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AN UPDATED REVIEW ON ANALYTICAL METHODS FOR ESTIMATION OF TENELIGLIPTIN AND DAPAGLIFLOZIN

PATEL H, CHAKRABORTHY GS* AND PATEL P

Department of Quality Assurance, Parul Institute of Pharmacy & Research, Parul University, Limda, Vadodara, Gujarat, India

***Corresponding Author: Dr. . G.S. Chakraborthy: E Mail: g.chakraborthy19159@paruluniversity.ac.in**

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ABSTRACT

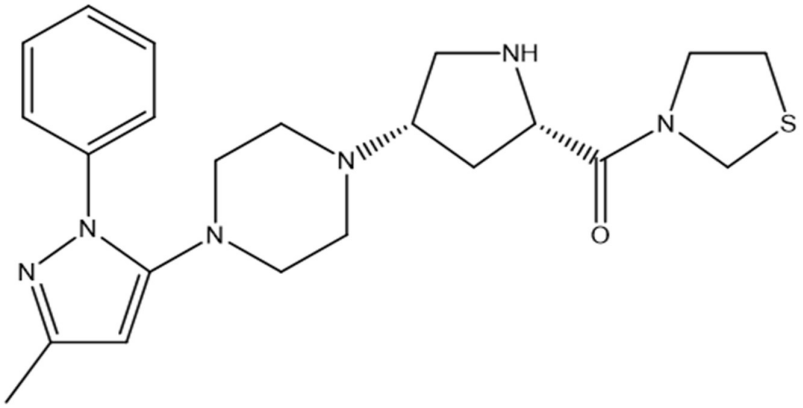
Today diabetes become a global concern and recent report revel that 422 million people suffer form the diabetes. 90 – 95 % case are type 2 diabetes. An update on spectrophotometric and chromatographic techniques for determining teneligliptin and dapagliflozin is the major goal of this review. The concentrations of Teneligliptin and Dapagliflozin are measured using UV, HPLC, HPTLC, UPLC, and LC/MS methods. Extensive studies describing various analytical methods have been conducted on dapagliflozin and teneligliptin. Spectrophotometric (UV) methods for Teneligliptin and Dapagliflozin alone and in combination with other drugs include parameters like a solvent, λmax, Range, Regression Coefficient etc. chromatographic methods (HPLC, HPTLC, and UPLC) for Teneligliptin and Dapagliflozin alone and combination with other drug include parameter like stationary phase, mobile phase, flow rate, λmax, Range, Regression Coefficient, retention time and Rf value etc. Additionally, this review gives comprehensive details on the circumstances for the separation of Teneligliptin and Dapagliflozin both alone and in combination with other medications, as well as the existence of its degradation products.

Keywords: Teneligliptin, Dapagliflozin, HPLC, HPTLC, LC-MS, UPLC, UV

INTRODUCTION:

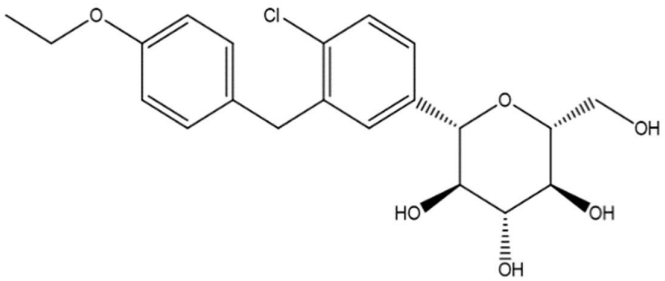
Teneligliptin is chemically [(2S,4S)-4- [4-(5-methyl-2-phenylpyrazol 3-yl) piperazin-1-yl] pyrrolidin-2-yl]- (1,3-thiazolidin-3-yl) methanone, has a molecular mass of 426.6 g/mol and the chemical formula C22H30N6OS. It was removed through

excretion from the kidney and metabolism involving specific enzymes, which had a half-life of 24.2 hours in human plasma. It is a fine, white powder that dissolves freely in water, sparingly in methanol, only little in ethanol, and not at all in acetonitrile. Dipeptidyl peptidase-4 inhibitors, often known as "Gliptins," include the medication teneligliptin, which is used to treat Type-2 mellitus diabetes. Teneligliptin inhibits the action of DPP-4 enzymes and slows down the rapid degradation of incretins. It also increases insulin synthesis by the pancreas and decreases glucagon levels which are counter-hormone of insulin, thereby further decreasing blood sugar levels.



