CLEANING BEYOND WHEY PROTEIN GELS: EGG WHITE

Boris Koutzenko[1,2], Xiao Dong Chen[2], Romain Jeantet[1] & Ruben Mercadé-Prieto[2,*]
[1] *Agrocampus Ouest, Rennes, France*
[2] *School of Chemical and Environmental Engineering, Soochow University, Suzhou, China*

ABSTRACT

There has been extensive research in the last decade trying to understand the fundamentals of dissolution of whey protein gels in order to lay the foundations of proteinaceous cleaning processes. Dairy fouling deposits are known to form a transparent layer and to swell when in contact with cleaning solutions based on alkalis. For this reason, fine stranded gels of pure ß-lactoglobulin, which are visually transparent, have been used in the past to simulate the final state of the protein fouling undergoing cleaning. This model system was useful to understand the existence of an optimum alkali concentration for dairy cleaning operations. The reason why dissolution proceeds very slowly at high concentrations of alkali has been shown to be caused by the high ionic concentration of the alkali solution itself. This inhibits the swelling of the gels, which prevents the intragel diffusion of cleaved protein oligomers. Previous research has not yet addressed more realistic fouling models at the fundamental level. Two issues are of particular interest and will be addressed here. First, how important is the nature of the protein itself? Are the dissolution processes universal for any kind of globular protein, as seems to be the case for gelation processes? Secondly, the majority of fouling deposits are of a particulate nature, due to the relatively high concentrations of salts in the fluids and particularly in the fouling deposits. Hence, even if particulate deposits are transformed into a transparent stranded-like structure when in contact with alkali, it is not known the effect of the initial particulate nature of the gel in dissolution. Here it is studied the dissolution of crude egg white gels, rich in ovalbumin (OVA) protein. OVA powder is also rich in minerals, resulting in white particulate gels when heated as in a boiled egg. The OVA fouling deposits have recently shown a different cleaning behavior to whey deposits, whereby no optimum alkali concentration is observed. The lack of an optimum concentration for OVA is confirmed in the present study in specially designed dissolution experiments. Compared to whey gels, the dissolution rate of OVA gels at comparable dissolution conditions is very small. The results show that the cleaning of OVA deposits is controlled by the alkali β-elimination of disulfide bonds, at least in 0.1-0.3 M NaOH, whereas in whey protein gels this limiting mechanism is only observed at >0.4 M.