A REVIEW ON CHROMATOGRAPHIC AND SPECTROPHOTOMETRIC METHOD FOR ESTIMATION OF DPP-IV INHIBITOR DRUGS IN BULK AND IN DIFFERENT DOSAGE FORMS

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Abstract
Dipeptidyl peptidase-4 inhibitors (DPP-4s), also called as gliptins, are a relatively new class of drugs to treat type 2 diabetes. Their mechanism of action is to improve insulin secretion from the Beta-cells of the pancreas as a result of an increase in blood sugar and simultaneously decrease glucagon output from the alpha-cells of the pancreas, which in turn decreased hepatic glucose output. It also opens new gateways for a personalized medicine in patients with Type 2 diabetes and it also offers various merits when compared to other glucose-lowering agents. Despite they have been commercialized since a few years only, available data obtained in randomized controlled trials are of better quality compared to those available with classical glucose-lowering agents, especially in elderly people who have suffering from renal impairment or at high cardiovascular risk and patients at higher risk of hypoglycemia. But, their remaining uncertainties and controversies that should be resolved by further ongoing large prospective controlled trials and increasing clinical experience combined with a careful post-marketing surveillance. This article narrate different chromatographic (HPLC, HPTLC, UPLC, LC) & different spectrophotometric method (UV) for Gliptins class single drug as well as combination with other drug.

Key Words:
Dipeptidyl peptidase-4 inhibitors (DPP-4s), UV, HPLC (High Performance Liquid Chromatography), HPTLC (High Performance Thin Layer Chromatography), UPLC (Ultra Performance Liquid Chromatography), LC (Liquid Chromatography)

Introduction
DPP-4 inhibitors work by blocking the action of DPP-4, an enzyme which destroys the hormone incretin which help the body produce more insulin only when it is needed and reduce the amount of glucose being produced by the liver
when it is not needed [1]. The change in glucagon correlates linearly with improvement in glucose tolerance. Since these drugs improve insulin secretion in response to an increase in blood glucose, it seems appropriate to pair them with drugs that have a different mechanism of action, such as insulin sensitizers or Metformin [2]. During short-term clinical trials, no increased risk of acute pancreatitis has been observed with Sitagliptin, Vildagliptin, Saxagliptin, Alogliptin, and Linagliptin [3]. Linagliptin (Trajenta) is still included in black triangle scheme, while Sitagliptin (Januvia), Saxagliptin (Onglyza) and Vildagliptin (Galvus) were removed from the black triangle list in 2012 [4]. 

DPPIV inhibitors (Gliptins) include Saxagliptin, Linagliptin, Alogliptin, Sitagliptin, and Vildagliptin. This Review Article offers an overview of various analytical methods for estimation of DPP-IV Inhibitors. Different methods have been developed for estimation of Gliptins like UV-Spectroscopy, Liquid Chromatography, HPTLC and RP-HPLC. Reported methods are categorized depending on the following considerations:

1. Single component DPP-IV Inhibitors analyzed by UV-Spectroscopy methods and Chromatographic method.

2. Analysis of DPP-IV Inhibitors with combination with other class drugs (More preferably Sulfonyl Urea) by UV-Spectroscopy methods and Chromatographic method

Table-1: Analysis of single component DPP-IV Inhibitors by UV-Spectroscopy methods.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Drug</th>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1       | Validated spectroscopic method for estimation of Saxagliptin in pure and from tablet formulation | Spectroscopic method | Detection wavelength: 208 nm in Methanol.  
Linearity range: 5-40 µg/ml.  
Co-relation Co-efficient: 0.999.  
LOD and LOQ: 0.0607 µg/ml and 0.1821 µg/ml respectively. |
| 2       | Estimation of Sitagliptin from bulk and Pharmaceutical formulation. | UV- spectrophotometric method  
First order derivative | λ max in Water & Methanol: 267  
First order derivative λ max: 275nm  
Linearity range: 10-60 µg/ml  
Correlation coefficient: 0.998  
% Recovery range: 98.54%– 99.98%  
% RSD: <2% |
| 3       | Spectrophotometric Methods Based on Charge Transfer Complexation Reactions for the Determination of Saxagliptin in Bulk and | Spectrophotometric Method: Charge Transfer Complexation | Charge transfer complexes of Saxagliptin: 2, 3-dichloro-5, 6-dicyano-1, 4-benzoquinone (DDQ) and 7, 7, 8, 8-tetracyanoquinodimethane (TCNQ).  
Linearity ranges: 50-300 µg/ml and 10-110 µg/ml with DDQ and TCNQ, respectively. |
4. A new UV Method for Determination of Linagliptin in bulk and pharmaceutical dosage form

