A REVIEW ON ANALYTICAL METHODS FOR DETERMINATION OF CEPHALOSPORINS AND OXAZOLIDINONES BULK AND IN DIFFERENT DOSAGE FORMS

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ABSTRACT
Cephalosporins and oxazolidinones are very effectively used as antimicrobials. They very potent in nature and used in complex infections cephalosporins work by interfering with cell wall synthesis while oxazolidinone act as potent anti bacterial. They used to treat pneumonia, strep throat, staph infections, tonsillitis, bronchitis, otitis media, various types of skin infections, gonorrhea; urinary tract infections cephalosporin antibiotics are also commonly used for surgical prophylaxis. They are generally administered as tablets as well as through intravenously. This review entails different methods developed for determination of the combination of cephalosporins and oxazolidinones like UV-spectroscopy and liquid chromatography.

KEYWORDS: Cephalosporins, Oxazolidinones, UV-Spectroscopy, High Performance Liquid Chromatography (HPLC).

INTRODUCTION
Cephalosporins have a beta-lactam ring structure that interferes with synthesis of the bacterial cell wall and so are bactericidal. Cephalosporins are derived from cephalosporin c which is produced from cephalosporium acremonium.
Cephalosporins are among the most diverse classes of antibiotics, they are grouped into "generations" by their antimicrobial properties. Each newer generation has a broader spectrum of activity than the one before.

- **The first generation** cephalosporins include: their spectrums of activity are quite similar. They possess generally excellent coverage against most gram-positive pathogens and variable to poor coverage against most gram negative pathogens. The first generation includes: cephalothin, cefazolin, cephalapirin, cephradine, cephalalexin, cefadroxil.

- **The second generation** cephalosporins in addition to the gram positive spectrum of the first generation cephalosporins, these agents have expanded gram negative spectrum. Cefoxitin and cefotetan. Also have good activity against bacteroides fragilis. Enough variation exists between the second generation cephalosporins in regard to their spectrums of activity against most species of gram negative bacteria, that susceptibility testing is generally required to determine sensitivity. The second generation includes: cefaclor, cefamandole, cefonicid, ceforanide, and cefuroxime.

- **The third generation** cephalosporins have much expanded gram negative activity. However, some members of this group have decreased activity against gram-positive organisms. They have the advantage of convenient administration, but they are expensive. The third generation includes: cefcapene, cefdaloxime, cefditoren, cefetamet, cefixime, cefmenoxime, cefodizime, cefoperazone, cefotaxime, cefpimizole, cefpodoxime, ceftibuten, ceftriaxone.

- **The fourth generation** cephalosporins are extended-spectrum agents with similar activity against gram-positive organisms as first-generation cephalosporins. They also have a greater resistance to beta-lactamases than the third generation cephalosporins. Many fourth generation cephalosporins can cross blood brain barrier and are effective in meningitis. The fourth generation includes: cefclidine, cefepime, cefluprenam, cefozopran, cefpirome, cefquinome[1]

Oxazolidinones are mainly used as antimicrobials. The antibacterial effect of oxazolidinones is by working as protein synthesis inhibitors, targeting an early step in volumeing the binding of n-formylmethionyl-trna to the ribosome. Some of the most important oxazolidinones are the last generation of antibiotics used against gram-positive pathogens, including superbugs such as methicillin-resistant staphylococcus aureus. These antibiotics are considered as a choice of last resort where every other antibiotic therapy has failed[2]
Cephalosporins and oxazolidinones are commonly used. Cephalosporins and oxazolidinones are used to treat pneumonia, strep throat, staph infections, tonsillitis, bronchitis, otitis media, various types of skin infections, gonorrhea, urinary tract infections cephalosporin antibiotics are also commonly used for surgical prophylaxis. Cephalexin can also be used to treat bone. Different methods have been developed for determination of like UV-spectroscopy, liquid chromatography (HPTLC and HPLC).

