Quantitative analysis of cefadroxil in presence of its degradation product by various spectrophotometric techniques

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ABSTRACT
Simple, Accurate, selective and sensitive spectrophotometric methods have been developed and validated for determination of cefadroxil in presence of its alkaline degradation product without preliminary separation. These methods include area under the curve method (AUC), Q-Analysis method (QA), ratio derivative method, Ratio difference method and Mean centering method. These methods were validated and successfully applied to the determination of Duricef® 500mg capsule. The obtained results were statistically compared with those of the reported method by applying t-test and F-test at 95% confidence level and no significant difference was observed regarding accuracy and precision.

INTRODUCTION
Cefadroxil (Figure 1) is (7R)-7-(á-D-4-Hydroxyphenylglycylamino)-3-methyl-3cephem 4-carboxylic acid monohydrate[1], it is indicated for the treatment of patients with infection caused by susceptible strains of the designated organisms in the following diseases: Urinary tract infections, Skin and skin structure infections, Pharyngitis and/or tonsillitis[2]. A wide variety of analytical methods have been reported for the determination of cefadroxil in pure form, in pharmaceutical preparations and in biological fluids. These methods mainly involve spectrophotometry[3-9], fluorimetry[10-13], electrochemically[14], HPTLC[15,16] and (HPLC)[17-20].

MATERIALS AND METHODS

Apparatus
1. Shimadzu UV-Vis. 1650 Spectrophotometer (Japan).
2. Hot plate (Torrey pines Scientific, USA).
3. Jenway, 3510 pH meter (Jenway, USA).
4. Rotatory evaporator (scilogex, USA)

Materials and reagents
1. Cefadroxil powder was kindly supplied by Glaxo Smith Kline Egypt. Haram Giza, Egypt. (B. NO.B339313).
2. Duricef® 500mg capsule. The product of Glaxo Smith Kline Egypt. Haram Giza, Egypt. (B. NO,NI04546), which labeled to contain 500 mg Cefadroxil per capsule.
3. Hydrochloric acid, Sodium hydroxide and Methanol (El-Nasr Co., Egypt).
4. Distilled water

**Standard solutions**

A stock solution of cefadroxil (100 \( \mu g \) ml\(^{-1} \)) was prepared by dissolving 10 mg of cefadroxil in 50 ml of distilled water and complete to 100 ml with distilled water and was further diluted with distilled water as appropriate.

**Degraded sample**

Alkaline-induced forced degradation was performed by adding 100 mg of cefadroxil to 100 ml of 1 N sodium hydroxide and leaving for thirty minutes at room temperature. The solution was then neutralized to pH 7 by addition of 1 N hydrochloric acid solution, evaporated to dryness, the residue was extracted three times with 25 ml methanol, filtered into 100 ml volumetric flask then the volume was adjusted to the mark by the same solvent. The obtained solution was claimed to contain (1 mg ml\(^{-1} \)).

**GENERAL PROCEDURES**

**Methods**

- **Area under the curve method**

  Aliquots from cefadroxil and its degradate working solutions (100 \( \mu g \) ml\(^{-1} \)) equivalent to (50–500\( \mu g \) ml\(^{-1} \)) were accurately transferred into two separate sets of 10-mL volumetric flasks and completed to the mark with distilled Water. The zero order absorbance of each set was scanned in the range of 200–400 nm and stored in the computer. The absorbance were measured at 250 nm (\( \lambda_{max} \) of cefadroxil) and 275.2 nm (iso-absorptive point). the absorptivity values for cefadroxil and its alkaline degrade at the selected wavelengths were calculated. The method employs Q values and the concentrations of the studied drug in the prepared mixed solutions were determined by using the following equations:

\[
C_x = [\frac{(Q_m - Q_y)(Q_x - Q_y)}{Q_x - Q_y}] \times \frac{A_{iso}}{a_{iso}}.
\]

- **Ratio derivative method**

  Aliquots from cefadroxil and its degradate working solutions (100 \( \mu g \) ml\(^{-1} \)) equivalent (50–500\( \mu g \) ml\(^{-1} \)) were accurately transferred into two separate sets of 10-mL volumetric flasks and completed to the mark with distilled water. The spectra of the prepared standard solutions are scanned from 200 - 400 nm and stored in the computer. For the determination of cefadroxil in presence of its degradation product, the stored spectra of cefadroxil are divided by the spectrum of 20 \( \mu g \) ml\(^{-1} \) degradate, to obtain the ratio spectra, then The first derivative of the obtained ratio spectra was employed. The calibration curve was constructed relating the amplitudes of the first derivative values to the corresponding concentrations in \( \mu g \) ml\(^{-1} \) of Cefadroxil at 234 nm, the regression equation was derived.

