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Sarkar, A, Juan, J, Kolodziejczyk, E et al. (3 more authors) (2015) Impact of protein gel porosity on the digestion of lipid emulsions. Journal of Agricultural and Food Chemistry, 63. 8829 - 8837. ISSN 0021-8561

https://doi.org/10.1021/acs.jafc.5b03700

Impact of protein gel porosity on the digestion of lipid emulsions

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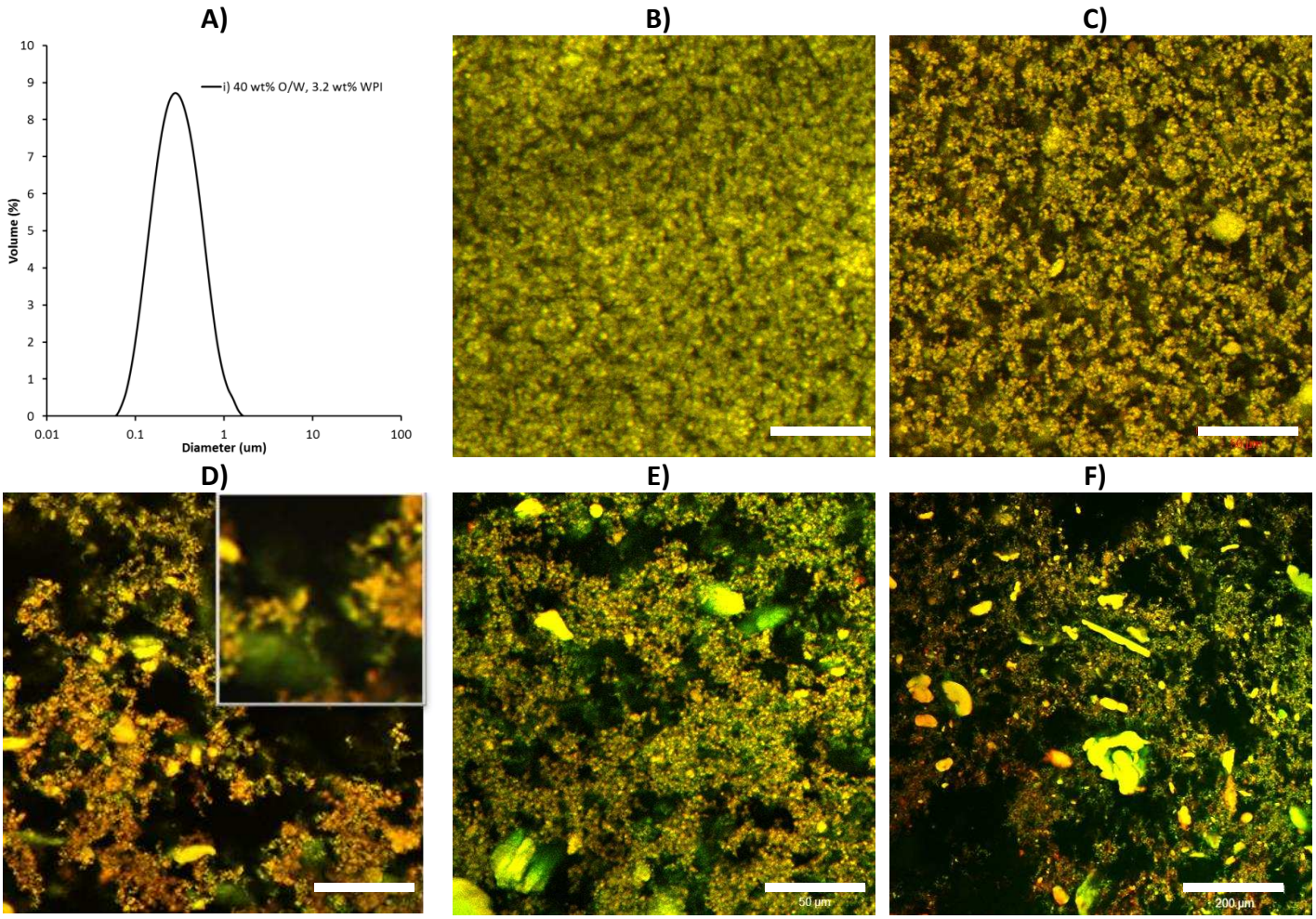