**Reported methods are categorized depending on the following considerations.**
1. Single component analyzed by UV-spectroscopy methods and chromatographic method.
2. Analysis of cephalosporin and oxazolidinones from combination formulation by UV-spectroscopy methods and chromatographic method.

**Table: 1. Analysis of single component cephalosporin and oxazolidinones by UV-spectroscopy methods.**

<table>
<thead>
<tr>
<th>SR. NO</th>
<th>DRUG</th>
<th>METHOD</th>
<th>DESCRIPTION</th>
<th>REF. NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Linezolid in tablets</td>
<td>Ultraviolet spectroscopy</td>
<td>Wavelengths: 590nm&lt;br&gt;Solvent: Distilled Water&lt;br&gt;Linearity range: 5-70 μg/ml&lt;br&gt;Correlation Coefficient: 0.9998</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>Cefuroxime axetil in bulk and pharmaceutical formulation</td>
<td>Ultraviolet spectroscopy</td>
<td>Wavelengths: 281 nm&lt;br&gt;Solvent: 0.1N HCl&lt;br&gt;Linearity Range: 0.4 – 2 mg/ml&lt;br&gt;Correlation Coefficient: 0.998.</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>Ceftriaxone sodium in bulk and sterile formulation</td>
<td>A simple spectrophotometric estimation</td>
<td>Wavelength: 490.4 nm&lt;br&gt;Linearity Range: 5-25 µg/ml&lt;br&gt;Correlation Co-Efficient: 0.998</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td>Cefixime trihydrate</td>
<td>Ultraviolet spectroscopy</td>
<td>Wavelength: 287 nm.&lt;br&gt;Linearity Range: 2-20 μg/ml&lt;br&gt;Correlation Coefficient: 0.999. &lt;br&gt;LOD: 0.053 μg/ml&lt;br&gt;LOQ: 0.159 μg/ml</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>Cefditoren Pivoxil</td>
<td>Spectrophotometric estimation</td>
<td>Wavelengths: Method-I : 450nm&lt;br&gt;Method-II : 510 nm&lt;br&gt;Solvent: Method-I: Hydrochloric acid and Sodium nitrite and Method- II: Ferric chloride and 1,10phenanthroline&lt;br&gt;Linearity Range: Method-I: 50-500 μg/ml and Method-II: 5-50 μg/ml&lt;br&gt;Correlation Coefficient: Method-I : 0.9986 and method-II: 0.998</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Cefpodoxime</td>
<td>UV–visible</td>
<td>Wavelength: 235nm</td>
<td>36</td>
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<tr>
<td>SR. NO.</td>
<td>DRUG</td>
<td>METHOD</td>
<td>DESCRIPTION</td>
<td>REF. NO.</td>
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<tr>
<td>8</td>
<td>Cefixime and linezolid in bulk and tablet</td>
<td>Simultaneous estimation</td>
<td><strong>Method I</strong>: estimation of cefpodoxime proxetil in methanol <strong>Method II</strong>: ion pair complex between cefpodoxime and bromocresol purple in acidic medium and subsequent extraction of ion pair chloroform <strong>Method III</strong>: ion pair complex between cefpodoxime and bromocresol yellow in acidic medium and subsequent extraction of ion pair chloroform</td>
<td>26</td>
</tr>
<tr>
<td>9</td>
<td>Cefuroxime axetil and potassium clavulanate</td>
<td>Simultaneous estimation</td>
<td><strong>Wavelengths</strong>: 284 nm for Cefuroxime axetil and 271 nm for Potassium clavulanate <strong>Solvent</strong>: Methanol <strong>Linearity Range</strong>: 5-50 µg/ml for Cefuroxime axetil and 1-30 µg/ml for Potassium clavulanate <strong>Correlation Coefficient</strong>: 0.999 for Cefuroxime axetil and 0.99 for Potassium clavulanate</td>
<td>27</td>
</tr>
</tbody>
</table>

