P4-7

Mastitis Diagnostics by Near-infrared Spectra of Cows milk, Blood and Urine Using SIMCA Classification

Roumiana Tsenkova[1*] and Stefka Atanassova[2]

[1]*Faculty of Agriculture, Kobe University, Kobe 657, Japan*
[2]*Department of Physics, Thracian University, Stara Zagora 6000, Bulgaria*

Constituents of animal biofluids such as milk, blood and urine contain information specifically related to metabolic and health status of the ruminant animals. Some changes in composition of biofluids can be attributed to disease response of the animals.

Mastitis is a major problem for the global dairy industry and causes substantial economic losses from decreasing milk production and reducing milk quality. The purpose of this study was to investigate potential of NIRS combined with multivariate analysis for cow's mastitis diagnosis based on NIR spectra of milk, blood and urine.

A total of 112 bulk milk, urine and blood samples from 4 Holstein cows were analyzed. The milk samples were collected from morning milking. The urine samples were collected before morning milking and stored at -35°C until spectral analysis. The blood samples were collected before morning milking using a catheter inserted into the carotid vein. Heparin was added to blood samples to prevent coagulation. All milk samples were analyzed for somatic cell count (SCC). The SCC content in milk was used as indicator of mastitis and as quantitative parameter for respective urine and blood samples collected at same time. NIR spectra of blood and milk samples were obtained by InfraAlyzer 500 spectrophotometer, using a transflectance mode. NIR spectra of urine samples were obtained by NIRSystem 6500 spectrophotometer, using 1 mm sample thickness.

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. SIMCA was implemented to create models of the respective classes based on NIR spectra of milk, blood or urine.

For the calibration set of samples, SIMCA models (model for samples from healthy cows and model for samples from mastitic cows), correctly classified from 97.33 to 98.67% of milk samples, from 97.33 to 98.67% of urine samples and from 96.00 to 94.67% of blood samples. From samples in the test set, the percent of correctly classified samples varied from 70.27 to 89.19, depending mainly on spectral data pretreatment. The best results for all data sets were obtained when first derivative spectral data pretreatment was used. The incorrect classified samples were 5 from milk samples, 5 and 4 from urine and blood samples, respectively.

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

Results from the present investigation showed that the changes that occur when a cow gets mastitis influence her milk, urine and blood spectra in a specific way. SIMCA allowed extraction of available spectral information from the milk, urine and blood spectra connected with mastitis. The obtained results could be used for development of a new method for mastitis detection.