Figure 1: Emulsion and gelled emulsion (micro)structure. **A)** Particle size distribution of the parent WPI stabilized emulsion, **B)** - **F)** confocal laser scanning microscope images of 10 wt% WPI emulsion (Nile) dispersed within gelatine gels (Rhodamine 6G, pH 8.0 100 mM NaCl) containing **B)** 2.5 wt% gelatine, **C)** 5 wt% gelatine **D)** 7.5 wt% gelatin **E)** 10 wt% gelatine and **F)** 15 wt% gelatin. Scale bar represents 50 um (B-E) or 200 um (F). Insert in D is 2.5 times magnification of original image.

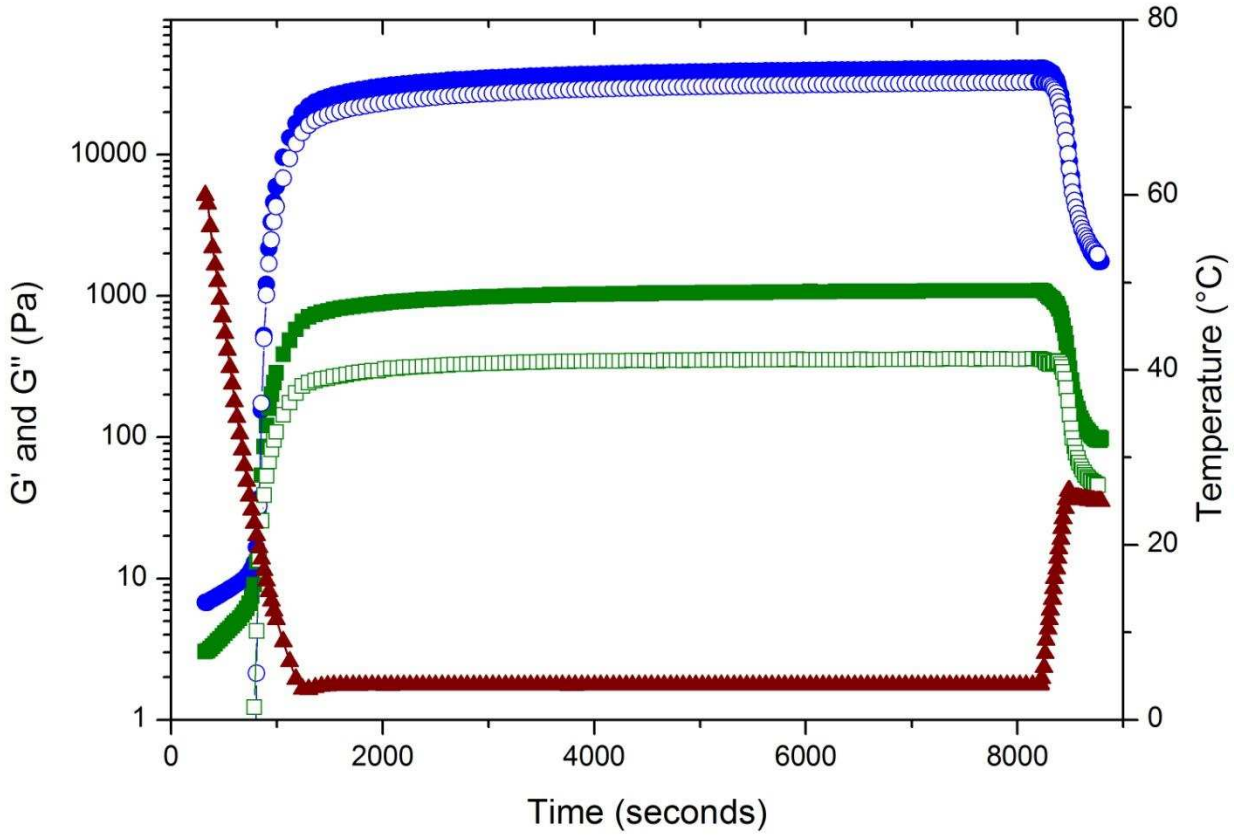

Figure 2: Kinetics of gelation of of gelatin gels (empty symbols) and corresponding filled emulsion gels (10.0 wt% oil, 0.7 wt% WPI, 15.0 wt% gelatin) (filled symbols). The crossover of G' (●) and G" (■) indicates the gel point. Temperature curve is represented by ▲ symbol.

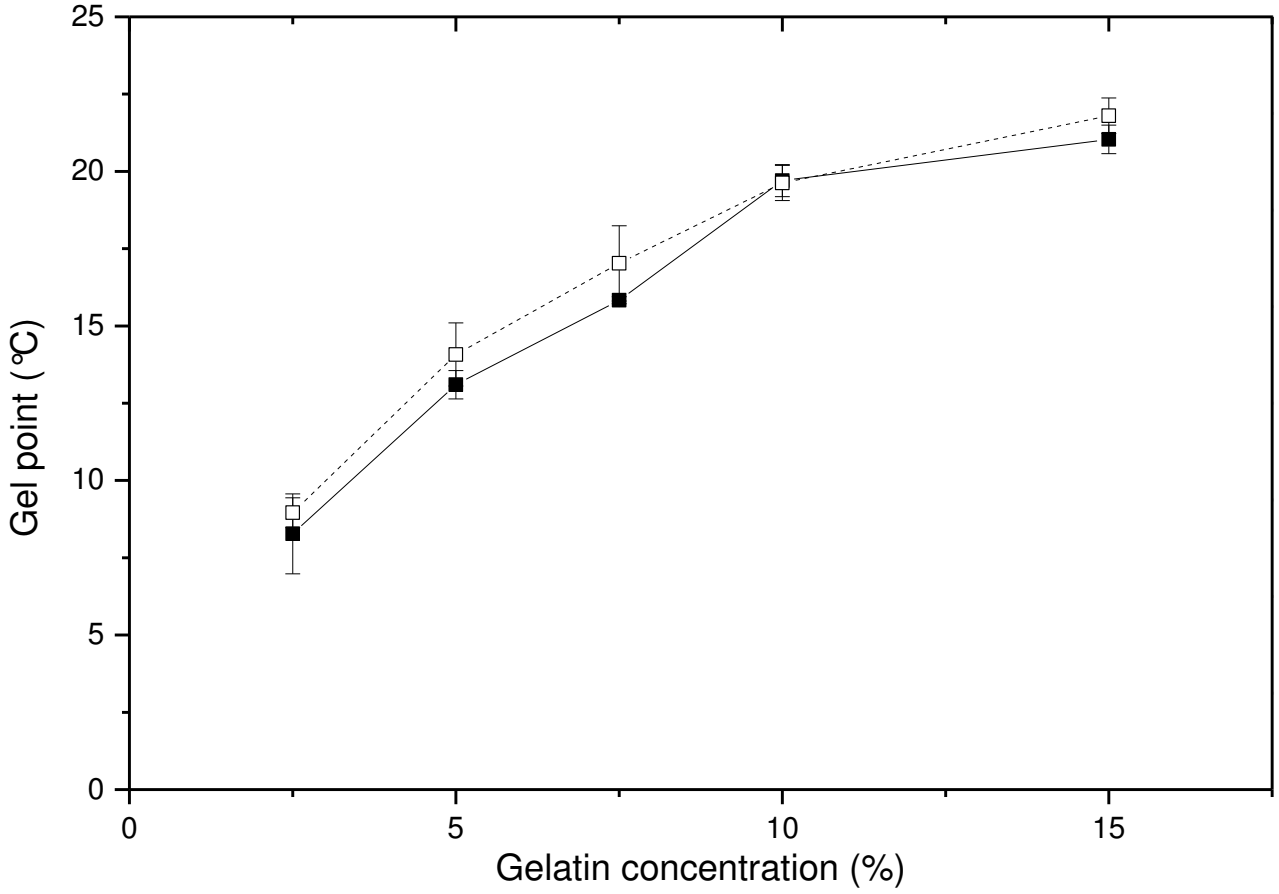

Figure 3A: Gel point of gelatine gels (□) and corresponding gelled emulsions (10.0 wt% oil, 0.7 wt% WPI, 2.5-15.0 wt% gelatine) (■) as a function of gelatine concentration