Table: 2. Analysis of cephalosporin and oxazolidinones in combined dosage form by UV-spectroscopy.
<table>
<thead>
<tr>
<th>Method</th>
<th>Wavelengths</th>
<th>Solvent</th>
<th>Linearity Range</th>
<th>Correlation Coefficient</th>
<th>LOD</th>
<th>LOQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method-I: simultaneous equation method</td>
<td>279 nm for Cefuroxime and 259 nm for Sulbactam</td>
<td>0.01 N NAOH</td>
<td>8-32 μg/ml for Cefuroxime Sodium and 4-16 μg/ml for Sulbactam Sodium</td>
<td>0.999 for Cefuroxime sodium and 0.999 for Sulbactam sodium</td>
<td>0.17 for Cefuroxime sodium and 0.097 for Sulbactam sodium</td>
<td>0.253 for Cefuroxime sodium and 0.33 for Sulbactam sodium</td>
</tr>
<tr>
<td>Method-II: Q-absorptions ratio method</td>
<td>279 nm for Cefuroxime and 272 nm for Sulbactam sodium</td>
<td>0.01 N NAOH</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spectrophotometric method</td>
<td>235 nm for cefpodoxime Proxetil and 298.0 nm for ofloxacin.</td>
<td>methanol: water (70:30)</td>
<td>0.9999 for cefpodoxime Proxetil and 0.9999 for ofloxacin.</td>
<td>0.072 for Cefuroxime sodium and 10.115 for Sulbactam sodium</td>
<td>0.253 for Cefuroxime sodium and 0.33 for Sulbactam sodium</td>
<td></td>
</tr>
<tr>
<td>Simultaneous estimation</td>
<td>251 nm for ceftriaxone sodium and 259 nm for sulbactam sodium</td>
<td>0.1m sodium hydroxide</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Drug Combinations</td>
<td>Methods</td>
<td>Details</td>
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<td>--------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
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</tr>
</tbody>
</table>
| 13  | Ceftriaxone sodium and sulbactam sodium               | Simultaneous equation method                                             | **Linearity range**: 4-20 μg/ml and 2-10 mg/ml  
**Correlation coefficient**: 0.9998 for ceftriaxone sodium and 0.9999 for sulbactam sodium  
**LOD(mg/ml)**: 0.5 for ceftriaxone sodium and 0.25 for sulbactam sodium  
**LOQ(mg/ml)**: 1.5 for ceftriaxone sodium and 2.5 for sulbactam sodium |
| 14  | Cefuroxime axetil and potassium clavulanate           | Simultaneous estimation                                                 | **Wavelengths**: 284 nm for cefuroxime axetil and 271 nm for potassium clavulanate  
**Solvent**: methanol  
**Linearity range**: 55-50 mg/ml for cefuroxime axetil and 1-30 mg/ml for potassium clavulanate  
**Correlation coefficient**: 0.999 for cefuroxime axetil and 0.998 for potassium clavulanate |
| 15  | Levofloxacin hemihydrates cefpodoxime proxetil in tablet | Spectrophotometric estimation                                           | **Wavelength**: 266 nm for levofloxacin hemihydrates and 295.4 nm for cefpodoxime proxetil  
**Solvent**: methanol  
**Linearity range**: 2.5-15 mg/ml for levofloxacin hemihydrates and 4-24 mg/ml for cefpodoxime proxetil  
**Correlation coefficient**: 0.9999 for levofloxacin hemihydrates and 0.9999 for cefpodoxime proxetil |
| 16  | Cefepime and Tazobactam in pharmaceutical dosage form | Method-I: simultaneous equation method  
Method-II: multi component mode method  
**Wavelength**:  
Method-I: 232 nm and 262 nm for cefepime  
Method-II: 232 nm for cefepime and 262 nm for Tazobactam  
**Solvent**: 0.1m NAOH.  
**Linearity range**:  
Method-I: 5-50 mg/ml for cefepime and 2.5-17.5 mg/ml for Tazobactam  
Method-II: 5-50 mg/ml for |
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<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Drug</th>
<th>Method</th>
<th>Description</th>
<th>Ref. No.</th>
</tr>
</thead>
</table>
| 17     | Cefetamet pivoxil hydrochloride and pitavastatin calcium | Spectrophotometric determination | cefepime and 2.5-17.5 mg/ml for Tazobactam

