Application Note B-XRD1125

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B-XRD1125 - Quantification of the taste of salt by DD (Direct Derivation) method

Introduction

In addition to NaCl, salt contains mineral compounds having specific tastes. The taste of a salt changes depending on the amount of these mineral compounds, and increasing certain mineral components has an influence on digestion and can interfere with the absorption of other nutrients. Quantitative analysis of the mineral compounds contained in salt is, therefore, a necessary task in food productions to maintain well-balanced flavor, well-being, and functionality. X-ray diffraction is widely used for the quantitative analysis of materials. However, the conventional method is difficult to apply to the quantification of mineral compounds in salt for the following reasons: (1) It is difficult to create calibration curves for the mineral compounds of natural salts; (2) There are few databases containing their crystal structures at the atomic position level; and (3) The water composition is unstable because they tend to dehydrate over time. The direct derivation (DD) method uses only the chemical composition formula and the integrated intensity of the diffraction profile, which is measured with high accuracy, for the quantitative analysis [1]. Slight deviations from the chemical composition do not significantly affect the accuracy of the quantitative analysis. Here we illustrate the quantitative results for mineral compounds of salts by the DD method.

Measurements and results

Figure 1 shows the crystal phases identified from the database using diffraction peak positions and relative integrated intensities, and the quantitative results by the DD method. The commonly known taste of each component is shown in the figure. Rock salt contains various mineral compounds including a bitter component that is not a characteristic of lake salt. From the results for lake and rock salt, it is assumed that the location where the rock salt was collected was a sea in the past. In sea salts, the bitter component is contained in the Ishigakijima salt, but not the Sicily or the Itoman salt. The results of the Itoman and Ishigakijima salt may indicate a geographical difference between Itoman of the main island of Okinawa and Ishigaki Island, or a difference in the degree of purification. In addition, the high $CaSO_4 \cdot xH_2O$ and $MgSO_4 \cdot xH_2O$ content explains why the Ishigakijima salt has a milder and richer taste than Itoman. These results show that the DD method with X-ray diffraction is a useful tool for not only the quantification of taste components but also the criteria of purification.

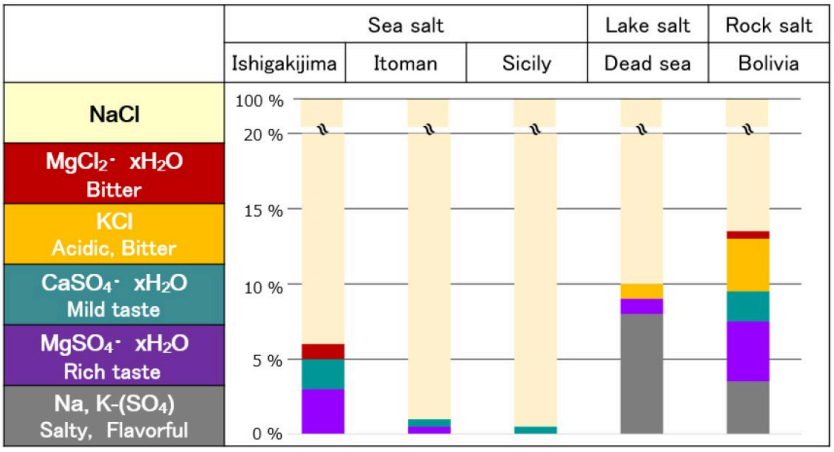

Figure 1: Mineral compounds of salt and quantitative result by the DD method

Reference

(1) H. Toraya: *Rigaku Journal* (English version), **35** (2) (2019) 27-34.

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