**UV Method**

- **Maximum absorption:** 241 nm
- **Mobile Phase:** Methanol and water 50:50.
- **Linearity range:** 10.0-35.0 µg/ml.
- **$R^2$:** 0.999
- **%RSD:** <2%

**Table-2: Analysis of DPP-IV Inhibitors with combination with other drugs by UV spectroscopy.**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Drug Description</th>
<th>Method</th>
<th>Description</th>
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<tbody>
<tr>
<td>6.</td>
<td>Simultaneous estimation of Sitagliptin and Pioglitazone and study of interference of various excipients on this combination of drugs</td>
<td>UV-spectroscopic method</td>
<td>Absorbance maxima: 267nm and 269nm for Sitagliptin and Pioglitazone as respectively. Correlation coefficient: 0.9999 Concentration range: 20-120µg/ml for Sitagliptin and 2.5-25µg/ml for Pioglitazone respectively. Mean percent recovery: 101.3±0.88 and 94.5±3.47 for Sitagliptin and Pioglitazone respectively.</td>
</tr>
<tr>
<td>7.</td>
<td>Simultaneous UV Spectrophotometric Method for Estimation of Sitagliptin phosphate and Metformin hydrochloride in Bulk and Tablet Dosage Form</td>
<td>UV Spectrophotometric Method</td>
<td>Method A- Absorbance maxima method: Absorption at maximum wavelength of 266 nm and 232 nm for Sitagliptin phosphate and Metformin hydrochloride respectively. Method B- Area under curve (AUC): wavelength range is 244-279 nm for Sitagliptin phosphate and 222-240 nm for Metformin hydrochloride %RSD:&lt;2% Linearity range: In the concentration range of 25-225 µg/ml for Sitagliptin phosphate and 2-12 µg/ml for Metformin hydrochloride. %Recovery: 99.64 % and 98.98% for Sitagliptin phosphate and Metformin hydrochloride</td>
</tr>
</tbody>
</table>
| 8. | Simultaneous spectrophotometric estimation of Vildagliptin and Metformin in bulk and tablet dosage form | Simultaneous estimation | **Linearity range:** 30-70 µg/ml for VIDA  
**Coefficient:** 0.999 and 5-25 µg/ml for MET with correlation coefficient of 0.999  
**%RSD:** <2% |
|---|---|---|---|
| 9. | Spectrophotometric & Spectrofluorometric methods for the determination of Saxagliptin and Vildagliptin in bulk and pharmaceutical preparations | Spectrophotometric & Spectrofluorometric methods | **Absorbance readings:** 3–32 and 5–50 µg mL−1 for the derivative readings of SAX and VDG, respectively. For NBD-Cl reaction, 1.5–25 and 2.5–40 µg mL−1 for the derivative readings of SAX and VDG, respectively.  
**Linearity range:** 0.02–0.25 and 0.03–0.37 µg mL−1 for SAX and VDG, respectively. |
| 10. | Sensitive and Selective approaches for real time estimation of Alogliptin benzoate and Metformin hydrochloride in synthetic mixture | Simultaneous equation (method A) Zero crossing first order derivative (method B) Dual wavelength method (method C). | **Linearity ranges:** For ALO and MET 0.1-0.5 µg/ml and 4-20 µg/ml for all the methods respectively  
**Method A:**  
**Limit of detection (LOD):** 0.005517 µg/ml, and 0.24018 µg/ml  
**Limit of quantitation (LOQ):** 0.016717 µg/ml and 0.727823 µg/ml for ALO and MET respectively.  
**Method B:**  
**Limit of detection (LOD):** 0.021481 µg/ml and 0.120206 µg/ml for ALO and MET, respectively.  
**Limit of quantitation (LOQ):** 0.065095 µg/ml and 0.364261 µg/ml for ALO and MET, respectively.  
**Method C:**  
**Limit of detection (LOD):** 0.008013 µg/ml and 1.34055 µg/ml |
<table>
<thead>
<tr>
<th>Limit of quantitation (LOQ):</th>
<th>0.024283 µg/ml and 4.062272 µg/ml for ALO and MET.</th>
</tr>
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<tbody>
<tr>
<td>%RSD:</td>
<td>Less than 2% R.S.D. for all three methods.</td>
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<table>
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<tr>
<th>Solvent:</th>
<th>Methanol</th>
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<tr>
<td>Linearity range:</td>
<td>5-30 µg/ml</td>
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<tr>
<td>ZCP:</td>
<td>Alogliptin was found 275.60 nm and Pioglitazone was found 268.20 nm.</td>
</tr>
<tr>
<td>Dual wavelength method:</td>
<td>Two wavelengths 270.20 nm and 265 were selected as ( \lambda_1 ) and ( \lambda_2 ) for the estimation of Alogliptin. Pioglitazone shows the same absorbance at these wavelengths. Similarly, wavelengths 280 nm and 271 nm were selected as ( \lambda_3 ) and ( \lambda_4 ) for estimation of Pioglitazone. Alogliptin shows the same absorbance at these wavelengths.</td>
</tr>
<tr>
<td>%Recovery:</td>
<td>100.8% for Alogliptin &amp; 100.33% for Pioglitazone.</td>
</tr>
<tr>
<td>%RSD:</td>
<td>&lt;2%</td>
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</table>