**Wavelength**: 221 nm for cefetamet pivoxil and 240 nm for pitavastatin calcium

**Solvent**: methanol

**Linearity range**: 1-35 mg/ml for cefetamet pivoxil hydrochloride and 1-25 mg/ml pitavastatin calcium,

**Molar absorptivities**: $1.3 \times 10^4$ l mol$^{-1}$ cm$^{-1}$ for cefetamet pivoxil hydrochloride and $2.4 \times 10^4$ l mol$^{-1}$ cm$^{-1}$ for pitavastatin calcium

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**Table 3. Analysis of single component cephalosporin and oxazolidinones by chromatographic method.**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Drug</th>
<th>Method</th>
<th>Description</th>
<th>Ref. No.</th>
</tr>
</thead>
</table>
| 18      | Cefuroxime axetil | HPTLC method     | **Stationary Phase**: Precoated Silica Gel 60F$^{254}$

**Mobile Phase**: Chloroform: Methanol: Toluene (4:2:2V/V/V)

**Wavelength**: 290 nm

**Linearity Range**: 300 To 800 ng/Spot

| 19      | Cephalexin    | HPTLC             | **Stationary Phase**: Aluminum Backed Layer Of Silica Gel 60 F254

**Mobile Phase**: Toluene: Methanol: Tri ethyl amine (6:4:0.1 V/V/V)

**Wavelength**: 254 nm

**Linearity Range**: 500 to 3000 ng/band

| 20      | Cefetamet    | HPTLC method      | **Stationary Phase**: Precoated Silica Gel 60 F254

**Mobile Phase**: Chloroform: Methanol: Toluene (6:1:3 V/V/V)

**Wavelength**: 236 nm

**Linearity Range**: 1 - 5 μg/Spot

**Rf Values**: $0.35 \pm 0.05$

| 21      | Cefotaxime sodium | RP-HPLC method | **Stationary Phase**: SS Wakosil II- C8 Column (250 mm ×4.6 mm I.D., 5 mm)

**Mobile Phase**: Ammonium

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| 22 | Ceftriaxone sodium in pharmaceutical formulations | HPLC method | Acetate Buffer (Ph 6.8) : Acetonitrile (85:15 V/V)  
Wavelength: 252 nm  
Flow Rate: 0.8 ml/min  
Linearity Range: 10-70 mg/ml  
% Recovery Range: 97-102 %.
| 23 | Ceftibuten | RP-HPLC | Stationary Phase: 18 Inert sil Column (150 mm × 4.6 mm, 3 mm)  
Mobile Phase: Degassed Mixture Of Buffer: Methanol (74:26 v/v)  
Wavelength: 241.5 nm  
Linearity Range: 80-120 µg/ml  
Injection Volume: 20 µl  
Flow Rate: 1 ml/min
| 24 | Cefpirome sulfate | RP-HPLC | Stationary Phase: YMC ODS C18 Column  
Mobile Phase: Acetonitrile and Ammonium acetate Buffer (Ph:6.8) (10:90 V/V)  
Wavelength: 262 nm  
Linearity Range: 0.05-0.15 µg/ml  
% Recovery: 99.94%  
Flow Rate: 1 ml/min
| 25 | Linezolid | HPLC (in vivo in-vitro study) | Stationary Phase: Reversed Phase C8 Column  
Mobile Phase: Water : Acetone (80:20V/V)  
Wavelength: 251 nm  
Linearity Range: 0.5-40 µg/ml
| 26 | Linezolid in pharmaceutical dosage form | RP-HPLC | Stationary Phase: C-18 Column  
Mobile Phase: Water : Methanol (50:50V/V)  
Wavelength: 254 nm  
Linearity Range: 001-3.4 mg/ml  
Flow Rate: 1.0 ml/min
Cefquinome sulphate in suspension | RP-HPLC | **Stationary Phase:** An XTERRA9(R) analytical column C18 column(250 X 4.6mm X 5 m)  
**Mobile Phase:** Buffer 0.02M Ammonium Acetate in Water : Acetonitrile Mixture (50:50V/V)  
**Wavelength:** 234 nm  
**Linearity Range:** 4-48 µg/ml  
**Flow Rate:** 1.0 ml/Min  
**Retention Time:** 6.06 min  
**Solvent:** Acetonitrile and Water (50:50) |
---|---|---|
Cefuroxime axetil in human plasma | HPLC | **Stationary Phase:** Guard Column C18 (4.0 *2 mm,4µ)  
**Mobile Phase:** 8.5% Acetonitrile in 0.07M Potassium Di hydrogen Phosphate Solution (PH=3.0)  
**Wavelength:** 275 nm  
**Linearity Range:** 0.2 -12 µg/ml |
Ceftibuten | RP -HPLC | **Stationary Phase:** YMC ODS-A-C18 Column  
**Mobile Phase:** Acetonitrile and Ammonium Acetate Buffer (Ph 6.8) (10:90 V/V)  
**Wavelength:**262 nm  
**Linearity Range:** 0.05-0.15 mg/ml  
**Flow Rate:** 1.0 ml/min  
**Solvent:** Water |

