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Journal of Pharmaceutical and Biomedical Analysis 43 (2007) 1535–1539
JOURNAL OF PHARMACEUTICAL AND BIOMEDICAL ANALYSIS
www.elsevier.com/locate/jpba

Short communication

Differential pulse cathodic voltammetric determination of floctafenine and metopimazine

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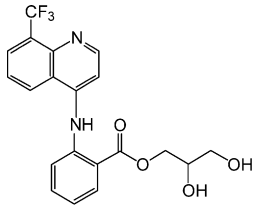
Received 18 June 2006; received in revised form 4 November 2006; accepted 7 November 2006
Available online 11 December 2006

Abstract

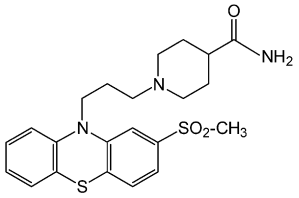
A simple, rapid and sensitive voltammetric method for the determination of floctafenine (FFN) and metopimazine (MPZ) was developed. Well-defined cathodic waves were obtained for both drugs in Britton–Robinson buffer pH 9.0 using the differential-pulse mode at the hanging mercury drop electrode (HMDE). The current–concentration relationship was found to be linear over the ranges 0.4–3.6 and 0.4–2.4 μg ml^{-1} for FFN and MPZ, respectively. The quantification of the two drugs in their pharmaceutical formulations was carried out using the proposed voltammetric method and compared with spectrophotometric analysis data. The mechanisms of the electrode reactions for the two drugs were proposed.

Keywords: Floctafenine; Metopimazine; Differential-pulse; Voltammetric determination; HMDE

1. Introduction



Floctafenine



Metopimazine

Floctafenine (FFN) is a non-steroidal analgesic anti-inflammatory drug, used in musculoskeletal and joint disorders. It is given by mouth for the short-term relief of pain [1]. Few methods have been reported concerning the analysis of FFN. In biological fluids, FFN and its major metabolite, floctafenic acid, have been assayed using HPLC [2,3], derivative synchronous spectrofluorimetry [4] and direct and synchronous spectrofluorimetry [5]. Derivative spectrophotometry [6] has been applied for the determination of FFN and its degradation products. In pharmaceuticals, FFN has been determined using direct and synchronous spectrofluorimetry [5], derivative spectrophotometry [7], and spectrophotometry [8].

Metopimazine (MPZ) is a phenothiazine dopamine antagonist with an antiemetic action. It is used in the treatment of nausea and vomiting, including that associated with cancer chemotherapy [1]. Only single analytical procedure is available in the literature for its analysis. It involves the application of HPLC for the simultaneous determination of MPZ and its acid metabolite in serum [9].

No attempts have yet been made to determine either floctafenine or metopimazine by any electrochemical method. Both drugs contain reducible functional groups which can be the basis for a cathodic voltammetric procedure. The aim of this work is to develop a simple and reliable method for their determination; based on the differential-pulse cathodic voltammetric measurement of the two drugs on the hanging mercury drop electrode (HMDE).

2. Experimental

2.1. Apparatus

The voltammograms were obtained with a Metrohm 693 VA Processor. A Metrohm 694 VA Stand was used in the hanging mercury drop electrode (HMDE) mode. The three electrode system was completed by means of a Ag/AgCl (3 M KCl) reference electrode and a Pt auxiliary electrode. For pH measurements, a Jenway 3310 digital pH meter was used.

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doi:10.1016/j.jpba.2006.11.006

2.2. Materials

All materials used were of analytical reagent grade. High purity distilled water was used allover the study. FFN was kindly donated by Roussel-Uclaf, Romainville, France and MPZ was kindly supplied by Amriya Pharmaceutical Industries, Alexandria, Egypt. Pharmaceutical formulations were purchased from the local market in Egypt. Idarac dispersible tablets (Batch no. 28202), Global Napi Pharmaceuticals, Egypt under licence of Aventis Pharma S.A.E., labeled to contain 200 mg floctafenine micronized per tablet. Vogalene syrup (Batch no. 853903), Amriya Pharmceutical Industries, Alexandria, Egypt under licence of Rhône-Poulenc-Rorer, Paris, France, labeled to contain 5 mg metopimazine per 5 ml.