Simultaneous estimation of Alogliptin and Pioglitazone from its tablet dosage form by area under curve & multicomponent UV spectrophotometric method

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<tbody>
<tr>
<td>%Purity:</td>
<td>99.90 ± 0.151 for ALO and 99.62 ± 0.220 for MET</td>
</tr>
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</table>

Method B - Multicomponent UV spectrophotometric method:

| Wavelength for Quantitation: | For MET and ALO 284 nm (\( \lambda \) max of MET) and 274 (\( \lambda \) max of ALO) for the analysis. |
| Linearity range:             | 10-50 microgram/ml for MET and ALO respectively.        |
| %Purity:                     | 99.73 ± 0.306 for ALO and 99.30 ± 0.224 for MET.         |
Development and validation of UV spectrophotometric method for simultaneous estimation of Metformin hydrochloride and Alogliptin benzoate in bulk drugs and combined dosage forms.

**UV spectrophotometric method**

Method A - Simultaneous equation method (Vierodt’s Method): Detection wavelength: 277nm and 232nm i.e. λmax of Alogliptin benzoate and Metformin hydrochloride respectively.

Method B - Absorbance ratio (Q- analysis method):
Detection wavelength: 250nm and 277nm i.e. iso-absorptive point of Alogliptin benzoate and Metformin hydrochloride and λmax of Alogliptin benzoate respectively.

Linearity range: 5-25 µg/ml for Alogliptin benzoate and 1-10 µg/ml for Metformin hydrochloride.

%RSD: <2%

%Recovery: 98-102% for both Alogliptin benzoate and Metformin hydrochloride.

