirring speed impedes gel formation.

Mechanical Spectra & Sol - Gel Characterization





- Gel formation takes 72 h sol storage at 5°C.
- Pseudogel behavior.
- Gel strength increases with [PHE].

Sol-gel transition temperature

Gel

G' & G'' 10-70°C

Browning kinetics

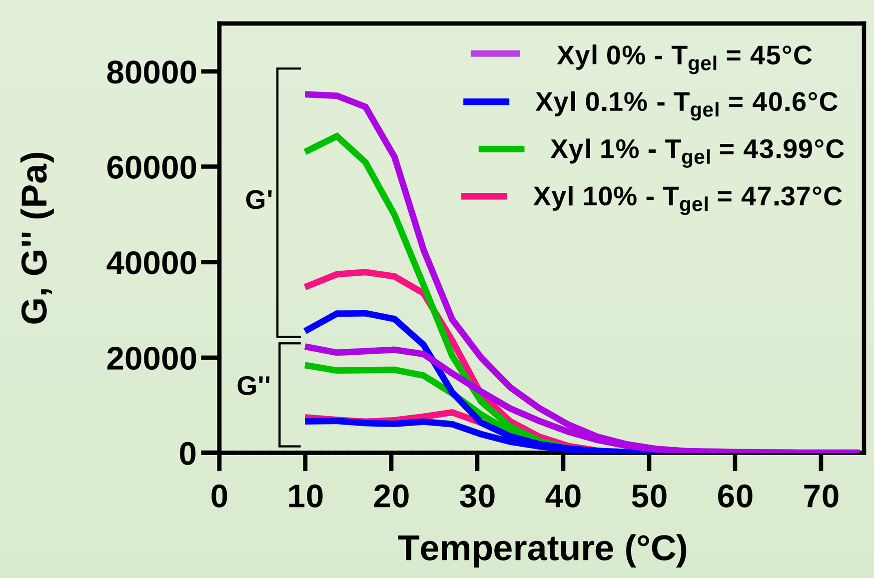
Sol + Xylose (XYL)