- **Ratio difference**

  To the ratio spectra obtained as in ratio derivative, The amplitude difference at 251 and 233nm (AP 251 - 233) was plotted against the corresponding cefadroxil concentration in \( \mu g \) ml\(^{-1} \) and the regression equation was computed.

- **Mean centering method**

  The ratio spectra obtained as before in ratio
derivative method were mean centered using MATLAB. The calibration curve was constructed relating the amplitudes of the mean centered values to the corresponding concentrations of cefadroxil at 243 nm. The regression equation was derived.

**Analysis of pharmaceutical preparation**

Five Duricef® 500mg capsule were accurately weighed and finely powdered, then a quantity equivalent to 10 mg of cefadroxil was shaken three times with 25 ml methanol 10 minutes then filtered into 100 ml volumetric flask and the volume was adjusted to the mark with distilled water to obtain a concentration of (100 μg ml⁻¹). The solution was analyzed using the procedure described under previous methods.

**RESULTS AND DISCUSSION**

**Spectral characteristics**

The zero order (D⁰) absorption spectra of cefadroxil (50 μg ml⁻¹), its alkaline degradation product (50 μg ml⁻¹) and their mixture containing equal concentration of them (25 μg ml⁻¹ of each) were recorded against distilled Water as blank over the range of 200 – 400 nm. (Figure 2)

**Area under the curve method**[21]

The proposed area under the curve method has the advantage of being simple and selective for determination of cefadroxil in presence of its alkaline degradation with minimal sample and data manipulation. Selection of the wavelength region to construct AUC method has a great effect on the analytical parameters such as slope, intercept and correlation coefficient. Different wavelength regions were tested where the wavelength ranges 223–233 nm and 265–275 nm were selected which showed good selectivity and percentage recovery (Figure 3).

Area under curve of the absorption spectra in the wavelength ranges 223–233 nm (λ₁ – λ₂) and 265–275 nm (λ₃ – λ₄) were calculated for both cefadroxil and its alkaline degradate in the concentration range of (5–50 μg ml⁻¹) The absorptivity ‘Y’ values of cefadroxil and its alkaline degradate were calculated at each wavelength range. The concentrations of cefadroxil in presence of its alkaline degradate can be obtained by applying Cramer’s rule and matrices in Eqs. (1) and (2).

\[
A_1 = 0.3000 C_{cf} + 0.238 C_D \quad \text{at 223–233 nm (λ₁ – λ₂)}
\]
\[
A_2 = 0.164 C_{cf} + 0.115 C_D \quad \text{at 265–275 nm (λ₃ – λ₄)}
\]

where Cₙ and C_D are the concentrations of cefadroxil and its alkaline degradation in μg ml⁻¹, respectively. 0.3000 and 0.164 are the absorptivity (Y value) of cefadroxil at (λ₁ – λ₂) and (λ₃ – λ₄), respectively. 0.238 and 0.115 are absorptivity (Y value) of cefadroxil degradate at (λ₁ – λ₂) and (λ₃ – λ₄), respectively. A₁, A₂ are the area under curve of sample solutions at the
wavelength range at \((\lambda_1 - \lambda_2)\) and \((\lambda_3 - \lambda_4)\) respectively.

**The graphical absorption ratio (Q-Analysis) method**\(^{[22]}\)

This method depends on the property that for the substance that obeys Beer’s Lambert’s law at all wavelengths, the ratio of absorptivity (or absorbance) values at any two wavelengths are constant, independent of the concentration or path length.

