

Study on the development of a rapid analytical method for
inorganic elements in animal blood
(動物血液の迅速無機元素分析法の開発に関する研究)

Summary of the thesis

Fumihito Takahashi

Laboratory of Biomolecular Chemistry, Nippon Veterinary and
Life Science University
(Teacher: Professor Hiroyuki Tazaki)

In this study, the classification technique that combined the information of multiple elements with multivariate analysis in plural biological samples was examined, as a definitive purpose, we would like to construct of the development procedures such as the discrimination of the fattening condition and disease diagnosis for the domestic animals.

Because biological samples had little quantity which can be obtained, and multiple elements in a sample, inductively coupled plasma mass spectrometry (ICP-MS) that had high sensitivity and can be simultaneously analyzed of multiple elements was used. Also, this study was performed by using semi-quantitative analysis of ICP-MS that can be measured more quickly and easily. The classification technique in this study was performed using linear discriminant analysis (LDA) that the discriminant model was simple as linear function, and that predict accuracy and discriminant accuracy were superior.

As preliminary experiment in this study, multiple elements in plasma (a total of 30 samples) obtained from three groups of lambs by different feed, and multiple elements in serum (a total of 145 samples) obtained from depilation disease dog and normal dog were performed using LDA. As a result, the discrimination rate for lamb groups was 100%, but for dog groups was less than 90%. Because the concentrations of macroelement such as Na, K and Ca were lower than the concentrations of these elements in blood of normal mammals, it was thought to be required for the verification of accuracy by using semi-quantitative ICP-MS analysis.

From the comparison of measurement data for bovine serum by semi-quantitative analysis with full-quantitative analysis that was fully utilized as traditional analysis, and additional recovery tests, it was shown that the measurement data obtained from bovine serum by using semi-quantitative method were accurate. The accuracy could be improved by adding both elements to the calibration standard when performing semi-quantitative analysis for K and Ca.

It was performed to investigate whether the fattening condition and the fattening region could be distinguished by the data from multiple elements in serum (a total of

116 samples) obtained from two groups of cattle by using ICP-MS method that evaluated accuracy. As a result, each of discriminant function can be classified the bovine serum from each group by 100% probability. In this study, same multivariate data was used for the classification of the fattening condition and the fattening period. Although, the combination of the sample was only changed in the same multivariate data group, it was suggested that the utilization of classification responded to each purpose was possible.

Because it was performed to investigate whether the combination of fixed flexible variables would be possible, the serum of cattle groups (a total of 27 samples) was newly measured. And classifying three groups with two above-mentioned cattle in total, it became clear that the discriminant function using 6 elements such as Br, Mo, Rb, Sr, I and Ba had the highest distinction accuracy. To investigate whether discriminant function using 6 elements could be used as flexible technique for all animal species, multiple elements in serum from horses (a total of 90 samples) were measured. As a result, creating the discriminant function to a total of four groups of a horse group and three cattle above-mentioned groups were classified the bovine serum from each group by 98.3% probability.

In future, we would like to promote the development such as the discrimination of the fattening condition and disease diagnosis for domestic animals.