Optical inspection of material properties is of great interest to industry because it can perform objective and non-invasive characterisation of large sample quantities. This may be used in various ways to lower production costs and improve product quality. In this thesis the objective has been to develop and investigate the applicability of optical broadband characterization techniques in industrially relevant production process. Both combined broad and high resolution techniques have the potential to provide important information on scattering properties related to particle size distributions, as well as details of the absorption spectrum which relate to chemical composition.

The thesis focuses on two production process from the food industry. The first process is from the dairy industry where discrimination between chemical and structural properties is of importance. To explore the applicability of optical techniques for this purpose, the fermentation of milk into yogurt has been used as a model system. Studies have been conducted on commercially available products, but also of on-line measurement of the fermentation process. The second process is from the aquaculture industry, quantification of the fish feed additive astaxanthin has been investigated. A measurement campaign has been carried out on a series of pellets specially produced for the purpose.

To investigate these process, the following three measurement techniques have been developed and applied. (I) A camera based inspection system for spectrally resolved Static Light Scattering (SLS). (II) Photon Time-of-Flight (PToF) spectroscopy, which is a state of the art technique for characterization of turbid media. (III) A new hyperspectral imaging system based on full-field illumination by diffuse laser light. This thesis reports on the design and operation of the different measurement techniques together with the necessary theoretical background for the industrial applications.

For the purpose of milk fermentation this work has demonstrated that the reduced scattering properties of milk change significantly throughout the fermentation process. It has also been shown that the optical inspection methods sense changes to structural properties before any are detected by traditional mechanical rheology. Finally, the developed hyperspectral imaging system was used to quantify the content of astaxanthin in fish feed, and performed at an equal level to a state of the art multi-spectral vision system.