

# Abstract

In this thesis a broad region of the electromagnetic spectrum been investigated for its potential use for quality control of potato tubers. The electromagnetic response has been investigated with a range of optical and electrical methods, including electric impedance spectroscopy, dielectric spectroscopy and VIS-NIR spectroscopy.

The primary parameter of interest have been the dry matter content of the potato tubers, which is an important parameter often strongly correlated to the product value and the nutritious content. In addition to this The content of selected sugars and amino acids have been investigated based on their importance for the frying properties of potato tubers. Finally have defects such as greening and black hearts also been investigated.

The results indicated that the low frequency response, measured with electric impedance spectroscopy, were generally not well suited for prediction of this type of parameters. The microwave response, measured with dielectric spectroscopy, showed promising results for the prediction of the dry matter content, with a prediction RMSE in the range of 1.6-1.9 percentage points. The VIS-NIR region were shown to be the most promising due to the detailed molecular information available from the vibrational overtones. This region allowed the prediction of the dry matter content with a prediction RMSE in the range of 1.1-1.2 percentage points. Furthermore it was possible to predict both the presence of greening and black hearts from the VIS-NIR response.

Spatial variances were found to be a major factor limiting the precision of the predictions based on the microwave response measured with the open ended coaxial probe technique. Because of this an alternative method for the evaluation of spatial sensitivity of reflection based microwave methods were developed. The application of the technique were demonstrated by analyzing the spatial sensitivity of 4 different coaxial probe designs.