This ratio is referred as Q-ratio\(^{[23]}\). One of the two selected wavelengths is an isoabsorptive point and the other is the wavelength of maximum absorption of the drug. The overlain spectra of cefadroxil, its alkaline degradate and their mixture, (Figure 2), show isoabsorptive points at 275.2 nm. The absorbance values at 275.2 nm \((\lambda_{iso})\) and 250 nm \((\lambda_{max})\) for cefadroxil and its alkaline degradate in the range of 5–50 \(\mu\text{g ml}^{-1}\) were measured, absorptivity coefficients were determined for both and the average values were taken. The values and the absorbance ratio were used to develop the following equation from which the concentration of cefadroxil in the sample mixture can be calculated:

\[
C_x = \left[\frac{(Q_m - Q_y)}{(Q_x - Q_y)}\right] \times \frac{A_{iso}}{a_{iso}}
\]

where \(C_x\) is the concentrations of cefadroxil in \(\mu\text{g ml}^{-1}\); \(Q_m\) is the absorbance of sample at \(\lambda_{250}\)/absorbance of sample at \(\lambda_{275.2}\); \(Q_x\) is the mean of absorptivity of cefadroxil at \(\lambda_{250}\)/mean of absorptivity of cefadroxil at \(\lambda_{275.2}\); \(Q_y\) is the mean of absorptivity of cefadroxil degradate at \(\lambda_{250}\)/mean of absorptivity of cefadroxil degradate at \(\lambda_{275.2}\); \(A_{iso}\) is the absorbance of the sample at \(\lambda_{275.2}\) and \(a_{iso}\) is the mean of absorptivity of cefadroxil at \(\lambda_{250}\).

**Ratio derivative method**\(^{[24]}\)

Upon dividing the absorption spectrum of a compound by a spectrum of the same compound, a straight line of constant amplitude (parallel to the baseline) will result. However, upon dividing the absorption spectrum of a compound (X) by the absorption spectrum of another compound (Y), a new spectrum (ratio spectrum) will result. The amplitude of the first or second derivative of the ratio spectrum at a maximum or a minimum is proportional to concentration of X without interference from Y. In this method, the absorption spectra of cefadroxil were divided by the absorption spectrum of the degradate (20 \(\mu\text{g/ml}\)) as a divisor to get the ratio spectra, as shown in Figure (4). The amplitudes of the first derivative of the ratio spectra at 234 nm are proportional to the concentrations of the drug without interference from its degradate, as shown in Figure(5).

**Ratio difference**\(^{[25]}\)

In this method, the absorption spectra of the drug
Figure 4: Ratio Spectra of cefadroxil (5-50 µg ml\(^{-1}\)) using (20 µg ml\(^{-1}\)) of cefadroxil Degradate as a Divisor and distilled Water as a Blank.

Figure 5: First Derivative of Ratio Spectra of cefadroxil (5-50 µg ml\(^{-1}\)) Using (20 µg ml\(^{-1}\)) cefadroxil Degradate as a Divisor and distilled water as a Blank.
were divided by a suitable absorption spectrum of the degradate (divisor) to get the ratio spectra. Different concentrations of divisor (cefadroxil degradate) are used (10, 20, 25, 30 and 40 µg ml\(^{-1}\)) and the divisor concentration 20 µg ml\(^{-1}\) of cefadroxil degradate is found the best regarding average recovery percent. The difference in peak amplitudes between two selected wavelengths in the ratio spectra is proportional to the concentration of the cefadroxil without interference from its degradate (Figure 4). The method comprises two critical steps, the first is the choice of the divisor. The selected divisor should compromise between minimal noise and maximum sensitivity. The second critical step is the choice of the wavelengths at which measurements are recorded. Any two wavelengths can be chosen provided that they exhibit different amplitudes in the

![Figure 6: Mean Centered Ratio Spectra of cefadroxil (5-50 µg ml\(^{-1}\)) Using (20 µg ml\(^{-1}\)) of its Degradate as a Divisor and distilled Water as a Blank](image)

**TABLE 1: Spectral data for determination of the studied drug by the proposed methods**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>AUC</th>
<th>Q analysis</th>
<th>Ratio derivative</th>
<th>Ratio difference</th>
<th>Mean centering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength (nm)</td>
<td>223-233</td>
<td>250&amp;275.2</td>
<td>234</td>
<td>251&amp;233</td>
<td>243</td>
</tr>
<tr>
<td></td>
<td>265-275</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity range (µg/ml(^{-1}))</td>
<td>5-50</td>
<td>5-50</td>
<td>5-50</td>
<td>5-50</td>
<td>5-50</td>
</tr>
<tr>
<td>LOD (µg/ml(^{-1}))</td>
<td>0.720</td>
<td>0.406</td>
<td>0.256</td>
<td>0.355</td>
<td>0.259</td>
</tr>
<tr>
<td>LOQ (µg/ml(^{-1}))</td>
<td>2.184</td>
<td>1.230</td>
<td>0.778</td>
<td>1.078</td>
<td>0.784</td>
</tr>
</tbody>
</table>

