Cadmium Rapid Test Kit Using Immunochromatography
− Application for Rice −

Background

Cadmium (Cd) is one of the greatest concerns to human health because of its toxicity at low concentration. Especially in Japan, contamination of Cd in rice is a serious issue. We have developed an immunochromatography (IC) device and pretreatment system for purification of Cd from rice. The IC device can detect low concentration Cd and the pretreatment system can purify Cd from other materials that would prevent the Cd measurement on IC. As screening tool to find Cd contaminated rice, the assay system composed of the IC device and the pretreatment system will allow more rapid and easier measurement than conventional instrument analysis.

Objectives

To develop Cd test kit and show that the kit is useful for screening of Cd contaminated rice

Principal Results

1. Cd test kit

We previously reported about Cd assay system composed of IC device and agents for pretreatment. In this study, we improved the sensitivity of the IC device so that it can detect 0.1 ppm Cd in brown rice. And the handling of pretreatment for purification of Cd was also improved by using silica column instead of liquid agents. Schematic diagram of the procedure of the Cd assay is shown in Figure 1. All processes could be completed in about an hour without any special proficiency. Aiming at commercialization of the assay system, we prepared a test kit for rapid analysis of Cd in rice (Figure 2).

2. Test of brown rice

Using the Cd test kit, screening was performed to find Cd contaminated brown rice among 273 samples. Concentrations of Cd of the samples determined by the test kit were compared to results from the most reliable method at present by nitrate degradation of rice and instrument analysis with ICP-AES (Figure 3). High correlation of the two measurements shows the test kit could be a useful screening method. In this screening, the kit could find all positive samples (contains >0.4 mg Kg^{-1} Cd) except for one sample by using a cut-off concentration, 0.28 mg Kg^{-1}, which is 30% below the maximum level for Cd in Japan. This result showed that the Cd test kit satisfied the philosophy of a safety guideline for screening methods *1.

The development of the Cd test kit was carried out in joint research with Kansai Electric Power Co., and EmBio Tec Laboratories Co., Ltd.

Future Developments

We will apply the Cd test kit to other objects, i.e.; other crops, soil and water.

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References

K. Sasaki, et.al., 2005, “Validation of accuracy of enzyme-linked immunosorbent assay in hybridoma screening and proposal of an improved screening method”, Anal Chem, 77: 1933.
K. Sasaki, 2005, “Development of Immunochromatography for Low-Level Cadmium Rapid Test”, CRIEPI’s Annual Research Reports.

*1 : safety guideline for screening methods: Commission directive 2002/69/EC ANNEX II 7, Laying down the sample methods and the methods of analysis for the official control of dioxins and the determination of dioxin-like PCBs in foodstuffs (2002)

