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DETERMINATION OF GLUCOSE, GLUTAMINE, AMMONIA AND ARGININE IN AQUEOUS SOLUTION USING NEAR-INFRARED SPECTROSCOPY AND MULTIVARIATE CALIBRATION METHODS

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The purpose of this project, is to investigate the applicability of Near-Infrared Spectroscopy (NIR) to the on-line monitoring of bioprocesses like cell culture environment and develop multivariate calibration models for real time simultaneous analysis of main components of these environments such as glucose, ammonia, glutamine and arginine.

On-line monitoring of artificial cell culture processes is an intense research area due to the recent developments in biotechnology and pharmaceutical industry. While the cells growing and producing desired bioproducts, they also produce side products, which might be poisonous for the cells at high levels. Therefore, it is important to control the process closely in order to obtain highest yield for the desired product(s) continue the necessary nutrient supply in an optimum way. Also, due to high susceptibility of these processes to contamination, care must be taken when one needs to take a sample to determine the state of the system without interrupting it. For these reasons, NIR spectroscopy coupled with fiber optic on-line monitoring and multivariate calibration offers an opportunity for simultaneous determination of various components in a cell culture environment. Multivariate calibration methods are useful to predict material compositions or in the process of data analysis to monitor and control process.

In this study, quaternary mixtures of glucose, ammonia, glutamine and arginine were prepared in aqueous solution in order to best mimic the real cell culture mediums and NIR spectra of samples were collected between 1000 and 2500 nm. Partial Least Squares (PLS) and Genetic Regression (GR) methods were used to build multivariate calibration models. As a result three sets were employed and calibration models constructed for each constituents.