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Development of PCR primers designed for sensitive detection of genetically modified potato DNA in processed foods*

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Abstract

The degree of DNA fragmentation in commercially processed potato products was investigated using qualitative polymerase chain reaction (PCR) with primers designed to amplify amplicons of different lengths. The PCR amplified the amplicons up to 301 bp using 25 ng of the DNA purified from snack foods, frozen potatoes, dried potatoes and pre-cooked potatoes. In contrast, the DNA from potato starch and processed potato products, such as vermicelli, were amplifiable up to 51–101 bp. The amplicons with 63 bp using the real-time PCR from the DNA extracted from all processed potato products were detected. The study suggests that the primers that are designed to produce amplicons less than 51–101 bp are required for detecting genetically modified potatoes in processed potato products.

Keywords : processed potato products, genetically modified potato, amplicon length, detection method, real-time PCR

I Introduction

In many countries, such as the European Union, Japan and Korea, risk assessment of genetically modified (GM) material for food is mandatory[1-4]. Japan announced mandatory food safety assessment under the Food Sanitation Law on April 1, 2001[5]. Therefore, any GM foods that are unauthorized are prohibited from sale or import in Japan. Consequently, only authorized GM foods are allowed to be on the Japanese market.

To date, 283 GM foods in eight agricultural products (soy, maize, potato, canola, cottonseeds, alfalfa, sugar beet and papaya) have been authorized in Japan[6]. In the case of GM potatoes, two lines with coleopteran insect resistance (BT-6, SPBT02-05) and six lines with coleopteran insect and viral disease resistance (RBMT21-129, RBMT21-350, RBMT22-82, RBMT15-101, SEMT15-15 and SEMT15-02) were authorized for foods in 2001–2003. Subsequently, more GM potatoes have been worldwide developed. In 2010, the European Union approved commercial planting of GM potato line EH92-527-1 (Amflora) that produces exclusively amylopectin for industrial applications, such as, papermaking[7]. For foods, GM potatoes with low reducing sugar accumulation[8] and with resistance to drought and salinity stresses[9, 10] were developed. These GM potatoes are worldwide still unapproved for foods.

With the increase in consumption of potato products in Japan[11], appropriate management of GM potatoes in the products is required to ensure that the foods are not contaminated by any unauthorized GM potatoes. Therefore, a reliable detection method to detect unauthorized GM potato in processed potato foods is necessary. Conventionally, GM foods have been widely detected by polymerase chain reaction (PCR) using total genomic DNA purified from food products as a template. Since DNA fragmentation is known to occur

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* This paper is part of a series for developing detection methods for detecting genetically modified foods in processed foods.