Table-3: Analysis of single component DPP-IV inhibitors by chromatographic method.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Drug</th>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Bioanalytical method development</td>
<td>RP-HPLC</td>
<td>Column: Reverse phase Phenomenex C 18 (250 × 4.6mm, 5µ) A</td>
</tr>
<tr>
<td></td>
<td>and validation of Sitagliptin</td>
<td></td>
<td>Mobile phase: mixture of 0.5% v/v of Triethylamine solution and acetonitrile (77:23 v/v)</td>
</tr>
<tr>
<td></td>
<td>phosphate by RP-HPLC and its</td>
<td></td>
<td>Flow rate: 1.0 ml/min</td>
</tr>
<tr>
<td></td>
<td>application to pharmacokinetic</td>
<td></td>
<td>Detection of SP: At 267 nm by an UV detector.</td>
</tr>
<tr>
<td></td>
<td>study</td>
<td></td>
<td>The retention time of Sitagliptin phosphate and internal standard: 6.1 &amp; 7.7 min, respectively.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Linearity range: 10-1000ng/ml.</td>
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<tr>
<td></td>
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<td></td>
<td>LOD and LOQ: 1 ng/ml and 10 ng/ml.</td>
</tr>
<tr>
<td>15</td>
<td>Development and validation of</td>
<td>RP-HPLC</td>
<td>Flow rate: 1.0 ml/min</td>
</tr>
<tr>
<td></td>
<td>RP-HPLC method for</td>
<td></td>
<td>Detection: At 210nm.</td>
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<td>Retention time: 6.3 min.</td>
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<td></td>
<td>Linearity range: 5-200 µg/ml.</td>
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<td>Page 3359</td>
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</tbody>
</table>
| 16 | Estimation of Vildagliptin from tablet dosage form  
| **Limit of detection (LOD):** 1.47 µg/mL  
| **Limit of quantization (LOQ):** 4.90 µg/mL  
| **% Recovery:** 99.11-100.62% |  
| Development and Validation of a Liquid Chromatographic Method for Estimation of Saxagliptin in Tablet Dosage form  
| **Mobile phase:** Acetonitrile: Buffer in proportion of 30:70 v/v  
| **Flow rate:** 1.0 ml/min  
| **UV detection:** 220 nm wavelengths.  
| **Retention time:** SAX was 3.487 min.  
| **Linearity range:** 50 µg/ml to 150 µg/ml  
| **Co-relation Co-efficient:** 0.9999 |  
| 17 | Stability indicating Isocratic Reverse phase HPLC method with PDA detector for the Estimation of Saxagliptin in bulk drugs and in its Formulation”  
| **Flow rate:** 1.0 mL/min.  
| **UV detection:** 213 nm  
| **Retention time:** 3.8 minutes.  
| **Linearity Range:** 25 µg/mL to 150 µg/mL  
| **%RSD:** <1.0  
| **% Recoveries:** 99.2% to 100.2% |  
| 18 | A new RP-HPLC method for the estimation of Linagliptin in tablet dosage forms”  
| **Mobile phase:** Mixture of phosphate buffer (pH 3.4) and acetonitrile (70:30 v/v)  
| **Flow rate:** 1.0 ml/min.  
| **UV detection:** 240 nm  
| **Retention time:** 2.791 min  
| **Linearity range:** 25-150 µg/mL |  
| 19 | Method development and validation of new RP-HPLC  
| **Mobile phase:** 0.01 M phosphate buffer (pH 5.3) and acetonitrile (30:70% v/v).  
| **Flow rate:** 1 ml/min  
| **Detector wavelength:** 210 nm |  
| 20 |  
| 21 |  
| 22 |
### Table-4: Analysis of DPP-IV Inhibitors with combination with other drugs 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>
| 22      | Validated RP-HPLC Method for Metformin hydrochloride and Sitagliptin phosphate in bulk drug and pharmaceutical formulation | RP-HPLC | **Column:** Xterra Symmetry C-8 analytical 100×4.6 mm I.D., 5 µm particle size).  
**Mobile phase:** methanol:acetonitrile:phosphate buffer in the ratio of 20:35:45 v/v/v (Phosphate buffer pH 8 was adjusted with sodium hydroxide) was selected as a mobile phase  
**Flow rate:** 1.0 ml/min  
**UV detection:** At 254 nm.  
**Retention time:** 3.69 & 4.90 min for Metformin Hydrochloride and Sitagliptin Phosphate respectively. | 25 |
### Linearity range

**A Validated RP–HPLC method for Simultaneous estimation of Metformin and Saxagliptin in tablets**

**RP–HPLC method**

- **Mobile phase:** Phosphate buffer (pH 5.0), Acetonitrile and Methanol in the ratio 75:15:10 respectively
- **Flow rate:** 1.5mL/min.
- **Detection wavelength:** For Metformin and Saxagliptin at 225 nm
- **Retention time:** For Metformin and Saxagliptin 5.65 and 6.20 min, respectively.

### Mean percent recovery

- **Metformin Hydrochloride:** 101%
- **Sitagliptin Phosphate:** 102%

### Development and Validation of HPTLC method for the estimation of Sitagliptin Phosphate and Simvastatin in bulk and Marketed Formulation

**HPTLC**

- **Stationary phase:** silica gel 60 F254 (0.2 mm thickness)
- **Mobile phase:** chloroform: methanol in the ratio of 8:2 v/v
- **Detection wavelength:** 217 nm
- **Linearity range:** 2000ng/spot - 7000 ng/spot & 250ng/spot -50 ng/spot for Sitagliptin phosphate & Simvastatin respectively.
- **Average Recovery:** 92.80 % and 98.01 % for Sitagliptin phosphate and Simvastatin respectively
- **LOD:** 660 ng/spot for Sitagliptin phosphate &50ng/spot for Simvastatin
- **%RSD:** <2%
- **LOQ:** 2000 ng/spot for Sitagliptin phosphate &150ng/spot for Simvastatin

