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Discrimination of Ecofriendly-rice Authenticity Using bulk C, N, O, and S Stable Isotope Ratios Combined with Chemometric Model

Won-Ryeol Kim[1], Hee-Sung Moon[1], Ji-Ye Kim[1], Ill-Min Chung[1], Seung-Hyun Kim[1]*

[1]Department of Crop Science, Konkuk University, Seoul 05029, Korea.

[Introduction]

Ecofriendly agriculture including organic and pesticide-free has been known to enhance the human health as well as to have a wide range of public interest values like environmental conservation, suggested as an alternative to future agricultures through the production of premium and differentiated agricultural products. Therefore, the correct authentication of ecofriendly agriproducts is highly crucial and challengeable to improve overall food safety and reliability of the national agricultural food certification system. The present study aims to examine bulk stable isotope ratios (SIRs) variations in organic (OR), pesticide-free (PFR), and conventional rice (CR) depending on a degree of milling (brown rice, milled rice, and rice bran). Also, this study reports the feasibility of ecofriendly rice authentication model based on multi bulk SIRs measurements.

[Materials and Methods]

Seven OR and PFR samples officially certified by the pesticide screen test and seven CR samples were collected at retailed markets across Korea in 2022 and each sample was composed of triplicate. The samples collected were lyophilized (-70°C, ≥2 days), pulverized (≤400 μm)and enclosed in a tin or silver capsule for bulk $\delta^{13}C$,$\delta^{15}N$,$\delta^{18}O$and$\delta^{34}S$. Then, the bulk SIRs in rice samples were measured with an elemental analyzer interfaced to an isotope ratio mass spectrometer.

[Results and Discussion]

In a linear discrimination analysis, the bulk SIR-model derived from the milled rice samples appeared the overall classification accuracy of 82.5%, whereas bulk SIR-model from brown rice and rice bran samples showed the poor classification accuracy of < 60%. A support vector machine (SVM) method was further improved the discrimination accuracy of ecofriendly rice authenticity upto 95% in the milled rice. In the SVM model, $\delta^{18}O$ and $\delta^{15}N$ were the most important variables for accurate prediction of OR, PFR, and CR authenticity. Thus, the multi-SIRs-based model can be a promising tool as alternative method for certifying ecofriendly rice authenticity instead of the current pesticide screening test.

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*Corresponding author: E-mail. kshkim@konkuk.ac.kr Tel. +82-02-2049-6163