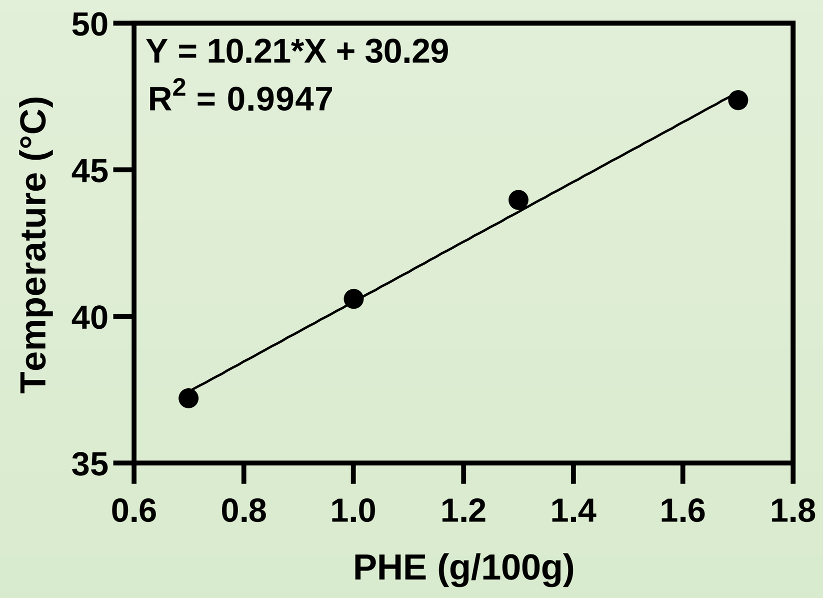
60°C oven 60 h

420 nm Absorbance

RESULTS & DISCUSSION

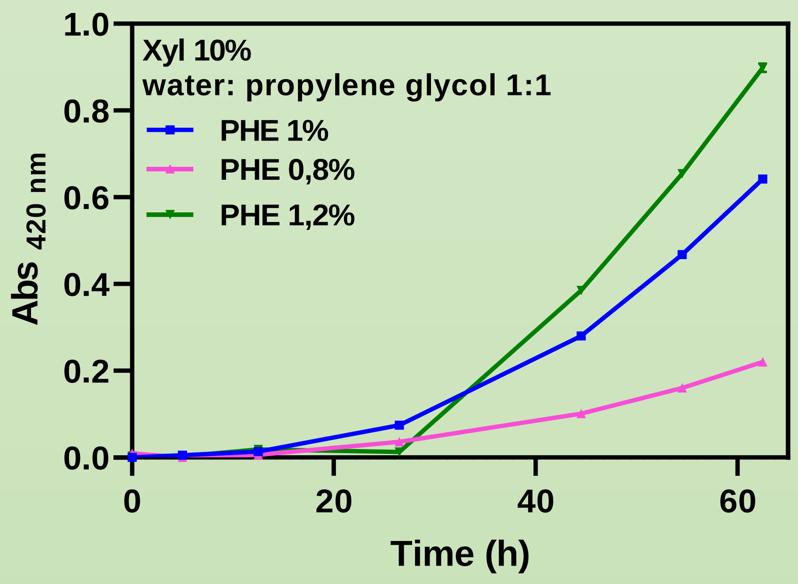
Sol – Gel Transition Temperature

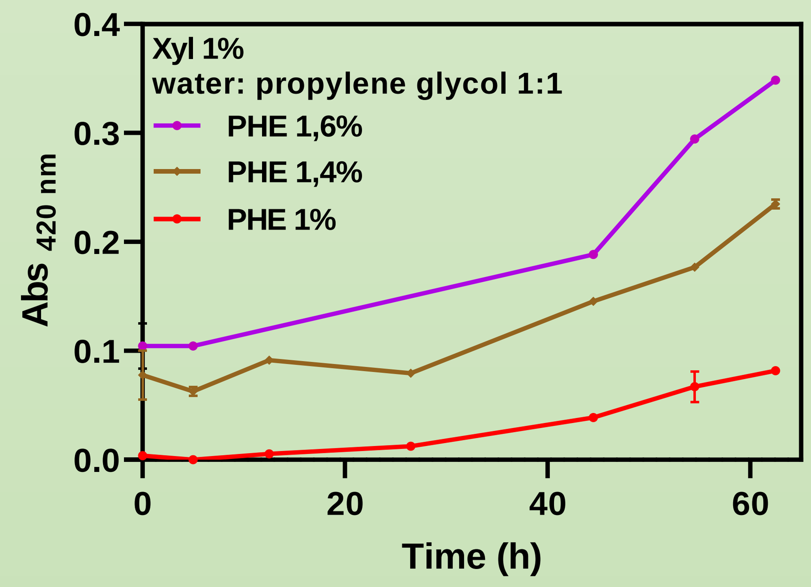




- Sol-gel transition temperature increases linearly with increasing PHE concentration.
- Xylose modifies sol-gel transition.

Non – Enzymatic Browning





- Long "lag" times, quite independent on reactant concentrations.
- First-order kinetics.
- Reactivity increased with increasing PHE or XYL concentrations

CONCLUSIONS

- PHE gels show pseudogel. or weak gel behavior.
- Sol viscosity increased linearly with stirring speed, rendering upscaling costlier.
- Non-enzymatic browning in PHE systems is slow compared to other amino acids and follows first-order kinetics.
- The combined effects of experimental variables should be analyzed in processing design and product development.
- When mildly heated, PHE gels release a floral aroma that could enhance tea-like blends, making them promising alternatives for food products, either desserts or appetizers with special texture and flavor.

REFERENCES

- Veloso, S. R., Rosa, M., Diaferia, C., & Fernandes, C. (2024). A Review on the Rheological Properties of Single Amino Acids and Short Dipeptide Gels. *Gels*, *10*(8), 507.
- Ginesi, R. E., & Draper, E. R. (2024). Methods of changing low molecular weight gel properties through gelation kinetics. *Soft Matter*, *20*(19), 3887-3896.
- Nisar, W., Chen, X., Tareen, M. B. K., Yan, S., & Li, J. (2024) Kinetics of Browning and Structural Changes During Non-Enzymatic Reactions in the L-Ascorbic Acid/Threonine Model System. *Threonine Model System*.