Table: 4. Analysis of cephalosporin and oxazolidinones in combined dosage form by chromatographic methods.

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>DRUG</th>
<th>METHOD</th>
<th>DESCRIPTION</th>
<th>REF. NO.</th>
</tr>
</thead>
</table>
| 30      | Cefixime and Azithromycin | RP-HPLC | **Stationary Phase:** RP-C18 Column  
**Mobile Phase:** 0.02M Potassium Di hydrogen Phosphate (KH2PO4): Acetonitrile ( 65:35V/V)  
**Wavelength:** 227 nm.  
**Linearity Range:** 40-60 mg/ml for Cefixime and 50-70 µg/ml for Azithromycin  
**Coefficient Correlation:** 0.998 for Cefixime and 0.999 for Azithromycin  
**Injection Volume:** 20 ml | 25 |
|        | Cefepime hydrochloride and Tazobactam | RP-HPLC | **Stationary Phase:** Princetonspher-100 C-18 Column (250 mm × 4.6 Mm I.D., 5 µm)  
**Mobile Phase:** 25 mm Potassium Di | 33 |
Linearity Range: 4-24 µg/ml for Cefepime hydrochloride and 0.5-3.0 µg/ml for Tazobactam sodium  
Coefficient Correlation: 0.9977 for Cefepime hydrochloride and 0.9974 for Tazobactam sodium |
|------|---------------------------------------------------------------|
| 31   | Sulbactam and Cefoperazone in dosage form and in plasma | Stationary Phase: Phenomenex Phenyl Hexyl Column (250 mm x 4.6 mm, 5 µm)  
Mobile Phase: Acetonitrile : Phosphate Buffer (SodiumPhosphate-20 mm) (65:35 V/V)  
Wavelength: 190 nm.  
Linearity Range: 0-50 mg/ml for Sulbactam and 10-50 mg/ml for Cefoperazone  
Flow Rate: 1 ml/min |
| 31   | Cefpodoxime Proxetil and Dicloxacillin Sodium in tablets | Stationary Phase: Kromasil C 18 Analytical Column  
(250x4.6 mm, 5 mm)  
Mobile Phase: Acetonitrile: Methanol: Tri fluoro acetic acid (0.001%) With PH 6.5 (30:50:20 V/V/V)  
Wavelength: 235 nm  
Linearity Range: 0.5-20 mg/ml for Cefpodoxime Proxetil and 5-50 mg/ml for Dicloxacillin Sodium  
Correlation Coefficient: 0.996 for Cefpodoxime Proxetil and 0.9987 for Dicloxacillin Sodium  
LOD(mg/ml): 0.0726 for Cefpodoxime Proxetil and 0.3685 for Dicloxacillin Sodium  
LOQ(mg/ml): 0.220 for Cefpodoxime Proxetil and 1.116 for Dicloxacillin Sodium |
| 33   | Cefpodoxime Proxetil and Clavulanic Acid in tablets | Stationary Phase: Pursuit C-18 Column  
(250 Mm X 4.6 mm I.D., 5 mm) Zorbax Eclipse XDB 5 M C18 (150x4.6 mm) Column  
Mobile Phase: Acetonitrile : 50 mm Potassium Di hydrogen Phosphate Buffer (Ph 3.0) (70:30 V/V)  
Wavelength: 228 nm.  
Linearity Range: 70-350 mg/ml for Cefpodoxime Proxetil and 20-100 mg/ml for Clavulanic Acid  
Coefficient Correlation: 0.998 for Cefpodoxime Proxetil and 0.999 for... |
<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
<th>Method</th>
<th>Stationary Phase</th>
