Rheological behavior of a commercial milk-based sauce

F.J. Rubio-Hernández[1], J. Rubio-Merino[2], A.I. Gómez-Merino[1], S. Cabello-Arrabal[1], C. Pérez-Hidalgo[1], S. Recio-Salguero[1], G. Alcázar[1], E. Lange[1]

[1]Departamento de Física Aplicada II, Universidad de Málaga, Málaga (Spain)
[2]Hospital Clínico Universitario "Virgen de la Victoria", Málaga (Spain)
E-mail of the presenter: aimerino@uma.es

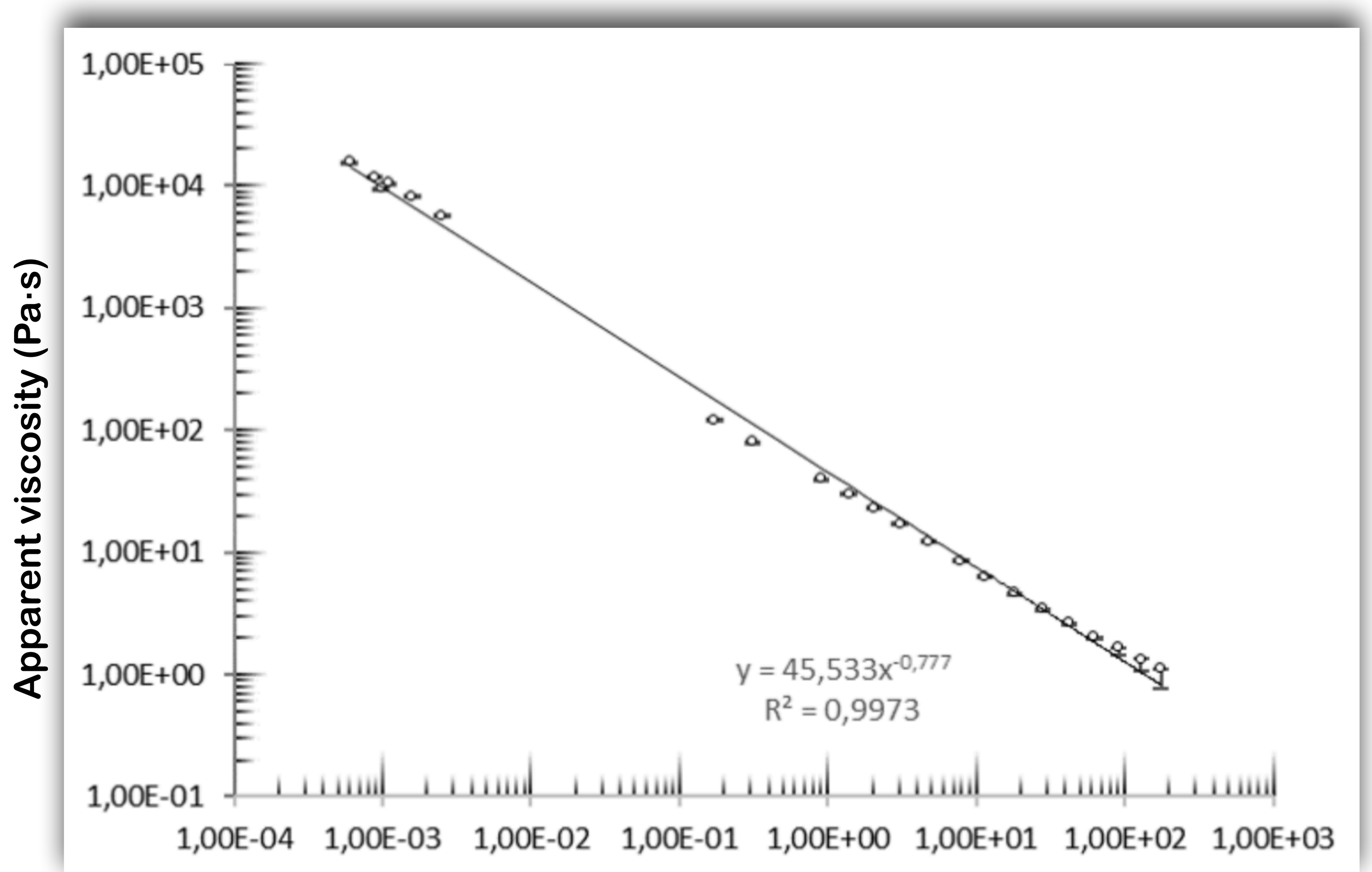
Background

- The acceptance of semisolid foods by consumers is greatly determined by their rheological properties.
- Sauces are semisolid foods and, in general, show viscoplastic and shear-thinning viscous flow behaviours [1]. On the other hand, viscoelastic properties are specifically significant in the handling and quality control tasks [2].
- As temperature changes cause alterations in physical and chemical properties of food components, which influence in texture, stability, taste, etc., a better understanding of the influence of this parameter on milk-based sauces would allow improve product quality.