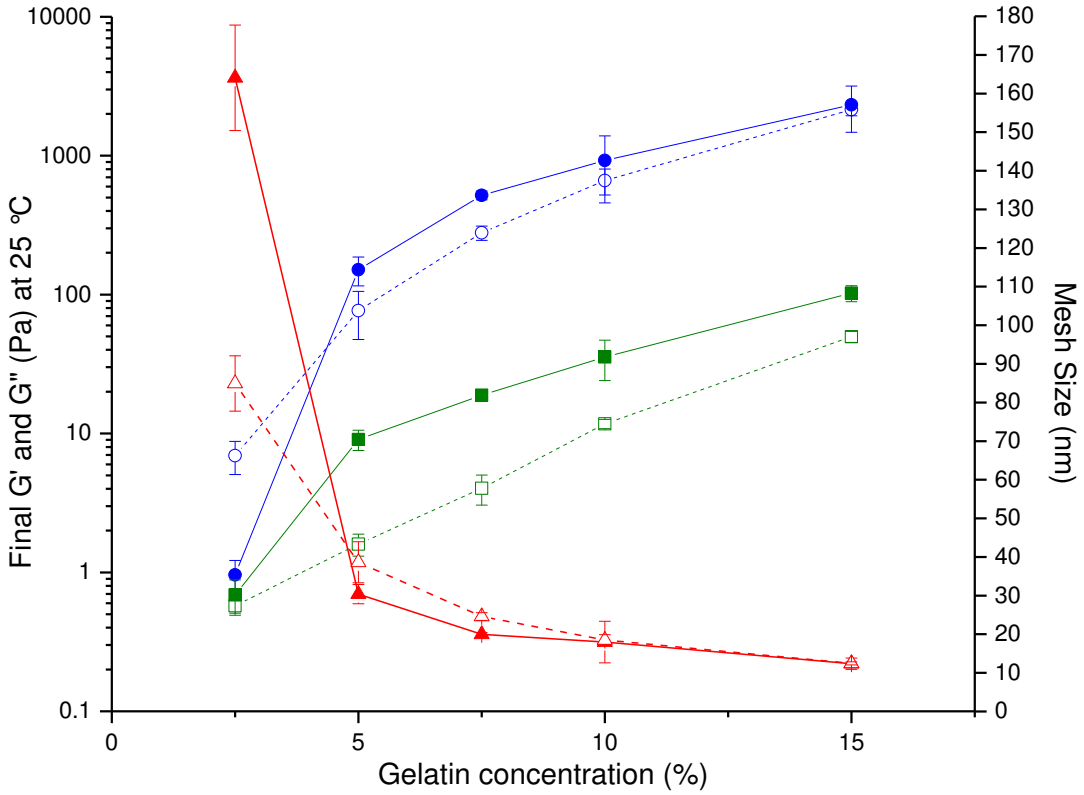

Figure 3B: Final G'(●), G" (■)and complex viscosity (▲) of gelatin gels (empty symbols) and corresponding gelled emulsions (10.0 wt% oil, 0.7 wt% WPI, 2.5-15.0 wt% gelatin) (filled symbols) as a function of gelatin concentrations . Average mesh size (▲) of gelatin gels (empty symbols) and corresponding filled emulsion gels (10.0 wt% oil, 0.7 wt% WPI, 2.5-15.0 wt% gelatin) (filled symbols) as a function of gelatine concentrations at temperature of digestion (25 °C).

