Spectrophotometric determination of ceftiofur hydrochloride in suspensions for veterinary medicine

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Ceftiofur is a third-generation cephalosporin antibiotic with a broad spectrum of bactericidal activity against gram-positive and gram-negative bacteria, including beta-lactamase-producing species and individual anaerobes. It has been approved for use exclusively in veterinary pharmacy. Manufacturers of veterinary drugs in different countries offer drugs based on ceftiofur for parenteral administration in the water-soluble form (based on sodium salt) and suspension (based on hydrochloride), which have some differences in pharmacokinetics.

It is known that the most common method for determining ceftiofur is HPLC, as well as spectrophotometric using derivatizing reagents. It is often more profitable for manufacturers to use spectrophotometry for their routine and control analyzes, given the economic component. Despite the fact that this method has certain limitations. Namely — often lower selectivity for determining the content of the active substance in the presence of excipients of veterinary drugs. The aim of our work was to develop a spectrophotometric method for the determination of ceftiofur in suspensions “Ceftiofur-VS 5%”, “Ceftiomast” (*Vetsintez LLC*), “Cefur” (*OLKAR-AgroZooVetService PC*) and “Cefenil” (*Bayer*) without prior separation of components.

Spectrophotometric studies were performed using a double-beam UV-Visible spectrophotometer *UV-2600 Shimadzu* (Japan) and l cm cuvettes were used. All absorbance measurements were performed at ~20°C.

Method validation for the quantitative determination of ceftiofur was carried out according to ICH Q2R, the State Pharmacopoeia of Ukraine and the European Pharmacopoeia.

The method is based on the ability of ceftiofur solutions to absorb light in the UV region of the spectrum at λ = 291±2 nm. The calculation of the content is proposed to be carried out by the method of standard. The defining stage in the development of the method was sample preparation — the optimal solvent was selected — a mixture of acetonitrile — water (50:50), the conditions of extraction of ceftiofur from the oil base — shaking for 3 min, heating in an ultrasonic bath at 40°C for 15 min, stable — 1 h.

Validation of the developed method on indicators of specificity, linearity, correctness and precision was carried out. The spectrum of the placebo solution lacks all the light absorption maxima characteristic of ceftiofur hydrochloride, which confirms the specificity of the developed technique. The determined parameters of the linear dependence of the analytical signal on the concentration of ceftiofur hydrochloride meet the criteria of linearity, precision and accuracy. The limits of linearity of the developed method are 0.7–17.6 μg×ml^{-1} of ceftiofur at R^2 = 0.9993. The value of Δ_{intra} does not exceed the maximum allowable uncertainty of the analysis. It was calculated when checking the intra-laboratory precision. Compliance of all validation parameters with pharmacopoeial acceptance criteria for tolerances of deviation from the nominal value of B = ±10% is a reason to claim that the developed method is suitable for determining the content of ceftiofur hydrochloride in the test suspension.

Spectrophotometric quantitative determination of ceftiofur in veterinary preparations was developed. The calculated parameters for determination of ceftiofur in drugs by the spectrophotometric method are up to the declared validation criteria — specificity, linearity, accuracy, precision and intra-laboratory precision, thus allowing us to state that the developed method is suitable for quality control of this preparation in accordance with the “Quantitative determination” indicator.

Key words: ceftiofur hydrochloride, suspension, spectrophotometry, validation, veterinary drugs