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Development and evaluation of a novel DNA extraction method suitable for processed foods

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Abstract

For easy and rapid DNA extraction from processed foods, we developed a new silica membrane-based DNA extraction method. DNA extraction conditions suitable for processed foods were examined based on an existing DNA extraction kit for raw grain materials, GM quicker 2. Twenty microliters of proteinase K solution (20 mg/ml) was used for cell lysis and the digestion was carried out at 65°C for 30 min. In addition, 200 µl for wet processed foods or 400 µl for dry processed foods of 2.0 M potassium acetate (pH 3.7) and 600 µl of 8.0 M guanidine hydrochloride were adopted as buffers to achieve good DNA recovery from cell lysates. The novel method was compared to four conventional methods using six kinds of processed foods as analytical samples, i.e., roasted soybean flour, soy milk, miso, canned whole kernel sweet corn, corn snack and dried soup mix. The developed method showed wide applicability to various process foods and it gave sufficient amounts of DNA with high purity. Also, the method was highly user-friendly because of the short handling time, the small number of pipette operations and non-use of toxic organic solvents. The method would be practically used for food testing to detect genetically modified organisms, allergens, pathogenic microorganisms and so on.

Keywords : processed foods, DNA extraction, guanidine hydrochloride, silica membrane, genetically modified organism

I Introduction

DNA analyses based on molecular biological techniques, such as polymerase chain reaction (PCR), are widely performed for food testing to detect genetically modified organisms (GMOs), allergens, pathogenic microorganisms and so on[1-3]. PCR analysis is generally comprised of four steps, i.e., sample grinding as pretreatment, DNA extraction, PCR and electrophoresis analysis. Of these steps, the DNA extraction step tends to be the most labor-intensive. An easy and fast DNA extraction method is highly desirable for efficient food testing. So far, methodologies enabling DNA extraction and purification from biological materials have been established. The Cetyltrimethylammonium bromide (CTAB)-based method[4, 5], the anion exchange resin-based method[6], and the silica membrane-based method[7] are practical, and a variety of DNA extraction kits based on these methods are commercially available.

From the viewpoint of consumer protection, it is important to test end products in food supply chain, many of which are processed foods. DNA in processed foods appears to be fragmented or degraded by physical, chemical, and/or biological factors during processing[8]. Additionally, processed foods are composed of numerous materials and/or ingredients. Hence, successful DNA extraction from processed foods is difficult. In fact, the currently existing DNA extraction methods have several drawbacks, including unstable yield, long handling time, complex operation, and/or use of toxic

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