Amplifying DNA Sequences Representative of Genetically Modified Products Using the Polymerase Chain Reaction

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Society is currently divided on the pros and cons of Genetically Modified (GMO) crops. Having a simple methodology to test for GMO will help the regulators, producers, or consumers to establish better requirements and standards for food prepared from GMO crops. The purpose of this project was to design a cost-effective home-made thermocycler that can amplify and detect the DNA representative of GMO crops through the Polymerase Chain Reaction (PCR). It was hypothesized that it is possible to identify GMO plant-based food if the right PCR protocol is developed. The designed thermocycler consists of an aluminum block, wire mound-resistors to heat the block, a fan assembly to cool the block, a thermocouple to measure the temperature, and an Arduino board. These components were connected together to run the PCR protocol software code. DNA was extracted from common food items available at the grocery stores as well as from a certified non-organic sample. The extracted DNA and the positive-GMO standard were then amplified using both a commercial thermocycler and the home-made thermocycler using two different primers. The primer that helped amplify the photosystem II gene served as the positive control to demonstrate a successful DNA amplification. The primer that helped amplify the cauliflower mosaic virus (CaMV 35S) promoter and the nopaline synthase (NOS) terminator from Agrobacterium tumefaciens served as the GMO indicator. The amplified DNA was then analyzed using agarose gel electrophoresis. The results obtained supported the hypothesis. The home-made thermocycler successfully ran the PCR protocol including 40 cycles of denaturation, annealing, and extension phase. The protocol developed was successful in distinguishing a GMO crop from a non-GMO crop.

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