Regression equation*

| Slope (b) | 0.1463 | 0.0115 | 0.0034 | 0.0205 | 0.068 |
| Intercept (a) | 0.2697 | 0.0245 | 0.0045 | 0.0368 | 0.0897 |
| Correlation coefficient (r\(^2\)) | 0.9999 | 0.9998 | 0.9997 | 0.9999 | 0.9998 |

* y = bx + a where y is the response and x is the concentration
### TABLE 2: Intra-day and inter-day accuracy and precision for the determination of the cefadroxil by the proposed methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Conc. (µg.ml⁻¹)</th>
<th>Intra-day</th>
<th></th>
<th>Inter-day</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Found</td>
<td>Accuracy (R%)</td>
<td>Precision (RSD%)</td>
<td>Found</td>
<td>Accuracy (R%)</td>
</tr>
<tr>
<td></td>
<td>Conc. ± SD</td>
<td>100.55</td>
<td>0.045</td>
<td>15.17±0.079</td>
<td>101.11</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A UC</td>
<td>25</td>
<td>100.36</td>
<td>0.943</td>
<td>25.13±0.197</td>
<td>100.52</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>101.01</td>
<td>0.0126</td>
<td>35.51±0.134</td>
<td>101.46</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>100.19</td>
<td>1.204</td>
<td>15.00±0.080</td>
<td>100</td>
</tr>
<tr>
<td>Q A</td>
<td>25</td>
<td>99.30</td>
<td>0.700</td>
<td>24.85±0.050</td>
<td>99.42</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>101.82</td>
<td>0.995</td>
<td>35.28±0.181</td>
<td>100.82</td>
</tr>
<tr>
<td>Ratio derivative</td>
<td>25</td>
<td>99.41</td>
<td>1.183</td>
<td>25.14±0.29</td>
<td>100.58</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>99.57</td>
<td>0.843</td>
<td>35.34±0.16</td>
<td>100.98</td>
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<tr>
<td></td>
<td>45</td>
<td>100.10</td>
<td>1.359</td>
<td>45.04±0.74</td>
<td>100</td>
</tr>
<tr>
<td>Ratio difference</td>
<td>15</td>
<td>99.46</td>
<td>0.822</td>
<td>15.01±0.028</td>
<td>100.11</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>99.35</td>
<td>1.374</td>
<td>24.98±0.212</td>
<td>99.94</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>100.32</td>
<td>1.252</td>
<td>35.24±0.149</td>
<td>100.70</td>
</tr>
<tr>
<td>Mean centering</td>
<td>25</td>
<td>99.66</td>
<td>0.938</td>
<td>25.18±0.352</td>
<td>100.72</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>99.33</td>
<td>0.933</td>
<td>35.35±0.331</td>
<td>101.00</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>99.47</td>
<td>0.447</td>
<td>44.97±0.389</td>
<td>99.93</td>
</tr>
</tbody>
</table>

Ratio spectrum and good linearity is present at each wavelength individually. The selected wavelengths are 251 and 233 nm (ΔP_{251-233 nm}) which gave the best results.

**Mean centering method**[26]

This method depend on the fact that mean centering of constant equal zero.

If the spectrum of a mixture of two compounds X and Y is divided by a standard spectrum of Y as a divisor (Y'), a ratio spectrum will result and therefore:

\[ P = \frac{AX}{AY'} + \frac{AY}{AY'} \]  

(1)

Where, P is the amplitude of the mixture in the ratio spectrum, AX, AY and AY' are the absorbance values of X, Y and divisor (Y'), respectively. Mean centering of equation (1) will lead to:

\[ MC(P) = MC\left(\frac{AX}{AY'}\right) + MC\left(\frac{AY}{AY'}\right) \]  

(2)

Since AY/AY' is a constant value, so its mean centering is equal to zero and therefore:

\[ MC(P) = MC(AX/AY') \]  

(3)

