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# Study of variation in electrochemical behavior of Ornidazole and levofloxacin simultaneously by differential pulse voltammetry

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**Abstract**
In present study, a successful attempt has been made to study the variation in electrochemical behavior of Ornidazole and Levofloxacin simultaneously using Differential Pulse Voltammetry (DPV) technique. The effect of different pH (2-10) of Britton-Robinson Buffer on voltammogram using 1M KCl as a supporting electrolyte was studied. The optimum pH was found to be pH 7.0. Both Ornidazole and Levofloxacin exhibited reduction cathodic peak at optimum pH with peak potential at -0.46 V for Ornidazole and -1.27 V for Levofloxacin vs. S.C.E. 0.1N $CH_3COOH$ was used as Solvent for the analysis. The variation in electrochemical behavior of Ornidazole and Levofloxacin simultaneously at the optimized pH was studied by varying pulse amplitude and scan rate. The optimized pulse amplitude was found to be 50mV and the optimized scan rate was found to be 20 mV/s.

**Keywords:** Voltammetry, Ornidazole, levofloxacin, electrochemical, pulse amplitude and scan rate

## Introduction
The main objective of study is to provide optimized parameters such as pH, pulse amplitude and scan rate of volammogram for Ornidazole and Levofloxacin simultaneously which can be used in the method development and validation of Ornidazole and Levofloxacin in combined pharmaceutical formulations using Differential Pulse Voltammetry technique.
Individual determination of several drugs by various electroanalytical methods has been reported [1-4]. Simultaneous determination of drugs using conventional methods such as HPLC and spectroscopy have been reported [5-11]. Simultaneous determination of some combinations by electroanalytical method has been reported [12]. For development and validation of any method based on voltammetric technique, the optimization of parameters is very important. The optimized parameters such as pH, pulse amplitude and scan rate can be useful in the simultaneous detection and determination of pharmaceutical formulation by voltammetric technique. It can also be used for devising electo-sensors for those pharmaceutical drugs.
Levofloxacin, $C_{18}H_{20}FN_3O_4$, that is (*S*)-9-fluoro-2,3-dihydro-3-methyl-10-(4-methylpiperazin-1-yl)-7-oxo-7*H*-pyrido[*1,2,3-de*]-1,4-benzoxazine-6-carboxylic acid (Molecular weight:- 361.368 g/mol) It is used in the treatment of bacterial pathogens responsible for respiratory, urinary tract, gastrointestinal, and abdominal infections.
Ornidazole, $C_7H_{10}ClN_3O_3$, that is 1-Chloro-3-(2-methyl-5-nitro-1H-imidazol-1-yl)-2-propanol, an anti-parasitic drug is used as an antiprotozoal drug. (Molecular weight: - 219.626 g/mol) It is highly effective for bacterial and protozoan infections and is available in the tablet form.
Ornidazole and Levofloxacin in combined dosage form is available in the market.

## Materials and Methods
### Electrochemical Workstation

Electrochemical workstation- PG STAT 30 with 663 VA Electrode stand (Metrohm)
It is made up of three electrode system namely-

1) Hanging Mercury Drop electrode (HMDE) as the working electrode
2) Saturated calomel electrode as the reference electrode
3) Platinum electrode as the counter electrode
4) The pH measurements were made with Euiptrances model No. 610.

**Solution preparation**

**Combined stock solution of standard OZ and standard LF (2000 µg/mL + 1000 µg/mL)**

200mg of standard **OZ** and 100mg standard **LF** was accurately weighed and transferred into 100 mL standard flask, about 80 mL of 0.1N acetic acid was added to it. The mixture was sonicated for 10 minutes to dissolve the standards with intermittent shaking. The volume was made up to the 100 mL mark by adding 0.1N acetic acid.

**Preparation of Britton-Robinson buffer**

0.204 g of boric acid, 2.8 mL of (85%) phosphoric acid and 2.3 mL of glacial acetic acid were transferred to three separate 100 mL of volumetric flasks and the volume of each flask was made up to the 100 mL mark with distilled water. These three solutions are then mixed in a beaker to get the solution of pH 1.8. The pH of the resulting solution was adjusted to the desired value by adding required quantity of 1M NaOH.

**Preparation of the supporting electrolyte solution (1M KCl).**

7.46 g of A.R. KCl were weighed and transferred into a 100 mL volumetric flask. About 80 mL of distilled water was added to dissolve the solid completely and then the volume was made up to the 100 mL mark with distilled water.

**Optimization of the pH**

The response of OZ and LF combination was studied over the pH range 2 to 10 in Britton – Robinson buffer. It was observed that peak shape and linearity ($R^2$) was best at pH = 7.0 for both OZ and LF, therefore pH = 7.0 was selected as the optimum pH for this combination.