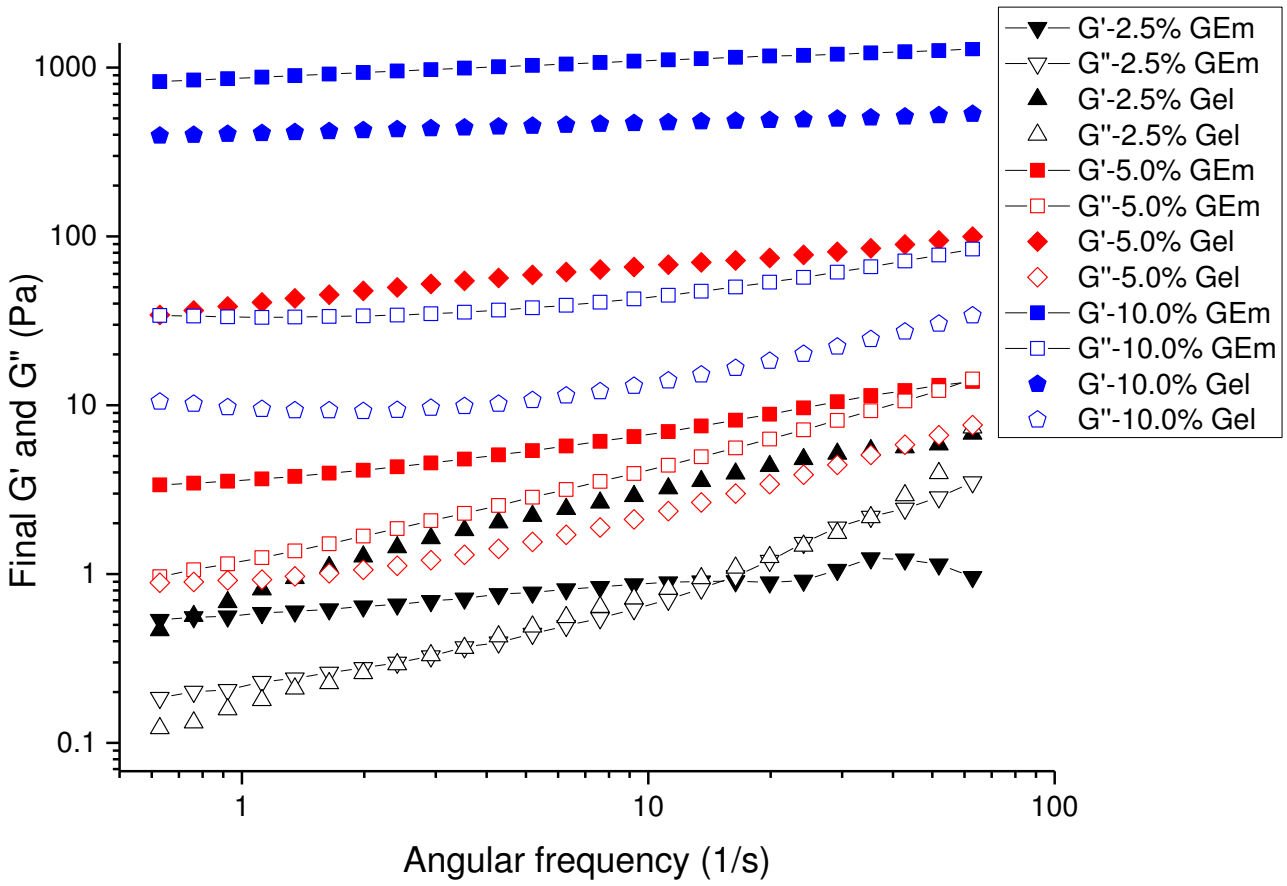

Figure 4: Frequency sweep test of gelatine gels (empty symbols) and corresponding gelled emulsions (10.0 wt% oil, 0.7 wt% WPI, 2.5, 5.0, 10.0 wt% gelatine) (filled symbols) at temperature of digestion (25 °C).

