

New opportunities with industrial non-contact sub-surface NIR measurements

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Analytical technology in food and agriculture

Representative sampling is often a limitation with NIR spectroscopic methods for heterogeneous foods. Reflection measurements are effective when the sample surface represents the target composition, such as in fat determination of ground meat batches, where an average value can be recorded over a large volume at the grinder outlet.

Sub-surface NIR measurements is required for characterization of the interior of the samples. NIR “point”-spectroscopy in interactance mode is widely used for assessing fruit quality through the skin, but the instruments often require contact to avoid noise from ambient light. At Nofima and SINTEF Digital, we have recently developed and evaluated novel NIR sensors that allow rapid, non-contact sub-surface NIR measurements. This technology offers rich opportunities for in-depth sampling in industrial processes, exemplified by monitoring dry matter in potatoes [1], core temperature in sausages [2], in-field assessment of sugar in strawberries [3], and meat content in king crab legs [4]. The novel NIR sensors have a unique combination of four features:

- 1) The ability to measure in depth and suppress signals from the surface.
- 2) The ability to measure without physical contact, even in ambient light.
- 3) The ability to easily evaluate different illumination geometries to find the best for different products.
- 4) They are designed to work well under industrial conditions, allowing rapid transition from lab to industry and evaluation under realistic conditions.

Results from three recent studies will be presented:

- 1) Non-contact measurement of total soluble solids (TSS) in cherry tomatoes moving on a conveyor belt, with typical standard errors of prediction ranging from 0.38% to 0.52%.
- 2) Industrial monitoring of core temperature in fish cakes, achieving an acceptable accuracy (RMSEP = 1.4 °C).
- 3) Determination of meat content in legs of live king crabs.