**Effect of pH on Voltammogram of OZ and LF**

Voltammogram of OZ and LF combination were recorded at different pH (2-10) at fixed scan rate (20 mV/s) and at fixed pulse amplitude (50 mV) for same concentration of OZ and LF using 1M KCl as supporting electrolyte. It was observed that with increase in pH, peak potential shift to more negative potential i.e. right side of Voltammogram for both OZ and LF. For OZ peak height increases with increase in pH till pH = 6 then peak height roughly remains constant with increase in pH. For LF no peak was obtained at pH = 2. First peak appears at pH = 3 for LF. Peak height roughly remains constant from pH = 3.0 to pH = 6, from pH = 7 to pH = 10 there was a continuous decrease in peak height. Figure [1] shows overlaid Voltammograms of OZ and LF combination at various pH (2-10).

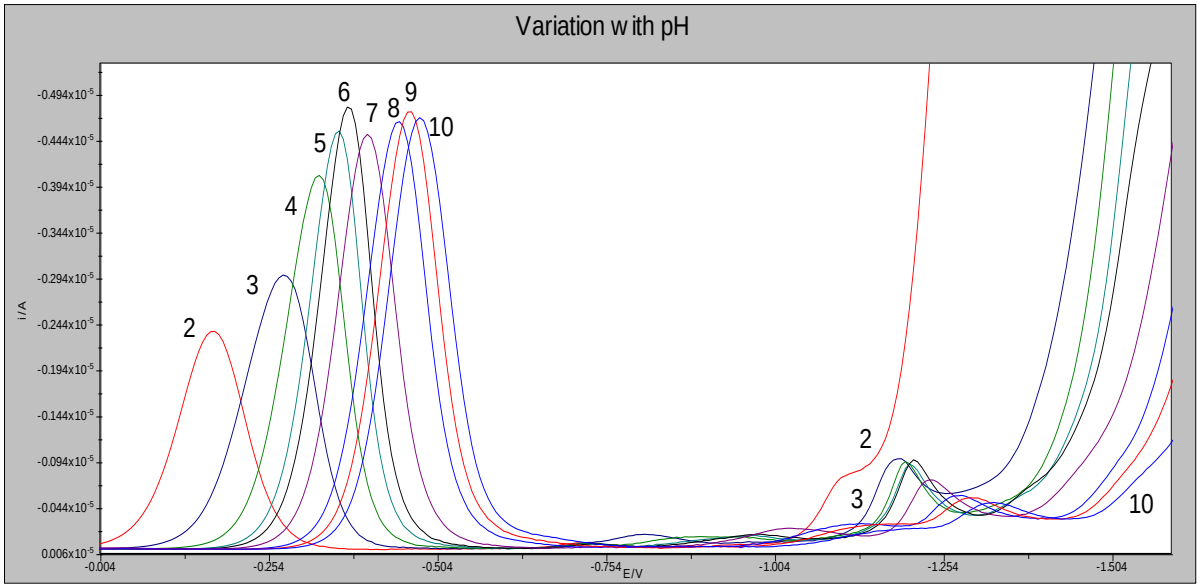


**Fig 1:** Voltammogram of OZ and LF combination at various pH (2 to 10), with pulse amplitude of 50 mV, and the scan rate of 20 mV/s

**Optimization of Pulse amplitude**

The peak current varies linearly with the pulse amplitude in the range of 10mV to 100 mV. The pulse amplitude of 50 mV was chosen for all the analytes, because ($R^2$) values were not satisfactory at higher pulse amplitudes and response was poor at lower pulse amplitudes.

- **Effect of pulse amplitude on voltammogram of OZ and LF**

Voltammogram of OZ and LF combination were recorded at different pulse amplitude (10-100 mV) at fixed scan rate (20 mV/s) and at pH = 7.0 for same concentration of OZ and LF using 1M KCl as supporting electrolyte. It was observed that with increase in pulse amplitude, peak potential shifted slightly towards positive side i.e. towards left side of the voltammogram for both OZ and LF. Shift for LF was more prominent than that for OZ. Peak height increases continuously with increase in pulse amplitude for both OZ and LF. Figure [2] shows overlaid voltammograms of OZ and LF combination at various pulse amplitudes (10-100 mV).

