

Modelling the influence of processing on charge and iso-electric point of bovine collagen: effect of tanning chemistry

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Content

Leather manufacture relies heavily on the manipulation of charge within the primary collagen structure. For example, it is the basis which enables swelling during liming, deswelling during deliming, penetration of chromium after addition of chrome tanning salts and the fixing of chrome to carboxylate residues during basification. Manipulation of the charge on collagen is readily achieved through the addition of acids or bases into the float which may react with these residues to alter the charge.

Recently, we detailed a model for the charge of type I bovine collagen at different pH's in raw and limed states.[1] The charge on the collagen substrate was calculated across a pH range of 0 to 14 from the relative concentrations of the amino acid residues and their respective pK_{a3} values. Interestingly, it was shown that the charging profile of collagen was significantly different in acidic conditions compared to alkaline. This provided further explanation for the rapid swelling of collagen in acidic media when compared with alkaline. Figure 1 shows that collagen will have increasingly negative charge beyond a pH of 14, whereas in acidic conditions the positive charge reaches a maximum at pH 2.5 and below.

Here we extend this model further to study the charge of collagen across a pH range of 0 to 14 up to and including the tanned state. The choice of tanning agent has a significant influence on the charge of collagen. Mineral salts, such as chromium sulphate, are cationic increasing the iso-electric point (IEP). Conversely, glutaraldehyde reacts with amine residues, removing possible cationic sites from collagen, decreasing the IEP. This work provides important insights to the behaviour of these different materials in further processing.

1. Ballantyne, A. D., Davis, S. J., *Modelling the Charge across pH and isoelectric point of bovine collagen during leather manufacture*, IULTCS Congress 2019, Dresden, Germany

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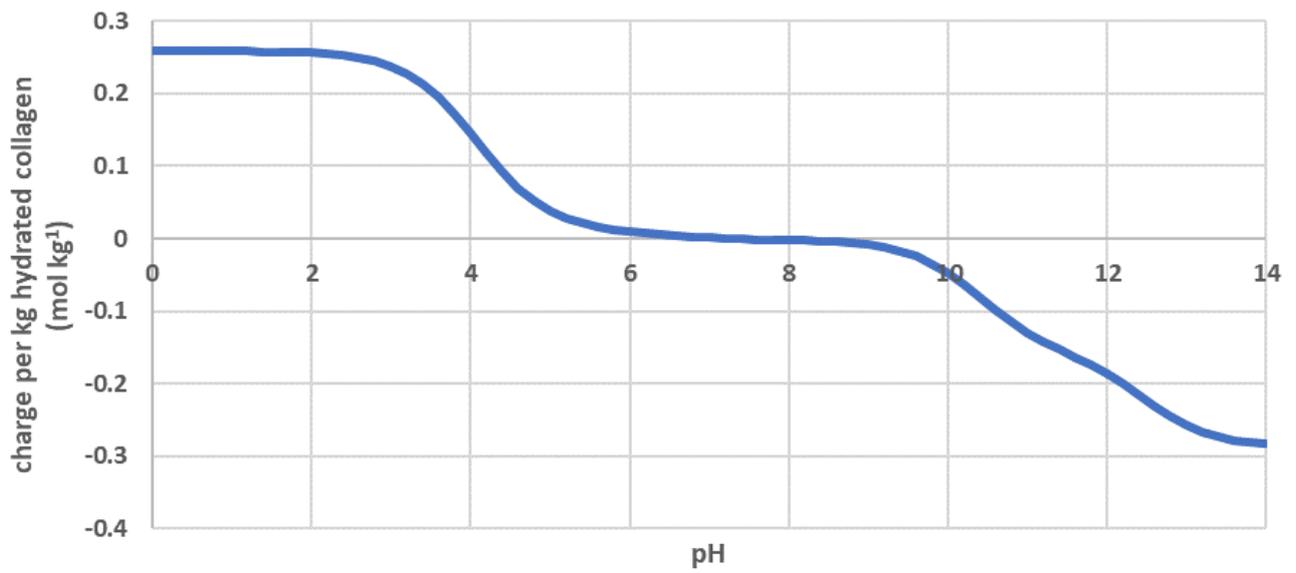


Figure 1
Total molar charge per kg hydrated collagen at different pHs

Keyword

Collagen, Iso-electric point, tanning