<th>Mobile Phase</th>
<th>Wavelength</th>
<th>Linearity Range</th>
<th>Flow Rate</th>
<th>Coefficient Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>Clavulanic Acid</td>
<td>RP-HPLC</td>
<td>Hyper Chrom ODS-BP C18 Column (200 mm x 4.6 mm, 5.0 μm)</td>
<td>Potassium Di hydrogen Orthophosphate and Acetonitrile (90:10 V/V)</td>
<td>230 nm</td>
<td>140-250 μg/ml for Ceftriaxone Sodium and 75 To 160 mg/ml for Sulbactam Sodium</td>
<td>1.0ml/min</td>
<td>0.9978 for Ceftriaxone sodium and 0.9999 for Sulbactam Sodium</td>
</tr>
<tr>
<td>35</td>
<td>Ceftriaxone sodium and Tazobactam sodium</td>
<td>RP-HPTLC</td>
<td>Silica Gel F254</td>
<td>Methanol, Chloroform, Triethyl amine, And Distilled Water (5:5:0.2:0.4 V/V/V/V)</td>
<td>245 nm</td>
<td>800-2800ng/spot for Ceftriaxone Sodium and 100-300 ng/Spot for Tazobactam Sodium</td>
<td>1.0 ml/min</td>
<td>0.53 for Ceftriaxone Sodium and 0.71 for Tazobactam Sodium</td>
</tr>
<tr>
<td>36</td>
<td>Cefoperazone and sulbactam in parenteral preparation</td>
<td>RP-HPLC</td>
<td>Kromasil C8 (15 Cm x 4.6 mm , 5μ)</td>
<td>Phosphate Buffer Ph 3.5 Adjusted With Ortho Phosphoric Acid and Acetonitrile(35:65)</td>
<td>215 nm</td>
<td>50 - 250 mg/ml for Cefoperazone and 100 - 500 mg/ml for Sulbactam</td>
<td>1 ml / min</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Cefepime Hydrochloride and Tazobactam sodium in bulk and Pharmaceuticals</td>
<td>RP-HPLC</td>
<td>Princeton Spher-100 C-18 Column (250 mm x 4.6 mm I.D.,5 mm)</td>
<td>Potassium Di hydrogen Phosphate Buffer, Ph 6.2 And Acetonitrile (94:6, V/V)</td>
<td>210 nm</td>
<td>4-24 mg/ml for Cefepime Hydrochloride and 0.5-3.0 mg/ml for Tazobactam Sodium</td>
<td>1 ml/min</td>
<td>0.9977 for</td>
</tr>
<tr>
<td>Page</td>
<td>Method</td>
<td>Stationary Phase</td>
<td>Mobile Phase</td>
<td>Wavelength</td>
<td>Linearity Range</td>
<td>Solvent</td>
<td>Flow Rate</td>
<td>Correlation Coefficient</td>
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</tr>
<tr>
<td>38</td>
<td>RP-HPLC</td>
<td>Cefepime HCl and Tazobactam sodium in Injection dosage form</td>
<td>Nertsil-Ods C18 Column (250mm×4.6mm, I.D.5 µ)</td>
<td>207 nm</td>
<td>0-140 µg/ml for Cefepime HCl and 7.5-17.5 mg/ml for Tazobactam Sodium</td>
<td>Water</td>
<td>1ml/min</td>
<td>0.9974 for Cefepime HCl and 0.9974 for Tazobactam Sodium</td>
</tr>
<tr>
<td>39</td>
<td>RP-HPLC</td>
<td>Cefuroxime axetil and potassium clavulanate in pharmaceutical dosage form</td>
<td>Micros orb MV 100-5 C-18 Column (250mm×4.6mm,5µm)</td>
<td>230 nm</td>
<td>7.5-17.5 mg/ml for Cefuroxime axetil and 7.5-17.5 mg/ml for Tazobactam Sodium</td>
<td>Methanol: Water (90:10 V/V)</td>