Experimental

- Materials: "Ybarra" Roquefort sauce (Sevilla, Spain.)
- Stress controlled rheometer: MARS III (Thermo Scientific, Germany). Cone-plate (20mm, 1º).
- Methods: Pre-shear of 10s^{-1} during 60s followed by rest during 60s. Temperature control with a bath circulator.

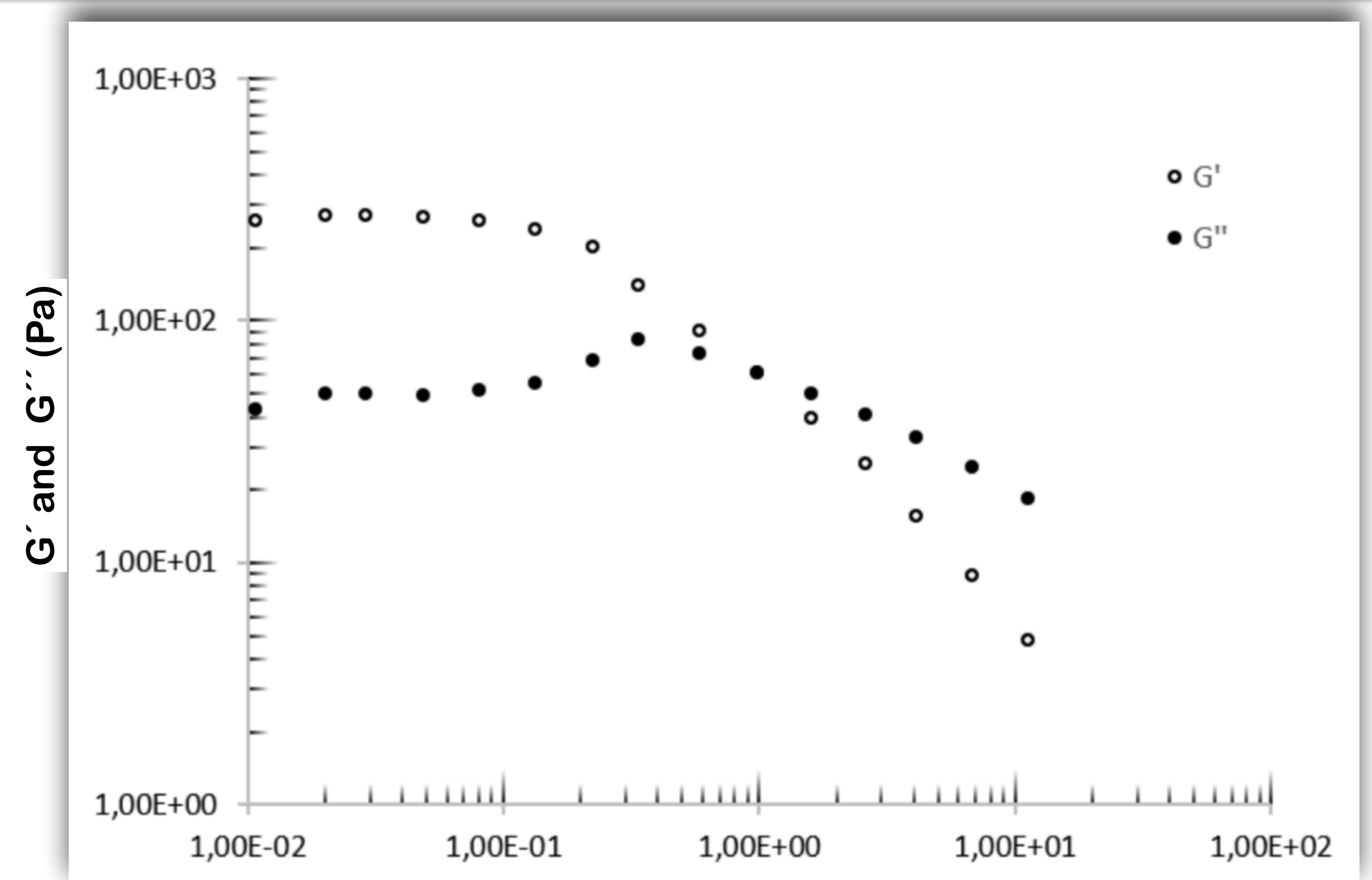
Steady Flow. SFC

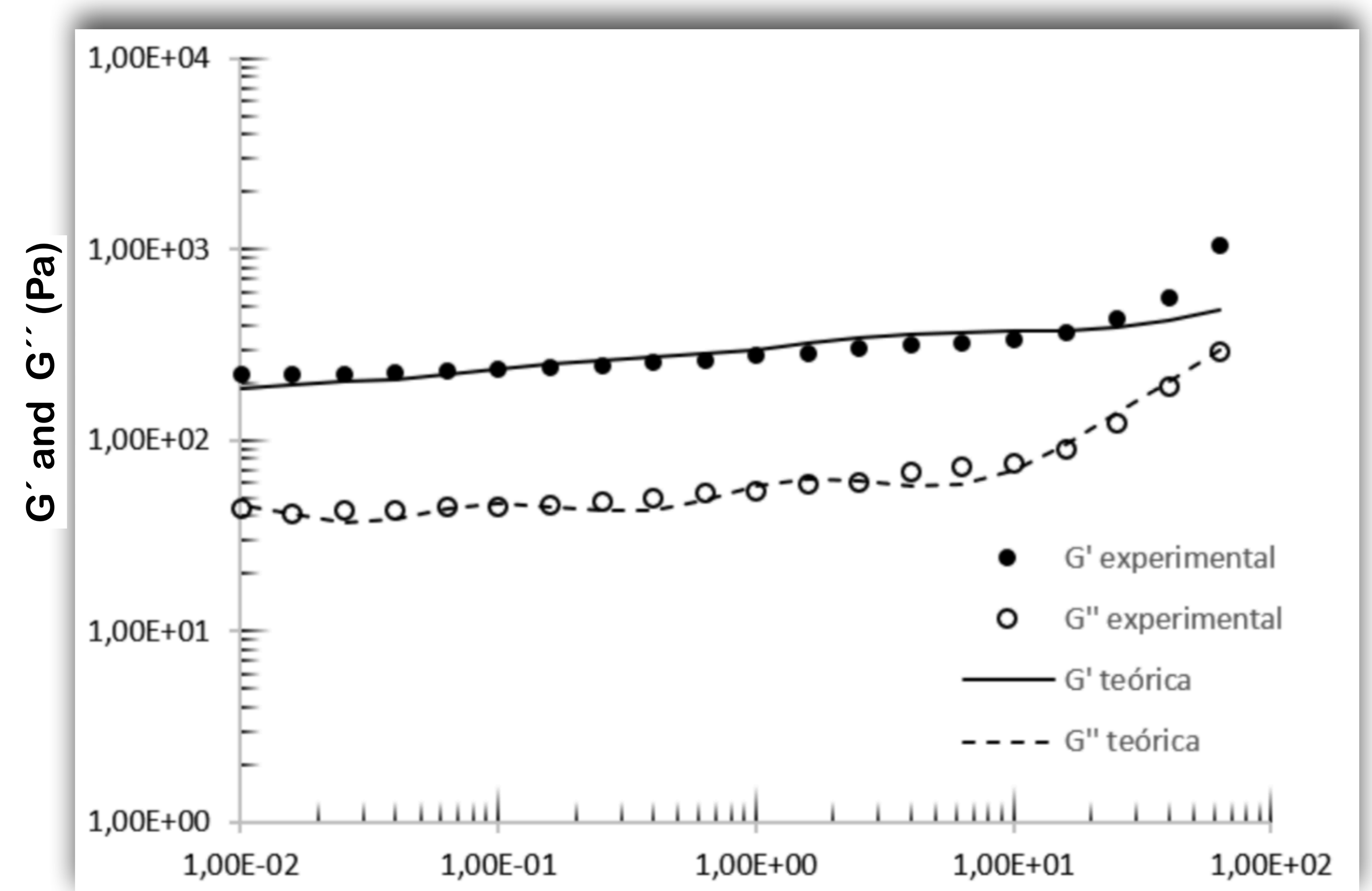


- Error bars (lower than 5%) are omitted for clarity. Figure corresponds to 20ºC sample. Power law model was fitted. Flow index almost constant (0.22) allows for consistency index comparison. The consistency decreased with temperature.

Temperature (ºC)	K (Pa·s^n)	n	r^2
6	45±1	0.22±0.02	0.9877
12	43±1	0.21±0.04	0.9796
18	40±1	0.23±0.03	0.9924
20	39±1	0.22±0.01	0.9973

Dynamic Analysis. SAOS





- Error bars (lower than 10%) are omitted for clarity. Figures correspond to 20ºC sample. SAOS analysis indicated linear behavior for amplitude lower than 0.1 for all temperatures, and gel behavior at the frequency window here studied. Generalized Maxwell model was used to obtain the relaxation time.

$$G'(\omega) = \sum_{k=1}^{N} \frac{g_k \lambda_k{}^2 \omega^2}{1 + (\lambda_k \omega)^2}$$

$$G''(\omega) = \sum_{k=1}^{N} \frac{g_k \lambda_k \omega}{1 + (\lambda_k \omega)^2}$$

Temperature (ºC)	Relaxation time (s)
6	17.3±0.1
12	15.6±0.1
18	12.3±0.1
20	10.7±0.1

- The relaxation time decreased with increasing temperature indicating an expected transition from solid-like to liquid-like behavior.

References

[1] Álvarez, E., Cancela, M.A., and Maceiras, R. (2006). International Journal of Food Properties. 9, 907-915.

[2] Rao, M.A., and Steffe, J.F. Eds. (1992). Viscoelastic Properties of Foods, Elseviee Applied Science, London.

IBEREO porto 2019