**Model of the swelling of protein gels  
 in simulated gastric juice**

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Soy gels at different crosslink densities has been subjected to immersion in a simulated gastric juice. Via titration the pH of the juice is kept at pH=2 level. Due to strong buffering effect of the soy protein the pH inside the gel is only slowly changing. Soy protein is a polyelectrolyte gel, whose charge depends on pH due to dissociation of acidic and basic groups.

We have modelled the experiments via extending Flory-Rehner theory with Donnan-equilibrium, to account for the ionic contribution to the swelling pressure, cf.[1]. The swelling pressure is plugged into Darcy’s law to describe swelling kinetics. Furthermore, the kinetics in the total of bound and free protons inside the gel has been modelled, taking into account diffusion of free protons, convection of protons due to swelling, and the buffering capacity of the soy gel.

The experiment and model show a rich dynamics of the gel, which shows shrinkage after an initial swelling stage. This indicate also a rich dynamics inside in-vivo gastric environment, where also the action of pepsin enzyme has to be added to the system. Its activity is strongly dependent on pH, and its diffusion is modulated by the mesh width of the shrinking/swelling gel.

[1] English, Anthony E and Tanaka, Toyoichi and Edelman, Elazer R. Equilibrium and non-equilibrium phase transitions in copolymer polyelectrolyte hydrogels

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