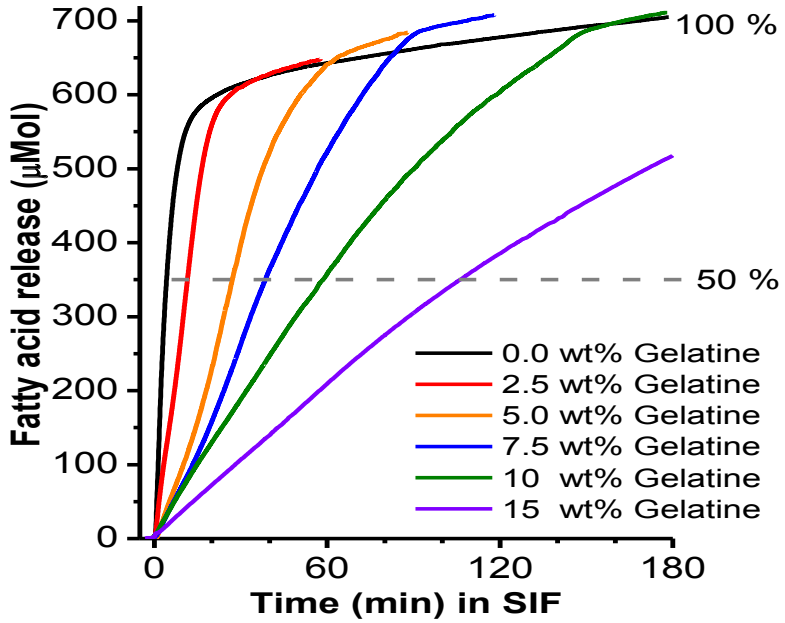

Figure 5: Acid release profiles obtained from 10 wt% O/W emulsions (stabilised by 0.7wt% WPI) alone i) or entrapped in varying amounts of bovine gelatine (Bloom 240) as a gelled emulsion. Acid release profiles were obtained during single step pH-STAT simulated intestinal lipolysis at pH 6.8 and 25^{o}C.

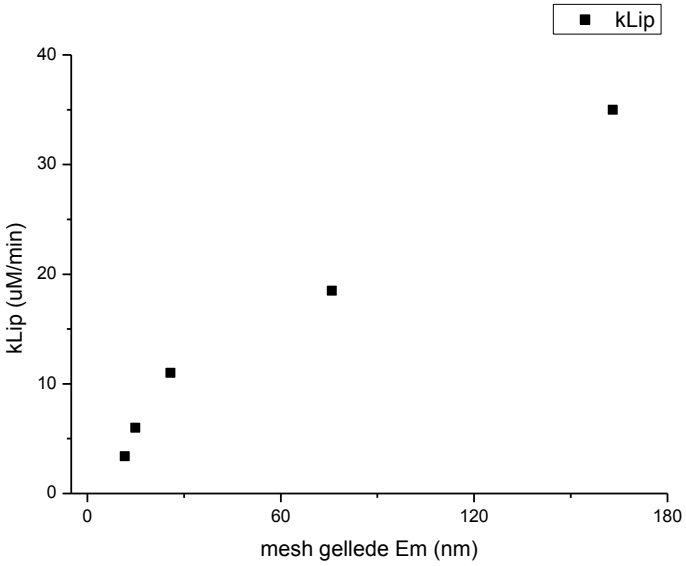

Figure 6: Relationship between the rate of acid release (lipolysis – K_{lip}) and the average mesh size calculated from G' at 25 °C using equation 2.

