Interfacial rheology and stability of food foams containing inulin

María Luisa López-Castejón*, José Manuel Aguilar, Carlos Bengoechea and Cecilio Carrera (* llcastejon@us.es)

Chemical Engineering Department, Universidad de Sevilla, SPAIN

ABSTRACT

In the present work, inulin, a prebiotic polysaccharide naturally found in species such as chicory, was added to a foam stabilized by β-lactoglobulin, at different content levels (from 0 to 10 %). The rheology of the interface seems to control the macroscopic properties of the aerated system at inulin concentrations lower than 2.5 %, but they are dominated by the thickening of the continuous phase at higher concentrations. Thus, the presence of inulin plays an important role in promoting the stabilization of the air/water interface, explained on basis of the reported thermodynamic incompatibility between β-lactoglobulin and inulin together with the polysaccharide thickening effect. Food products containing prebiotic are attractive within the food industry due to their proven health-promoting properties.

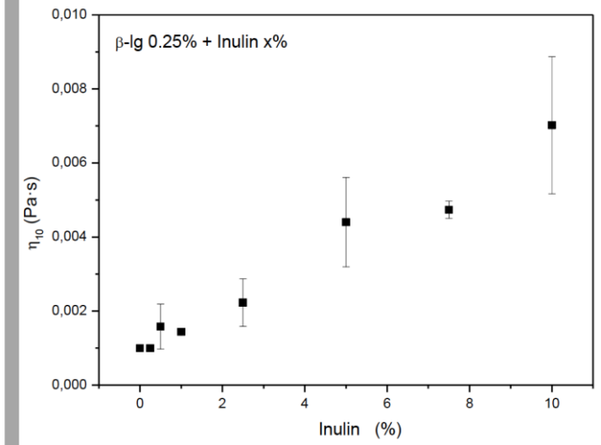
CONCLUSIONS

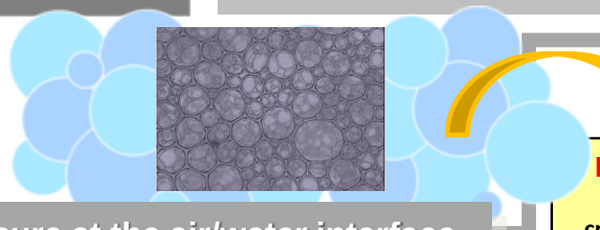
Despite not possessing an important surface activity, inulin is able to modify the interfacial properties of β-lactoglobulin. Therefore, an inulin-β-lactoglobulin ratio of 10 % was needed to increase significantly the surface pressure at the air/water interface. Nevertheless, higher inulin contents also resulted in an important increase in the viscosity of the aqueous phase, which contributed to lowering the adsorption kinetics. Thus, higher polysaccharide concentrations made interfacial properties lose their influence in favour of the properties of the bulk phase (i.e. higher viscosity). Consequently, inulin-β-lactoglobulin ratios higher than 20 resulted in more stable foams due to this thickening effect.

Flow tests of aqueous phase

AR2000 rheometer
PP60, gap 1 mm, 0.1-100 s^{-1}

higher viscosity values were detected as inulin concentration was increased, which could be related to the **thickening effect** exerted by the polysaccharide.

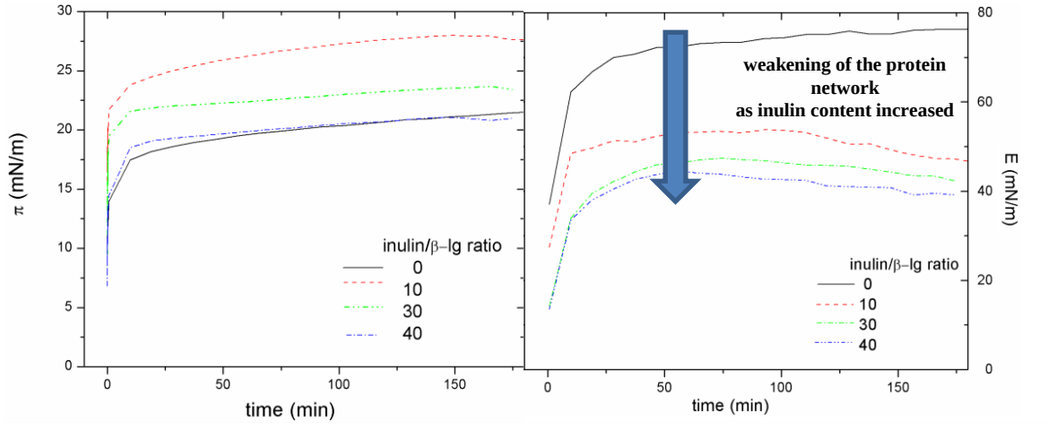




Surface pressure at the air/water interface

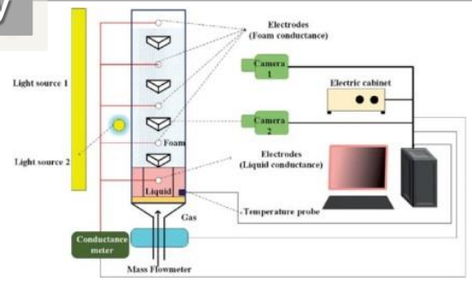
Higher π at low In/prot ratios (10):
Protein-polysaccharide incompablity promotes protein adsorption
Lower π at high In/prot ratios (30, 40):
Thickening effect retards the protein adsorption

Tracker drop tensiometer
Periodic sinusoidal interfacial compression and expansion 10% of deformation amplitude, 100 mHz, 20 °C



Foam stability

Foamscan IT
N_2 blown at 45 cm^3/min through a glass tube containing 20 ml of the solution



$t_{1/2}$ represents the time needed to drain half of the volume of the liquid incorporated in the foam.

inulin/β-lg ratio	$t_{1/2}$ (s)	
0	166.3 ± 5.5	+
1	158.2 ± 5.9	
2	157.6 ± 11.6	
4	93.0 ± 4.4	
10	78.7 ± 15.5	-
20	150.0 ± 9.6	
30	218.0 ± 13.7	
40	229.7 ± 28.9	+