Detection of pesticide residues in imported and locally-grown perishables through gas chromatography and mass spectrometry

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Abstract

Food safety is a crucial issue worldwide. Consumers frequently complains to relevant authorities about health concerns associated with locally grown vegetables and in particular imported fruits. Pesticide residues in 111 samples, including 6 different crops, i.e., 27 samples of potatoes, 22 samples of oranges, 34 samples of onions, 13 samples of chillies, 12 samples of apples and 3 samples of grapes from selected growing areas and imported consignments at Orugodawatta, Sri Lanka were evaluated against 12 pesticides (Pirimiphos methyl, Dicofol, Pendimethalin, Quinalphos, Pretilachlor, Bifenthrin, Diazinon, Chlorphyrifos, Fipronil, Prothiophos, Oxyfluorfen, Tebuconazole). Fifty four imported samples including 28 samples from India, 14 samples from China, 5 samples from Pakistan, 1 sample from Bangladesh, 1 sample from South Africa, 1 sample from Australia, 2 samples each from USA and France and 57 of local samples were collected during May to December 2017 and samples were extracted according to the quick, easy, cheap, efficient, rugged, safe (QuEChERS) method as per Association of Official Analytical Chemist (AOAC) official method 2007.01, applying a single step buffered acetonitrile extraction. Salting out liquid-liquid partitioning from water in the sample with $MgSO_4$ and clean-up were done by dispersive solid-phase extraction. Concentrated samples were analysed by Gas Chromatography Mass Spectrometry (GC-MS) in selective ion mode (SIM) and the presence of pesticides was confirmed with retention time (RT) and mass spectrum (MS). Matching of RT and MS data of the sample peak with that of the certified reference materials (CRM) gave unambiguous identification of the pesticides presence in the sample. Recovery studies at three spiking concentration levels, i.e. 1 Limit of Quantification (LOQ), 5 LOQ and 10 LOQ varied from 70 % to 110 % with a Relative Standard Deviation (RSD) below 20%. Among the imported samples that were positive for pesticide residues, Diazinon, Chlorphyrifos, Fipronil, Oxyfluorfen, Tebuconazole were detected in 5.6%, 1.9%, 14.8%, 16.7 %, 13.0% samples, respectively and among the local samples that were positive for pesticide residues, Pendimethalin, Pretilachlor, Bifenthrin, Chlorphyrifos, Fipronil, Oxyfluorfen, Tebuconazole were detected in 2.8%, 2.8%, 22.2%, 1.8%, 12.3%, 17.5% and 7.01% respectively. The results revealed that a presence of pesticide residues in both imported and local samples. Continuous monitoring of pesticide residues in imported perishables and those grown in Sri Lanka with spatial tagging need to be executed to obtain sufficient evidences to make conclusive policy decisions to ensure consumer safety.

Key words: Gas chromatography, Mass spectrometry, Pesticide residues, LOQ, QuEChERS

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