

Mastitis Detection by Near-infrared Spectra of Cows Milk and SIMCA Classification Method

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Mastitis is a major problem for the global dairy industry and causes substantial economic losses from decreasing milk production and considerable compositional changes in milk, reducing milk quality.

The potential of near infrared (NIR) spectroscopy in the region from 1100 to 2500nm and chemometric method for classification to detect milk from mastitic cows was investigated. A total of 189 milk samples from 7 Holstein cows were collected for 27 days, consecutively, and analyzed for somatic cells (SCC). Three of the cows were healthy, and the rest had mastitis periods during the experiment. NIR transmittance milk spectra were obtained by the InfraAlyzer 500 spectrophotometer in the spectral range from 1100 to 2500nm. All samples were divided into calibration set and test set. Class variable was assigned for each sample as follow: healthy (class 1) and mastitic (class 2), based on milk SCC content.

The classification of the samples was performed using soft independent modeling of class analogy (SIMCA) and different spectral data pretreatment. Two concentration of SCC - 200 000 cells/ml and 300 000 cells/ml, respectively, were used as thresholds for separation of healthy and mastitis cows. The best detection accuracy was found for models, obtained using 200 000 cells/ml as threshold and smoothed absorbance data - 98.41% from samples in the calibration set and 87.30% from the samples in the independent test set were correctly classified. SIMCA results for classes, based on 300 000 cells/ml threshold, showed a little lower accuracy of classification.

The analysis of changes in the loading of first PC factor for group of healthy milk and group of mastitic milk showed, that separation between classes was indirect and based on influence of mastitis on the milk components.

The accuracy of mastitis detection by SIMCA method, based on NIR spectra of milk would allow health screening of cows and differentiation between healthy and mastitic milk samples. Having SIMCA models, mastitis detection would be possible by using only NIR spectra of milk, without any other analyses.