### Validated HPTLC method for simultaneous estimation of Metformin hydrochloride and HPTLC

- **Stationary phase:** Aluminum plates precoated with silica gel 60 F254
- **Mobile Phase:** acetone:methanol:toluene:formic acid (4:3:2:1 v/v/v/v)
- **Densitometry evaluation:** 220 nm
- **R f values and drug content of metformin**
| 26 | Sitagliptinphosphate in bulk drug and formulation | Sitagliptin phosphate: 0.36±0.02, 0.63±0.02100.1%, 99.84% respectively.  
**Linearity range:** 2000-5000 ng per band for metformin hydrochloride, 200-500 ng per band for Sitagliptin phosphate  
**Regression coefficient** ($r^2$): >0.99  
**LOD:** Metformin hydrochloride and Sitagliptin phosphate was 45 and 27 ng per band respectively  
**LOQ:** For metformin hydrochloride and Sitagliptin phosphate 150 and 87 ng per band respectively. |
|---|---|---|
| 27 | Analytical method development and validation of Alogliptin and metformin hydrochloride tablet dosage form by RP-HPLC method | **RP-HPLC METHOD**  
**Buffer:** 0.2% TEA pH adjusted with OPA to 6.0  
**Mobile phase:** By adjusting the ratio of buffer and Methanol as 30:70 v/v + 0.2% Triethylamine  
**Flow rate:** 1.0 ml/min  
**Detection wavelength:** 254 nm  
**Run time:** 10 minutes  
**Column:** Agilent C18 with dimension 250 mm length, 4.6 mm i.d., 5µ particle size.  
**Linearity range:** 25-150 µg/ml for Alogliptin and Metformin Hydrochloride respectively  
**Correlation coefficient:** For Alogliptin and Metformin Hydrochloride were 0.9995 and 0.9996.  
% **Recovery:** 99.96% and 99.83% for Alogliptin and Metformin Hydrochloride respectively. |
| 28 | Development and Validation of RP-HPLC Method for Simultaneous Estimation of Vildagliptin and Metformin | **RP-HPLC**  
**Column:** Lichrocart C18 (250 x 4.60 x 5 µm)  
**Mobile phase:** 0.05 M KH$_2$PO$_4$: Acetonitrile (70:30 v/v pH 3.5 with Ortho Phosphoric Acid).  
**Flow rate:** 1.0ml/min  
**UV detection:** 215 nm.  
**Retention time:** VIDA and MET 6.64 and 5.18 minutes respectively.  
**Linearity range:** 5-25 µg/ml, 10-50 µg/ml for
<table>
<thead>
<tr>
<th>Page</th>
<th>A revised RP-HPLC method for simultaneous determination of Vildagliptin and Pioglitazone Hcl – application to commercially available drug products</th>
<th>Development and Validation of Simultaneously Estimation of Vildagliptin &amp; Metformin Hydrochloride by RP-HPLC in Bulk and Oral Dosage Form</th>
<th>Development and Validation of Simultaneous Estimation of Linagliptin and Metformin in pure and pharmaceutical dosage form</th>
</tr>
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<tbody>
<tr>
<td>28</td>
<td><strong>RP-HPLC</strong></td>
<td><strong>RP-HPLC</strong></td>
<td><strong>RP-HPLC</strong></td>
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<td></td>
<td>Column: ACE 3 150mm*4,6mm, 3.5µm with gradient flow.</td>
<td>Mobile phase: Acetonitrile: Water: Methanol (25:50:25 (v/v/v) to pH 4.1 with 0.1% orthophosphoric acid Detection Wavelength:243 nm Detector: Diode array detector Linearity range: 5-30µg/ and 10-100 µg /ml for Linagliptin and Metformin respectively.</td>
<td>Mobile phase: Disodium hydrogen phosphate buffer (pH 3.5): methanol in the ratio 73.5:26.5 v/v. Flow rate:1.0 ml/min UV detection: 200 nm. Retention times: 2.490&amp;4.243 for Metformin Hcl and Vildagliptin respectively. Linearity range: 75-175µg/ml for Metformin Hcl and 7.5-17.5µg/ml for Vildagliptin.</td>
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<tr>
<td></td>
<td>Regression equation and correlation of coefficient: For VIDA and MET were found to be (y = 1014x + 54.43, R² = 0.999) and (y = 307.8x + 146.0, R² = 0.999) respectively.</td>
<td></td>
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<tr>
<td>Form</td>
<td>Mean percent recovery: 98.88% for Metformin Hcl and 99.85% for Vildagliptin.</td>
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<tr>
<td>HPTLC</td>
<td><strong>Mobile phase:</strong> Acetone-methanol-toluene-formic acid 4:3:2:1 (v/v/v/v) <strong>Detection Wavelength:</strong> 259 nm between 400-2000 (ng/spot) <strong>Rf Value:</strong> 0.61 and 0.82 for Metformin hydrochloride and Linagliptin respectively. <strong>Linearity Range:</strong> 20-100 (ng/spot) for Metformin hydrochloride and Linagliptin respectively. <strong>Limits of detection and quantification:</strong> 20 (ng/spot) and 10 (ng/spot) for Metformin hydrochloride and Linagliptin respectively</td>
<td></td>
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<tr>
<td>31</td>
<td>Development and validation of HPTLC method for simultaneous estimation and stability indicating study of Metformin Hcl and Linagliptin in pharmaceutical formulation</td>
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</table>