From this equation we note that the mean centering value will related to the X component only. so for determination of cefadroxil in a mixture with its degradation product the mixture was divided by a suitable absorption spectrum of the degradate (divisor) to get the ratio spectra (Figure 4) then the obtained ratio spectra were mean centered using MATLAB and the concentration of cefadroxil was determined by measuring the amplitude at 243 nm (Figure 6).
### TABLE 3: Determination of cefadroxil in presence of its alkaline degradate in their laboratory mixtures by the proposed methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Intact in (µg ml⁻¹)</th>
<th>Degradate in (µg ml⁻¹)</th>
<th>Percent of degradate</th>
<th>Intact found in (µµ ml⁻¹)</th>
<th>Recovery % of intact</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>5</td>
<td>10 %</td>
<td>44.82</td>
<td>99.61</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>15</td>
<td>30 %</td>
<td>34.64</td>
<td>98.99</td>
</tr>
<tr>
<td>AUC</td>
<td>25</td>
<td>25</td>
<td>50 %</td>
<td>24.77</td>
<td>99.10</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>40</td>
<td>80 %</td>
<td>9.88</td>
<td>98.86</td>
</tr>
<tr>
<td>Mean ± SD%</td>
<td>99.14±0.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>5</td>
<td>10</td>
<td>44.78</td>
<td>99.51</td>
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<td>35</td>
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<td>34.84</td>
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<td>100.61</td>
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<td>15</td>
<td>35</td>
<td>70</td>
<td>15.29</td>
<td>101.98</td>
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<tr>
<td>Mean ± SD%</td>
<td>100.41±1.157</td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>45</td>
<td>5</td>
<td>10 %</td>
<td>45.14</td>
<td>100.32</td>
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<td>35</td>
<td>15</td>
<td>30 %</td>
<td>35.14</td>
<td>100.42</td>
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<tr>
<td>Ratio derivative</td>
<td>25</td>
<td>25</td>
<td>50 %</td>
<td>25.44</td>
<td>100.98</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>35</td>
<td>70</td>
<td>15.14</td>
<td>101.76</td>
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<tr>
<td>Mean ± SD%</td>
<td>100.87±0.655</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>45</td>
<td>5</td>
<td>10 %</td>
<td>45.03</td>
<td>100.07</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>15</td>
<td>30 %</td>
<td>34.88</td>
<td>99.67</td>
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<tr>
<td>Ratio difference</td>
<td>25</td>
<td>25</td>
<td>50 %</td>
<td>25.13</td>
<td>100.52</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>40</td>
<td>80 %</td>
<td>10.05</td>
<td>100.58</td>
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<tr>
<td>Mean ± SD%</td>
<td>100.21±0.423</td>
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<tr>
<td>Mean centering</td>
<td>25</td>
<td>25</td>
<td>50 %</td>
<td>24.59</td>
<td>98.39</td>
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<td></td>
<td>15</td>
<td>40</td>
<td>70</td>
<td>14.99</td>
<td>99.99</td>
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<tr>
<td>Mean ± SD%</td>
<td>99.77±1.399</td>
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</table>
VALIDATION OF THE METHODS

Linearity and range

• Area under the curve method

Under the described experimental conditions, the calibration graph for the method was constructed by plotting area under curve versus concentration of cefadroxil in µg ml⁻¹. The regression plot was found to be linear over the range of 5-50 µg ml⁻¹. The linear regression equation for the graph is:

\[ \text{P}_{\text{AUC}} = 0.1463 \times C + 0.2555 \] \( (r^2 = 0.9999) \)

Where P_{AUC} is area under curve at the selected wavelength, C is the concentration of cefadroxil in µg ml⁻¹ and r² is the correlation coefficient, as shown in TABLE 1.

• The graphical absorption ratio (Q-Analysis) method

Linear correlation was obtained between the absorbance at 275.2 nm, versus concentration of cefadroxil in µg ml⁻¹. Good linearity is obtained in the concentration range of 5 - 50 µg ml⁻¹. The linear regression equation for the graph is:

\[ A = 0.0115 \times C + 0.0245 \] \( (r^2 = 0.9998) \)

Where A is the absorbance at the selected wavelength, C is the concentration of cefadroxil in µg ml⁻¹ and r² is the correlation coefficient as shown in TABLE 1.

• Ratio derivative method

Linear correlation was obtained between the absorbance values at 234 nm, against the corresponding concentration of cefadroxil. Good linearity is obtained in the concentration range of (5 - 50 µg ml⁻¹). The corresponding regression equation was computed to be:

\[ A = 0.0034 \times C - 0.0045 \] \( (r^2 = 0.9997) \)

Where A is the absorbance at the selected wavelength, C is the concentration of cefadroxil in µg ml⁻¹ and r² is the correlation coefficient as shown in TABLE 1.

