STRATEGIES FOR RESIDUE ANALYSIS OF VETERINARY DRUGS IN FOOD OF ANIMAL ORIGIN

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Abstract: The presence of residues and their associated harmful health effects on humans makes the strategies for veterinary drug residue analysis an important measure in ensuring consumer protection. These strategies include sampling and analytical approach. Emphasis is given to sample preparation and method of detection.

Keywords: Residues, veterinary drugs, extraction, detection

INTRODUCTION

Veterinary drugs are generally used in farm animals for therapeutic and prophylactic purposes and they include a large number of different types of compounds that can be administered in the feed or in the drinking water. In some cases, the residues may proceed from contaminated animal feedstuffs. The residues of veterinary drugs or its metabolites in meat and other food of animal origin may cause adverse toxic effects on consumers' health. Other important effects are mainly due to the presence of residual antibiotics and consist in allergic reactions or the selection of resistant bacteria that could be transferred to humans through the food chain. Suspicious carcinogenicity of growth-promoting agents has induced the European Union (EU) to ban these compounds since 1988. To ensure that the analysis of a veterinary drug is performed appropriately, several criteria must be addressed, from selecting the right target matrix, storage, extraction and detection of samples.

SAMPLING

All developed countries have their own guidelines in conducting a residue monitoring program. For the European Union, Commission Directive 96/23/EC has outlined two main groups of compounds that need to be monitored which are Group A consisting of six groups of substances having anabolic effects and unauthorized substances, and Group B being a list of veterinary drugs and contaminants. For Group A substances, surveillance should be aimed at detecting the illegal administration of prohibited substances and the abusive administration of approved substances. Therefore, 50% of the total samples are to be taken from slaughter houses or processing plants and another 50% of the samples are from farms of either animal feed, drinking water, etc. For the compounds in Group B, all samples should be taken from a slaughterhouse or processing plant. The residue control program is established to detect all illegal treatments and to controlling the compliance with the MRLs for residues of veterinary drugs as well as a revealing the reasons for residues occurring in food of animal origin at farms, slaughterhouses and processing plants. Therefore, sampling is required to be unforeseen, unexpected and to be undertaken at no fixed time and on no particular day of the week.

Meaningful residue data can only be obtained provided special care is taken in collecting samples and the collected samples are truly representative. The laboratory usually has no control over the field sampling and must assume that the sample received for analysis is representative of the lot of food sampled. Several edible tissues from food producing animals can be selected for residue surveillance including muscle, liver, kidney, skin and fat, which are normally taken at slaughterhouses. In addition, further sample matrix types can be taken on-farm or at production sites, including milk and eggs. The approach normally adopted in residue surveillance is to target the matrix where residues are most persistent for banned substances and at their highest concentration for licensed veterinary drugs or drugs with maximum residue limit (MRL). Samples for banned substances include plasma/serum, urine, faeces, water, feed, bile and thyroid gland, which can be taken on-farm or at abattoirs. The residue levels are also usually varied according to matrixes and that makes types of samples to be taken also an important factor. Therefore, the technical knowledge of the compound should be known

before sampling is conducted to ensure that the results obtained from the laboratory analysis is valuable and can be used to make an important decision at the administrative level.

SAMPLE PREPARATION AND DETECTION

Preparation of samples for analysis is one of the laboratory's most important tasks and must be entirely within the laboratory's control. Sample preparation is the process of extracting chemical residues from a sample and the subsequent purification of the extract to isolate the residues of interest and remove any matrix interferents that may affect the detection system. It also makes the analytes more suitable for separation and detection. Sample preparation impacts nearly all the later assay steps and is hence critical for unequivocal identification, confirmation and quantification of analytes. Sample preparation typically takes 80% of the total analysis time. Besides wide-spread conventional and automatic solid phase extraction (SPE), liquid-liquid extraction (LLE) and protein-precipitate technique (PP), newly developed sample preparation techniques include solid phase microextraction (SPME), pressurized liquid extraction (PLE), molecularly imprinted polymer (MIP), monolith monolith spin extraction, etc. (Novakova *et. al.*, 2009). The target residue for analysis is not always the parent drug but can be in the form of metabolites. The free parent and metabolite residues are readily extracted by organic solvents, water or aqueous buffers. However, many residues are present in the conjugated forms and require liberation through enzymatic or chemical hydrolysis prior to extraction. Common enzymatic preparations used for hydrolysis include β-glucuronidase and protease. Examples of bound residues are nitrofuran, florfenikol, chloramphenicol, and β-agonist (Kinsella *et al.,* 2009).

In general, analytical methods detection of veterinary drug residues can be classified in two groups; confirmatory and screening. Screening methods are used to detect the presence of a substance or classes of substances while confirmatory methods allow identifying the specific substance and, if necessary, quantify it at the level of interest. Tandem mass spectrometry (MS/MS) has become the method of choice for high sensitivity quantitative analysis of all veterinary medicine drugs and a preferable detector for confirmatory purposes (De Brabander *et al.*, 2009). According to data that are issued by Web of Knowledge Database, LC-MS is the analytical method that is most used (38%), followed by LC-UV (18%), ELISA (18%) and biosensor (8%).The new generation of high-resolution mass spectrometry (MS) equipment permits detection and identification of a priori non-target analytes; this method is highly advantageous for controlling the illegal use of antimicrobials.

CONCLUSION

Strategies for the analysis of veterinary drug residues are governed by integrated factors such as sampling and analytical approach. In the future, analysis of veterinary drugs is foreseen to proceed in the direction of the use of more sophisticated and expensive machines with multi-group analysis.

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