



Review

Recent advances in sample preparation techniques and methods of sulfonamides detection – A review



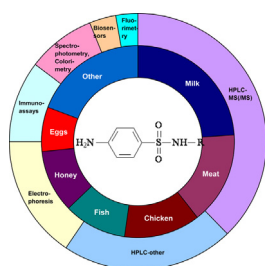
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HIGHLIGHTS

- An overview on recent trends in the sample preparation and determination of sulfonamides is given.
- A comparison of different methods of real samples preparation is made.
- The general chromatographic and other methods of SAs determination are discussed.
- Examples of SAs determination in different matrices are given.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 25 March 2014

Received in revised form 7 August 2014

Accepted 11 August 2014

Available online 17 August 2014

Keywords:

Sulfonamides

Sample preparation

Extraction

Residue determination

Multi-class methods

Liquid chromatography–tandem mass spectrometry

ABSTRACT

Sulfonamides (SAs) have been the most widely used antimicrobial drugs for more than 70 years, and their residues in foodstuffs and environmental samples pose serious health hazards. For this reason, sensitive and specific methods for the quantification of these compounds in numerous matrices have been developed. This review intends to provide an updated overview of the recent trends over the past five years in sample preparation techniques and methods for detecting SAs. Examples of the sample preparation techniques, including liquid–liquid and solid-phase extraction, dispersive liquid–liquid microextraction and QuEChERS, are given. Different methods of detecting the SAs present in food and feed and in environmental, pharmaceutical and biological samples are discussed.

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Abbreviations: Ac, acetate; AD, amperometric detection; ACN, acetonitrile; CE, capillary electrophoresis; DAD, diode-array detector; DLLME, dispersive liquid–liquid microextraction; DSPE, dispersive solid-phase extraction; EDTA, ethylenediaminetetraacetic acid; ELISA, enzyme-linked immunosorbent assays; EMIS, electrochemical magnetoimmunosensor; ESI, electrospray ionization source; EtOH, ethanol; F, formate; FL, fluorescence detection; HPLC, high-performance liquid chromatography; HPLC-MS/MS, high-performance liquid chromatography tandem mass spectrometry; LLE, liquid–liquid extraction; LLME, liquid–liquid microextraction; LOD, limit of detection; LOQ, limit of quantification; MeOH, methanol; MIPs, molecularly imprinted polymers; MRLs, maximum residue limits; MRM, multiple reaction monitoring; MS, mass spectrometry; MS/MS, tandem mass spectrometry; MSPD, matrix solid-phase dispersion; MWCNTs, multi-walled carbon nanotubes; PLE, pressurized liquid extraction; PSA, primary–secondary amine; QqLIT, quadrupole linear ion-trap; QTOF-MS, quadrupole time of flight mass spectrometry; SAA, sulfacetamide; SAM, sulfanilamide; SAs, sulfonamides; SCP, sulfachloropyridazine; SDD, sulfadimidine; SDM, sulfadimethoxine; SDO, sulfadoxine; SDZ, sulfadiazine; SML, sulfametrole; SMP, sulfamethoxypyridazine; SMR, sulfamerazine; SMT, sulfamethizole; SMX, sulfamethoxazole; SMZ, sulfamethazine; SPE, solid-phase extraction; SPME, solid-phase microextraction; SPY, sulfapyridine; SQX, sulfaquinoxaline; SSA, sulfisoxazole; SSZ, sulfasalazine; STZ, sulfathiazole; ToF-MS, time-of-flight mass spectrometry; UHPLC-MS/MS, ultra-high-performance liquid chromatography tandem mass spectrometry; UV, ultraviolet detection.

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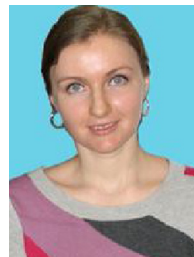
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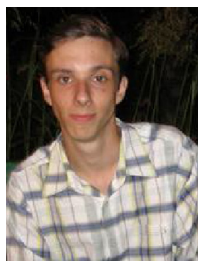
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1. Introduction

The problem of food and environmental sample contamination by veterinary drugs is of great concern [1–3]. There are

systematized data on detection of antibiotics in foods of animal origin [4,5], milk [6], honey [7], fish [8], and feed [9], as well as in environmental samples [10]. According to a previous review [5], sulfonamides (SAs) and fluoroquinolones are among the most

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