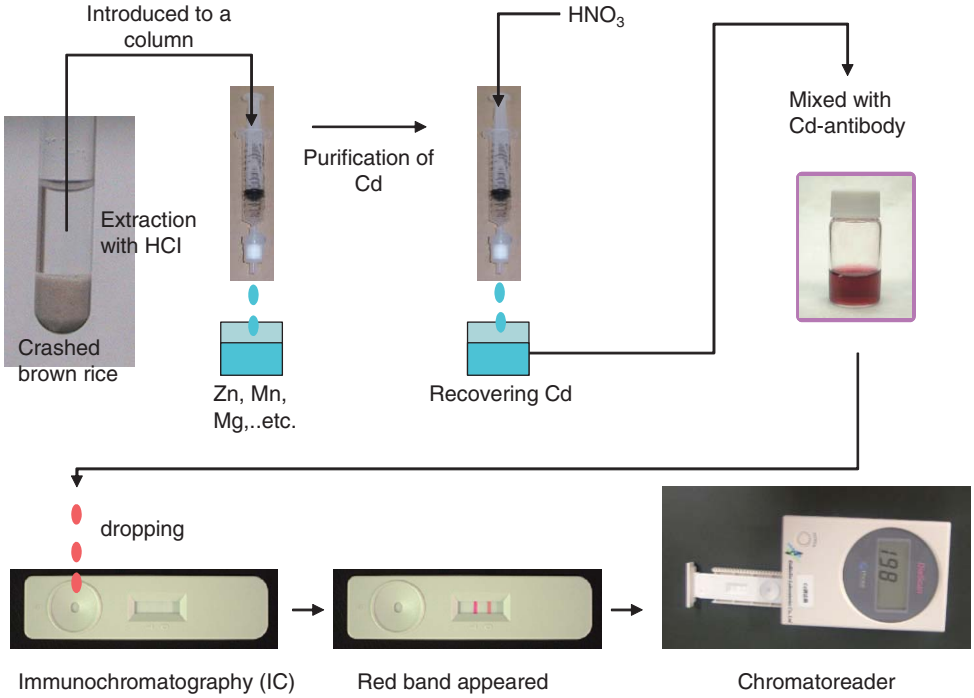

Fig.1 Cd extraction procedure from brown rice and aspects of immunochromatography device

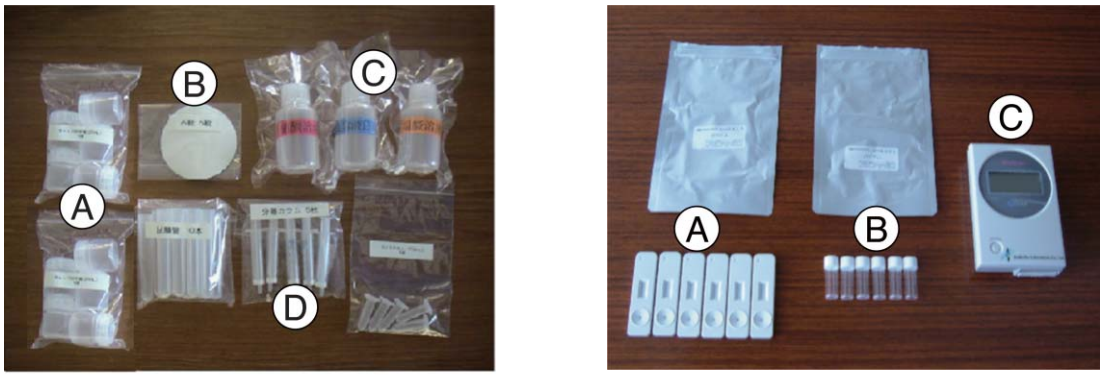

Fig.2 Contents of Cd test kit

Left: Pretreatment kit. A: Bottle, B: Filter paper, C: Reagents, D: Silica column, and others
Right: IC kit. A: IC device, B: Antibody, C: Chromatoreader

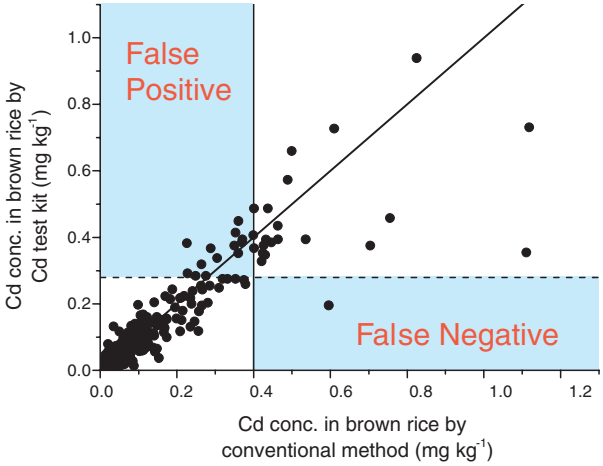

Fig.3 Cd test kit vs. conventional method

Concentrations of Cd from 273 brown rice samples were measured by the Cd test kit and conventional method (HNO_3 treatment and ICP-AES). Cd positive sample is determined if its measured concentration is in upper side of the dotted line that is drawn at 0.28 mg kg^{-1} on the Y axis. To evaluate results of the test kit, solid line is drawn at 0.4 mg kg^{-1} on the X axis. "False positive" is defined that it is determined positive by the kit and is determined negative by ICP-AES. "False negative" is defined in that it is determined negative by the kit and is determined positive by ICP-AES.