Comparative study of QuEChERS methods for monitoring pesticides in milk using GC-MS/MS

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The presence of pesticides in milk is a serious concern at the global level, which can threaten human health. Detection of pesticides in milk is a challenge due to their small concentration and large amounts of other interfering substances that can be co-extracted along with the pesticides. In this study, we have compared two variants (original and acetate) of quick, cheap, effective and safe (QuEChERS) method to evaluate the efficiency and suitability of these methods for the extraction of organochlorine and organophosphorous residues from milk using GC-MS/MS. The acetate method was found to be more efficient in terms of recovery of all the studied pesticides, except monocrotophos. It resulted in good linearity (R^2 > 0.9928% in matrix and >0.9940% in solvent), recovery (71.69%–99.38%) over the range 10–250 ng/ml and precision of RSD% < 20%. This method can be easily applied for the extraction of pesticide residues in milk and its products, and further quantification using GC-MS/MS in the dairy sector.

Keywords: Acetate method, dairy sector, human health, milk, pesticide residue.

bio-accumulate in lipid-rich tissues of animals[3] and are consequently excreted along animal-derived products. Nowadays, organophosphates (OPs) are commonly used pesticides for pest control worldwide, as they are generally less persistent in nature than OCs[5]. Among 13 structural types OPs, the thiono form can lead to much higher mammalian toxicity through active inhibition of acetylcholinesterase[6,7]. Pesticides may have adverse health effects like headache, vomiting, skin irritation, neurological disorders, and cancer ultimately leading to death[8]. Therefore, the pesticide residues must be monitored and analysed at the trace level with high sensitivity and precision. The Codex Commission, European Union (EU) and Food Safety and Standards Authority of India (FSSAI) have specified the permissible level of various pesticides (Table 1). Although application of OC is not legally permitted for agricultural use, pesticides like DDT are still legally used in many countries for vector control, especially where malaria cases are more. Hence monitoring of these pesticide residues is crucial for the safety of food products.

Traditionally, analysis of pesticides has been performed using chromatographic techniques like gas chromatog-