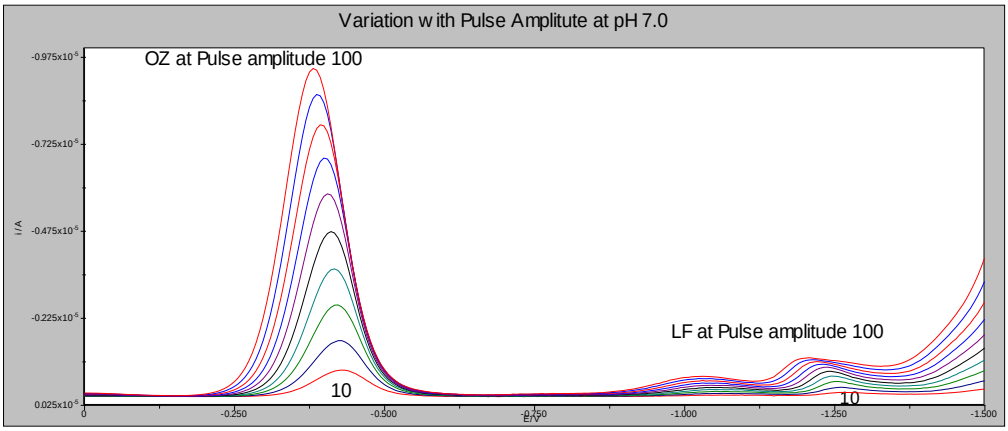


**Fig 2:** Voltammogram of OZ and LF combination at various pulse amplitudes (10 to 100 mV), at pH = 7.0 and at the scan rate of 20 mV/s

**Optimization of Scan rate**

The voltammograms for OZ and LF combination were recorded at various scan rates from 5 mV/s to 35 mV/s with the interval of 5mV/s. At scan rate higher than 20mV/s the peak height increased but peak shape of OZ got distorted. $R^2$ values at a scan rate of 20 mV/s were best so a scan rate of 20mV/s was chosen as the optimum scan rate for the analysis of OZ and LF combination.

**Effect of scan rate on voltammogram of OZ and LF**

Voltammogram of OZ and LF combination were recorded at different scan rate (5-35 mV/s) at fixed pulse amplitude (50 mV) and at pH = 7.0 for same concentration of OZ and LF using 1M KCl as supporting electrolyte. It was observed that with increase in scan rate, there was no shift in peak potential for both OZ and LF. Peak height increases continuously with increase in scan rate for both OZ and LF. Figure [3] shows overlaid voltammograms of OZ and LF combination at various scan rates (5-35 mV/s).

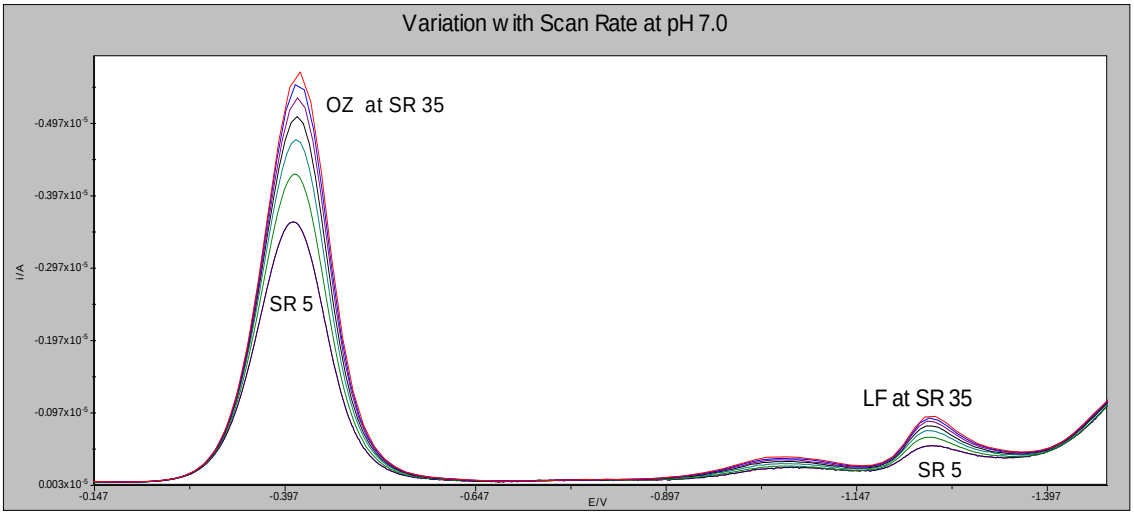


**Fig 3:** Voltammogram of OZ and LF combination at various scan rates (5 to 35 mV/s), at pH = 7.0 and at the pulse amplitude of 50 mV.

**Result and discussion**

**Table 1:** All the optimized voltammetric parameters and instrumental parameters are as follows

| Parameters | Optimum Values |
|---|---|
| Buffer | Britton – Robinson buffer |
| pH | 7.00 |
| Supporting Electrolyte | 1 M KCl |
| Purge Time (Blank) | 180 sec |
| Purge Time (Addition) | 100 sec |
| Equilibration Time | 10 sec |
| Start Potential | 0.0 V |
| End Potential | -1.6 V |
| Pulse Amplitude | 0.05 V |
| Pulse Time | 0.04 sec |
| Voltage Step | 0.008 V |
| Voltage Step Time | 0.4 sec |
| Scan Rate | 0.020 V/sec |

**Conclusion**

The optimized voltammetric parameters such as pH, pulse amplitude and scan rate for Ornidazole and Levofloxacin can be used for any further research involving electrochemistry of Ornidazole and Levofloxacin.

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