| RP-HPLC | UV detection: 207 nm **Linearity range:** 25-125µg/mL for MET and 50-250µg/mL for VLD respectively. **Limit of detection and limit of quantification:** For MET were 0.36µg/mL and 1.22µg/mL, and for VLD were 0.75µg/mL and 2.51µg/mL respectively. |
| 32   | Development of validated stability indicating assay method for simultaneous estimation of Metformin hydrochloride and Vildagliptin by RP-HPLC |

| RP-HPLC and HPTLC Methods | RP-HPLC **Mobile phase:** Phosphate buffer (pH adjusted to 6 using 3M KOH): methanol: acetonitrile in the ratio of 50:30:20 v/v/v. **Flow rate:** 0.8ml/min **Linearity range:** 10-60µg/mL for MET and VLD respectively **LOD:** For MET and VLD were 1.09µg/ml and 1.70µg/ml respectively **LOQ:** For MET and VLD were 3.32µg/ml and 5.15µg/ml respectively. **HPTLC** |
| 33   | RP-HPLC and HPTLC Methods for Simultaneous Estimation of Metformin Hydrochloride and Vildagliptin from Bulk and Marketed Formulation: Development and Validation |
| 34 | A Validated High Performance Liquid Chromatography Method for the Determination of Saxagliptin and Metformin in Bulk, a Stability Indicating Study | **HPLC** | **Linearity range:** 1000-5000ng/spot and 500-2000ng/spot for MET and VLD respectively. **LOD:** MET and VLD were 17.22ng/spot and 34.60ng/spot respectively **LOQ:** MET and VLD were 52.20ng/spot and 104.85ng/spot respectively. |
| 35 | RP-UPLC method development and validation for simultaneous estimation of Vildagliptin with Metformin hydrochloride and Ciprofloxacin hydrochloride with Dexamethasone sodium phosphate | **RP-UPLC** | **Mobile phase:** Mixture of Methanol-50 mm phosphate buffer (pH 2.7) in a gradient elution mode **Flow rate:** 1.0 ml min-1. **Detection Wavelength:** 225 nm **Total run time:** 7 min. **Linearity range:** 5.00-125.00 µg ml-1 for Saxagliptin and 2.50-62.50 µg ml-1 for Metformin. **Flow rate:** 1 mL/min **Detection wavelength:** 220 or 254 nm for the two mixtures **Linearity range:** 0.5-5 µg/mL for Vildagliptin & 5-50 µg/mL for Metformin hydrochloride while ranges from 2-20 µg/mL for both ciprofloxacin hydrochloride and Dexamethasone sodium phosphate. |

**Conclusion**

This review depicts the reported Spectrophotometric and Chromatographic methods; developed and validated for estimation of DPP-IV inhibitors. According to this review it was concluded that for DPP-IV inhibitor (Sitagliptin, Saxagliptin, Linagliptin, Vildagliptin, and Alogliptin) different Spectroscopic & Chromatographic methods are available for Single component as well as for combination and also it was found that the Mobile phase...
containing Phosphate buffer, Methanol and Acetonitrile were common for most of the chromatographic method to provide more resolution. It was observed that most common combination of DPP-IV inhibitors were with Metformin. For chromatographic method flow rate is observed in the range of 0.8-1.5 ml/min to get good retention time. For most of the Spectroscopic methods common solvent is Methanol. Hence this all methods found to be simple, accurate, economic, precise, and reproducible in nature. Most of Methods were of RP-HPLC and UV absorbance detection because these methods provided with best available reliability, repeatability, analysis time and sensitivity.

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References:


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