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Simultaneous kinetic spectrophotometric determination of cephalexin and trimethoprim in pharmaceutical preparation and human urine with the aid of chemometrics

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Abstract

A procedure for the simultaneous kinetic spectrophotometric determination of cephalexin and trimethoprim was described. It was based on the different reaction rate of oxidation of these compounds with yellow ammonium cerous (IV) sulfate in acidic medium and colorless cerous (III) sulfate was produced. The overlapped kinetic data was quantitatively resolved by the use of chemometric methods, partial least squares (PLS), principal component regression (PCR) and radial basis function-artificial neural network (RBF-ANN). The proposed method was also applied to the simultaneous determination of cephalexin and trimethoprim in pharmaceutical preparation and human urine with satisfied results, which compared well with those obtained by HPLC.

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Keywords: Kinetic determination; Spectrophotometry; Chemometrics; Cephalexin; Trimethoprim

Cephalexin and trimethoprim (Table 1) have been widely used in clinical trials for the treatment of respiratory, urinary tract and other infections over several decades [1–3]. It was found that a combination of tablet formulation containing 125 mg of cephalexin and 25 mg of trimethoprim (5:1), each tablet exhibiting a synergistic action against various clinical isolates, could expand antibacterial spectrum and enhance the antibacterial activity [4].

In this work, different kinetic behaviors of cephalexin and trimethoprim, which react with yellow ammonium cerous (IV) sulfate and form colorless product of cerous (III) sulfate were observed. However, only overlapped kinetic data can be obtained and it is difficult to directly determine these two compounds individually. On this basic chemical principle, a differential kinetic spectrophotometric method was developed for the simultaneous determination of these two compounds with the aid of chemometrics, such as principal component regression (PCR), partial least squares (PLS) and radial basis function-artificial neural network (RBF-ANN), which are powerful mathematical tools and are generally used to resolve the overlapped spectra.

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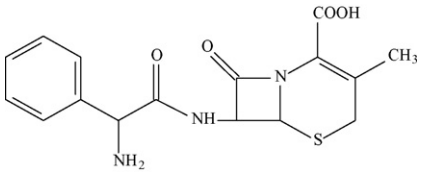
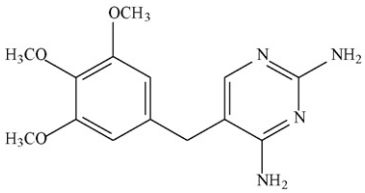
Table 1
Chemical structure of cephalexin and trimethoprim

Pharmaceuticals	Molecular formula	Molecular weight	Chemical structure
Cephalexin	$C_{16}H_{17}N_3O_4$	347.39	
Trimethoprim	$C_{14}H_{18}N_4O_3$	290.32	

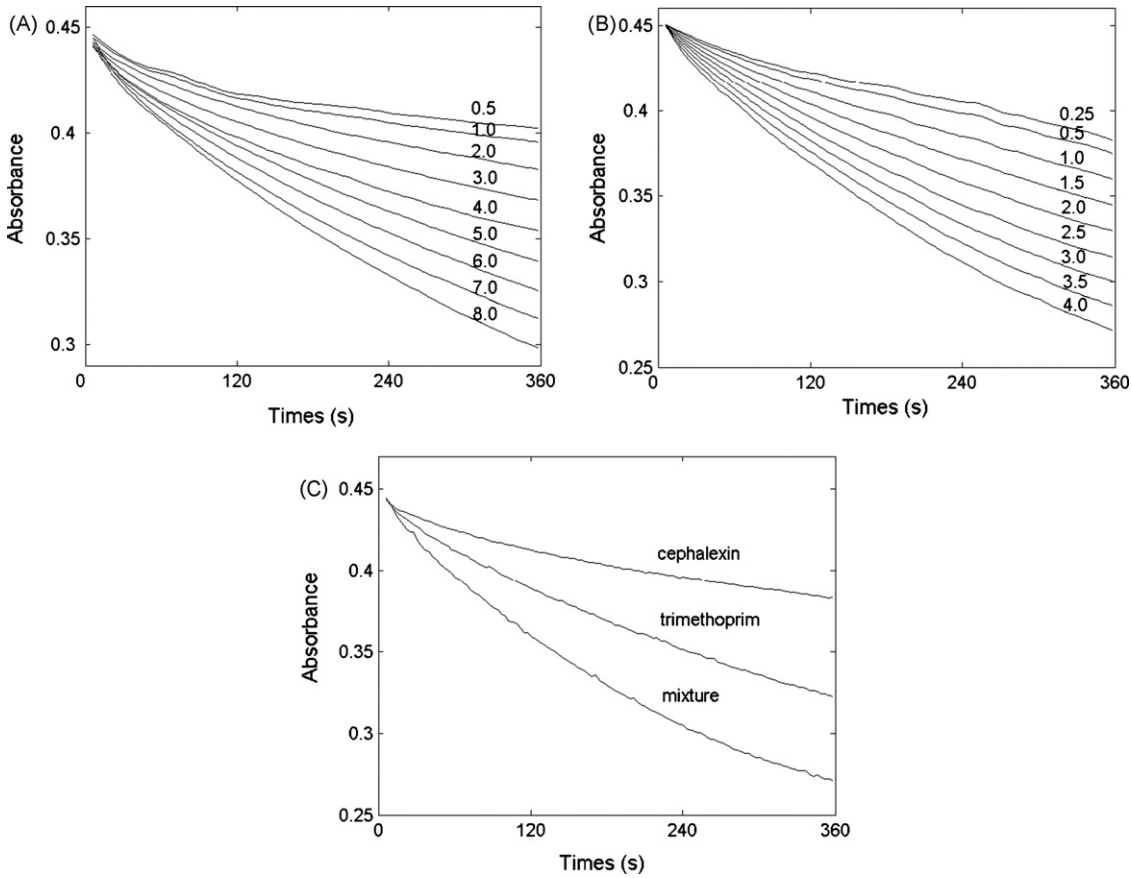


Fig. 1. (A) and (B) are the kinetic profiles for cephalexin and trimethoprim with different concentrations (mg L^{-1}), and (C) are the kinetic data for cephalexin (2 mg L^{-1}), trimethoprim (2 mg L^{-1}) and their mixture. Ammonium cerous sulfate: 160 mg L^{-1}, Sulfuric acid: 0.05 mol L^{-1} and the temperature = 70 °C.

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