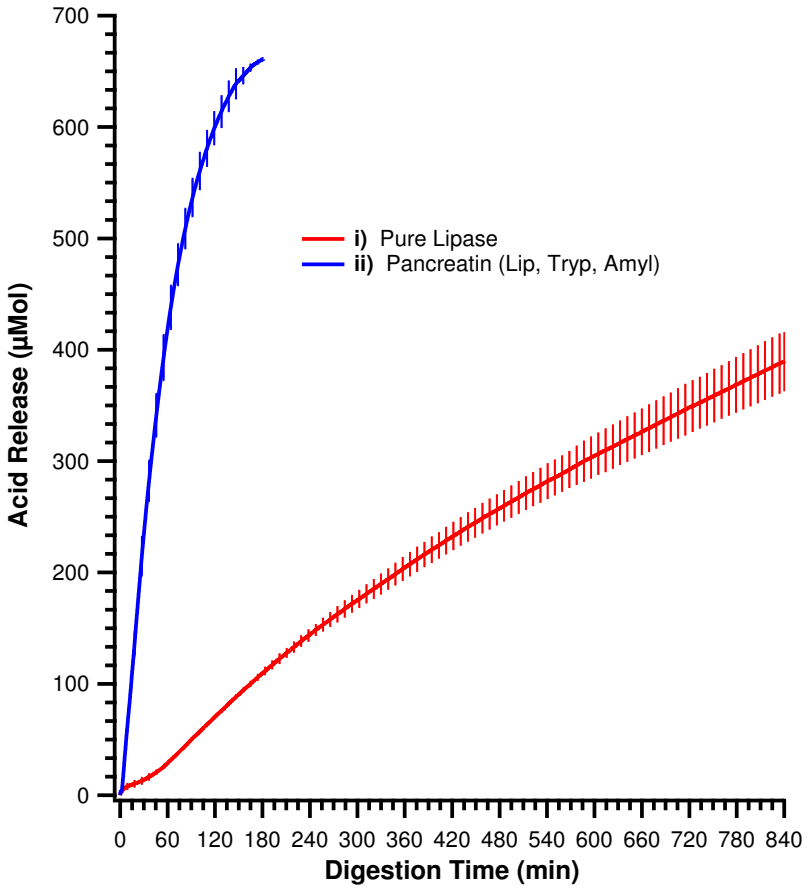

Figure 7: Kinetics of acid release (lipolysis) from 10 wt% gelatine 10 wt% O/W gelled emulsions when they are exposed to i) pure pancreatic lipase (11,000 U, 250 U/mL) ii) pancreatin containing pancreatic lipase (2,700 U, 63 U/mL), trypsin (16,575 U), amylase and chymotrypsin (20,250 U). Lines represent average of 3 measurements, error bars +/- 1 standard deviation.

(A) II B) IV
I) III

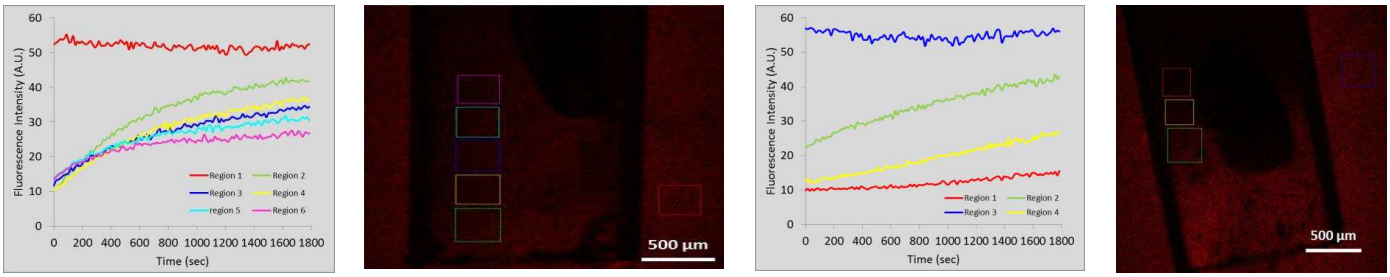

Figure 8: Diffusion of fluorescently labelled (Fluorescein isothiocyanate - FITC) porcine pancreatic lipase into A) 5 wt% gelatine gel and B) 10 wt% gelatine gel. I) Fluorescence intensity within different regions of gel II) and the external buffer (constant intensity) was monitored over time. Gel pieces were contained within glass capillaries, the faster rate of fluorescence intensity equilibration within the 5 wt% gelatine gel compared to the 10 wt% gel highlights much faster diffusion of the fluorescently labelled lipase.