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SUPERCHILL!
Study of ice crystal formation in beef

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Meat consumption is controversial due to the juxtaposition between its high nutritional value and high environmental impact. Such impact could be reduced through alternative approaches that can extend meat product shelf life while maintaining high quality levels. Superchilling technology represents a unique possibility to preserve fresh food as demonstrated in fishery products (Kaale and Eikevik, 2014). However, to fully exploit the advantages of superchilling, on-line, nondestructive approaches need to be developed for its monitoring. The potentiality of NIR capability in studying ice formation in superchilling relied on the difference in light absorption between liquid and solid water.

In these preliminary experiments, NIR spectroscopy has been applied to study ice formation and content in beef samples. In detail, five cubes of beef round steak (6 x 6 x 6 cm) were treated in a chamber with air at -18°C (speed of 1.3 m/s) and monitored by MicroNIR and thermal camera acquiring data every two minutes for up to 280 minutes.

The NIR spectra show a systematic shift in water peaks with increasing ice fraction, i.e., a displacement of the absorption bands from 980 to 1020 nm and from 1200 to 1250 nm. The data were explored by PCA, showing a PC1 trend following the theoretical curve of freezing (Rahman et al., 2009), and the temperature was recorded by thermal camera, revealing the capability to follow the crystallisation process in the superchilling of beef. Further studies will be carried out to implement NIR technology in tailored superchilling protocols for different meat cuts.

Keywords: superchilling, crystallisation process, MicroNIR, beef

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