2.3. Solutions and reagents

FFN stock solution, 400 μg ml^{-1} and MPZ stock solution, 400 μg ml^{-1}, were prepared in methanol. Working solutions of either FFN or MPZ 100 μg ml^{-1} were prepared by dilution of aliquots of the stock solutions in methanol and stored refrigerated at 4 °C.

The studies were carried out in Britton–Robinson buffer (0.04 M in each of acetic, *o*-phosphoric and boric acids) adjusted to the required pH with 0.2 M sodium hydroxide solution.

2.4. Procedure for voltammetric analysis

Aliquots from the working solutions of FFN and MPZ, within the concentration ranges shown in Table 1, were transferred into two separate sets of 10-ml volumetric flasks and completed to volume with Britton–Robinson buffer pH 9.0 for the two drugs. The content of each flask was transferred into the measuring vessel and purged with pure nitrogen for 5 min then the DP voltammograms were recorded using the HMDE as working electrode.

The differential-pulse voltammetric measurements were performed for both drugs with −100 mV pulse amplitude and maximum drop size, 9 (0.6 mm^2 drop area). For FFN assay, the voltammogram was recorded from 0 to −1600 mV at a scan rate of 25 mV/s versus Ag/AgCl reference electrode.For MPZ assay, the voltammogram was recorded from 0 to −2000 mV at a scan rate of 20 mV/s versus Ag/AgCl reference electrode.

2.5. Procedure for pharmaceutical preparations

2.5.1. For FFN

A total of 20 tablets were massed and finely powdered. To an accurately weighed quantity of the powder containing the equivalent of 40 mg FFN, 60 ml methanol were added, stirred for 10 min then filtered into a 100-ml volumetric flask. The residue was washed with two 10 ml portions of methanol and washings were added to the filtrate and diluted to volume with methanol. Working tablet solution was prepared by dilution with methanol to reach a concentration of 100 μg ml^{-1} FFN. Aliquots of the working tablet solution were diluted with Britton–Robinson buffer pH 9.0 to give the concentrations mentioned in Table 1. These final solutions were measured as under procedure for voltammetric analysis.

2.5.2. For MPZ

An accurate volume (1.0 ml) of the syrup was transferred into a 10-ml volumetric flask and diluted to volume with Britton–Robinson buffer pH 9.0. Aliquots of this diluted solution were diluted with the same buffer to reach the concentrations mentioned in Table 1. These final solutions were measured as under procedure for voltammetric analysis.

3. Results and discussion

FFN exhibited a well defined differential pulse cathodic peak in the pH range 5–12, while the cathodic peak of MPZ was exhibited in a narrow pH range of 8–10. The FFN peak lied in the potential range of −1.05 to −1.27 V, while that of MPZ was shown at −1.85 V allover the studied pH range. Maximum peak current for both drugs was obtained using B–R buffer pH 9.0 which can be successfully used to determine FFN and MPZ by applying a differential-pulse voltammetric method and measuring the peak current at peak potential of −1.175 and −1.85 V for FFN and MPZ, respectively (Figs. 1 and 2).

Concerning the reversibility of the electrochemical reduction process, cyclic voltammetry is the best method to determine

Table 1
Experimental and analytical parameters for the differential-pulse voltammetric determination of FFN and MPZ

Parameter	FFN	MPZ
Buffer	B–R pH 9.0	B–R pH 9.0
Pulse amplitude (mV)	−100	−100
Scan rate (mV/s)	25	20
E_p (V)	−1.175	−1.850
Linearity range (μg ml^{-1})	0.4–3.6	0.4–2.4
Regression equation $I_p = a + bC$	$I_p = -1.250 + 133.69C$	$I_p = -37.458 + 2903.81C$
Correlation coefficient (r)	0.99987	0.99983
S_a	3.3176	56.637
S_b	1.5143	37.509
$S_{y/x}$	2.7088	57.622
LOD (μg ml^{-1})	0.0286	0.0724
LOQ (μg ml^{-1})	0.0953	0.2413