• Ratio difference method

Linear correlation was obtained between the differences in amplitudes at 251 and 233 nm, against the corresponding concentration of cefadroxil. Good linearity is obtained in the concentration range of 5 - 50 µg ml⁻¹. The corresponding regression equation was computed to be:

\[ \Delta P_{251-233} = 0.0205 \times C + 0.0368 \] \( (r^2 = 0.9999) \)

Where ΔP is the amplitude difference at the selected wavelengths (251 & 233), C is the concentration in µg ml⁻¹ and r² is the correlation coefficient as shown in TABLE 1.

• Mean centering method

Linear correlation was obtained between the mean centered values at 243 nm, against the corresponding concentration of cefadroxil. Good linearity is obtained in the concentration range of (5 - 50 µg ml⁻¹). The corresponding regression equation was computed to be:

\[ \text{MCN}_{243} = 0.068 \times C + 0.0897 \] \( (r^2 = 0.9998) \)

Where MCN is the peak amplitude of the mean centered ratio spectrum curve at 243 nm, C is the concentration of cefadroxil in µg ml⁻¹ and r² is the correlation coefficient, as shown in TABLE 1.

Limits of detection and quantitation

The limit of detection (LOD) and the limit of quantitation (LOQ) were calculated according to ICH guidelines[27] from the following equations:

\[ \text{LOD} = 3.3 \times S_a / \text{slope} \]
\[ \text{LOQ} = 10 \times S_a / \text{slope} \]

Where S_a is the standard deviation of y-intercepts of regression lines.

LOD and LOQ values of cefadroxil for each method were listed in TABLE 1.

Accuracy and precision

According to the ICH guidelines[24], three replicate determinations of three different concentrations of the studied drugs in pure form within their linearity ranges were performed in the same day (intra-day) and in three successive days (inter-day) for each method. Accuracy as recovery percent (R%) and precision as percentage relative standard deviation (RSD%) were calculated and results are listed in TABLE 2.

Specificity

The specificity of the proposed methods were assured by applying the laboratory prepared mixtures of the studied drug and its degradate. The results are
TABLE 4: Determination of Cefadroxil in Duricef® 500 Mg capsule by the proposed and reported methods

<table>
<thead>
<tr>
<th></th>
<th>AUC</th>
<th>QA</th>
<th>Ratio derivative</th>
<th>Ratio difference</th>
<th>Mean centering</th>
<th>Reported method[7]</th>
</tr>
</thead>
<tbody>
<tr>
<td>N*</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>X−</td>
<td>99.65</td>
<td>100.45</td>
<td>98.99</td>
<td>100.22</td>
<td>99.88</td>
<td>99.83</td>
</tr>
<tr>
<td>SD</td>
<td>1.502</td>
<td>0.861</td>
<td>1.326</td>
<td>1.162</td>
<td>0.783</td>
<td>1.490</td>
</tr>
<tr>
<td>RSD%</td>
<td>1.507</td>
<td>0.857</td>
<td>1.340</td>
<td>1.160</td>
<td>0.784</td>
<td>1.493</td>
</tr>
<tr>
<td>t**</td>
<td>0.1827 (2.3060)</td>
<td>0.8063 (2.4469)</td>
<td>0.9386 (2.3060)</td>
<td>0.4630 (2.3060)</td>
<td>0.0709 (2.4469)</td>
<td>———</td>
</tr>
</tbody>
</table>

*No. of experimental.; ** The values in the parenthesis are tabulated values of t and F at (p = 0.05)

Pharmaceutical applications

The proposed methods were applied to the determination of the studied drug in (Duricef® 500) capsule. The results were validated by comparison to a previously reported method[7]. No significant differences were found by applying t-test and F-test at 95% confidence level[12], indicating good accuracy and precision of the proposed methods for the analysis of the studied drugs in their pharmaceutical dosage form (TABLE 5).

CONCLUSION

The proposed methods are simple, rapid, accurate and precise and can be used for the determination of Cefadroxil in pure form and in pharmaceutical dosage form as well as in presence of its degradation product.

REFERENCES


[20] V.M. Shinde, C.V. Shabadi; Simultaneous determination of cefadroxil and cephalixin from capsules by reverse phase HPLC. Indian Drugs; 34, 399-402 (1997).