<td>20 µl</td>
<td>0.991 for Cefuroxime axetil and 0.991 for Tazobactam Sodium</td>
</tr>
<tr>
<td>40</td>
<td>RP-HPLC</td>
<td>Linezolid and cefixime trihydrate in tablet</td>
<td>ACE5 C18 (150ml×4.6ml,5mcm)</td>
<td>230 nm</td>
<td>23.33-40 mg/ml for Linezolid and 70 –120 mg/ml for Cefixime Trihydrate</td>
<td>Methanol: Water (70:30v/v)</td>
<td>1.2ml/min</td>
<td>0.9987 for Linezolid and 0.9998 for Cefixime Trihydrate</td>
</tr>
<tr>
<td>41</td>
<td>RP-HPLC</td>
<td>Cefuroxime axetil and its impurities</td>
<td>Lunn c-18 column</td>
<td>278 nm</td>
<td>50-500 µg/ml</td>
<td>Water and methanol</td>
<td>3.30 min For Linezolid 8.07 min For Cefixime Trihydrate</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>RP-HPLC</td>
<td>Cefoperazone and Tazobactam in marketed formulation</td>
<td>0.02 Mm Potassium Di hydrogen Phosphate Buffer, PH 4.0 and Methanol (80:20, V/V)</td>
<td>250 nm</td>
<td>20-60 mg/ml for Cefoperazone (CEFO) and 2.5-7.5 mg/ml for Tazobactam</td>
<td>Thermo BDS Hypersil C18 Column (250 × 4.6 Mm I.D.5 mm)</td>
<td>1.0ml/Min</td>
<td>0.9987 for Cefoperazone and 0.9998 for Tazobactam</td>
</tr>
</tbody>
</table>
CONCLUSION
This review represents the reported spectrophotometric and chromatographic methods developed and validated for determination of cephalosporin and oxazolidinones. According to the literature review it can be concluded that for cephalosporin and oxazolidinones in single component and its combination with other drug spectroscopy and chromatography methods available. This all methods are found to be simple, accurate, economic, precise, and reproducible in nature. Comparing various validation parameters of already reported methods, it can be concluded that different analytical methods like spectrophotometric, HPTLC and HPLC can be developed for cephalosporin and oxazolidinones showing its simplicity, sensitivity (low LOD and LOQ values) linearity and accuracy. Most of the researchers have used the reversed-phase HPLC and UV absorbance detection because this provided with best available reliability, repeatability, analysis time and sensitivity. Most common combination of cefpodoxime proxetil and ofloxacin but there is no reported method for cefuroxime axetil and linezolid combination. There is a great scope for development of newer analytical methods for latest drugs such as cefuroxime axetil and linezolid combination.

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REFERENCE
34. Pramod L. Ingale, “simultaneous estimation of cefuroxime axetil and potassium clavulanate analytical method development and validation”, Der Pharma Chemical, 2013; 5.