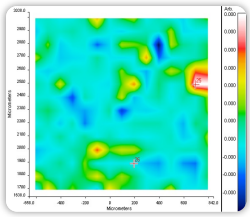
Optical Spectroscopy

Capability Case Study

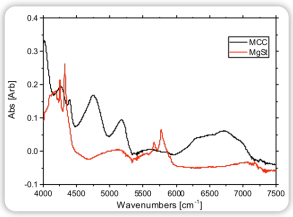
Light is an excellent way to gather information in a non-invasive, non-destructive manner; the unique, 'fingerprint' spectral response of different molecules can be used to determine composition, monitor processes, and inspect quality. CAPPA operates a suite of powerful spectroscopy techniques.

Infrared Spectroscopy

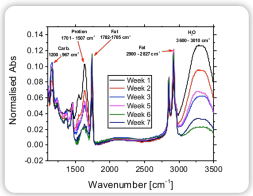
Medicine: Here, we are using Infrared (IR) spectroscopy to gather information on the distribution of different ingredients in a blend. This type of spectroscopy is capable of measuring a material in solid, liquid or gas state and can be applied to a host of applications such as quality control, contaminant identification, moisture content, density, hardness, changes due to heating and cooling, and many more. The IR mapping spectra were collected on a Perkin Elmer Spotlight 400 FT-IR Imaging System with a Spectrum 400 FT-IR Spectrometer.



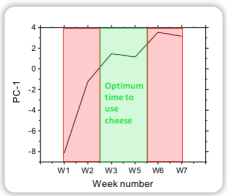
Distribution of ingredients in a powder



Reference spectra of blend ingredients



IR spectra of mozzarella cheese

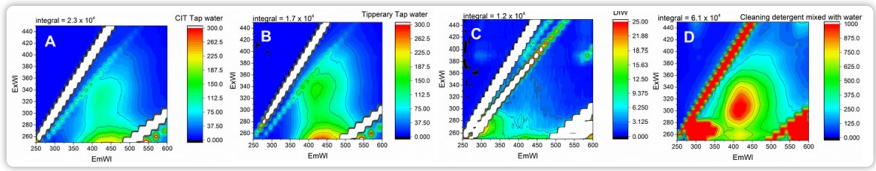


Modelled maturity cycle

Food: The example on the left shows the use of IR spectroscopy to measure the maturity cycle for mozzarella cheese. In this case, we performed analysis over a seven week period collecting a spectra each week. We then used software (multivariate analysis) to process the information and create a model, which can be used to predict the maturity of an unknown sample.

Fluorescence Spectroscopy

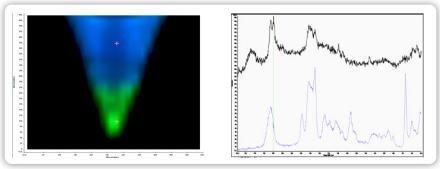
CAPPA develops sensors and detection equipment using light, the goal of these projects can be cost reduction, miniaturisation or other specific applications. The example here is an on-going project to develop a miniature fluorescence spectrometer with the aim of monitoring dissolved organic matter (DOM: humic-like, tyrosine-like, tryptophan-like and protein-like) found in water, without any sample handling. Depending on the level of detail required, it is possible to determine what type of organic matter is present in the water based on the fluorescence excitation and emission wavelengths.



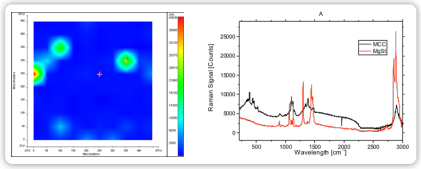
A: CIT tap water; B: Tipperary tap water; C: Deionised water; D: Water sample collected from floor.

Raman Spectroscopy

Two examples are shown; the first is of a microneedle showing API (tip of needle, green) and excipient (base, blue) with reference spectra on right. The second example shows Raman mapping to measure a blend. This type of measurement can be used for quality control and also for counterfeit detection. Raman mapping spectra were collected on a Perkin Elmer RS400 with a laser excitation source of 785nm with an output of 250mW.



Raman image of a microneedle showing API and excipient. Right: Reference spectra; API (top), Excipient (bottom).



Map showing blending of a compound. Right: Reference spectra of the blend.

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