teneligliptin

Dapagliflozin (DAPA) is a drug of gliflozin class. Chemically it is (2S, 3R, 4R, 5S, 6R)-2- (4- chloro- 3- (4-methoxybenzyl) phenyl)-6- (hydroxymethyl)tetrahydro-2H-pyran-3, 4,5-triol with molecular formula of $C_{21}H_{25}ClO_6$ and 408.875g/ mol as its molecular weight. It is a white, crystalline substance that is soluble in DMSO, dimethylformamide, and ethanol, among other organic solvents. It melts at 55 and 60 ^oC. Dapagliflozin has antihyperglycemic effect as a selective sodium-glucose co-transporter subtype 2 (SGLT2) inhibitor. Compared to SGLT1, the co-transporter of glucose in the gut, dapagliflozin specifically and strongly inhibits SGLT2. boosting glucose excretion through the urine and lowering blood sugar levels. Its mode of action is unrelated to insulin sensitivity and pancreatic cell activity, by inhibiting SGLT2, Dapagliflozin blocks reabsorption of filtered glucose in the kidney, increasing urinary glucose excretion and reducing blood glucose levels. Its mechanism of action is independent of pancreatic β cell function and modulation of insulin sensitivity **[1]**.



dapagliflozin

Table 1: Reported Method for Estimation of Teneligliptin

Sr. No.	Drugs	Method	Method Description	Ref. No.
1.	Teneligliptin and Remogliflozin	UV	Method: First-Order Derivative Method λ_{max}: ROSU: 243 nm TENE: 296 nm Range: 5-15 µg/ml	[2]
2.	Vildagliptin and Remogliflozin /Teneligliptin and Remogliflozin	RP-HPLC	Column: Zorabx C18 Mobile Phase: Acetonitrile: Phosphate Buffer (58:42 v/v) Flow Rate:1.2 ml/min λ_{max}: 210 nm Retention Time: VLG: 1.26 min TNG: 1.65 min RGE: 2.48 min Range: VLG: 5-100 µg/ml RGE: 5-100 µg/ml TNG: 2-60 µg/ml	[3]
3.	Remogliflozin Etabonate and Teneligliptin	RP- HPLC	Detector: UV Column: Cosmosil C18 column (250-4.6 mm) Mobile phase: Acetonitrile: water (80:20 v/v) Flow rate: 1ml/min λ_{max}: 245 nm Range: REMO:10-80 µg/ml TENE: 1-8 µg/ml	[4]
4.	Teneligliptin Hemihydrate Hydrobromide and Rosuvastatin Calcium	Stability indicating HPTLC	Stationary Phase: silica gel 60 F_{254} plates Mobile Phase: Ethyl acetate: Toluene: Acetonitrile: Formic Acid (6:3.5:0.5:0.2 v/v/v/v) Range: 50-500 ng/spot	[5]
5.	Teneligliptin	GC-MS	Columns: (HP-5, DB-1, and SPB-624) HP-5: (30 m length × 0.32 mm × 1 µm film thickness) DB-1: (30 mm × 0.32 mm × 1µm) Flow rate: 1.0-1.5 ml/min Range: 0.38-56 µg/ml	[6]
6.	Dapagliflozin and Teneligliptin Hydrobromide Hydrate	UV	Model: Double beam UV/Visible spectrophotometer1700 Shimadzu Method: 1. simultaneous Equation: λ_{max}: DAPA: 223 nm TEN: 243 nm 2.Q-absorbance ratio λ_{max}: DAPA and TEN: 230 nm 3.First Derivative:	[7]

			DAPA: 251 nm Ten: 243 nm Range: TEN and DAPA: 5-75 µg/ml	
7.	**Teneligliptin Hydrobromide and Metformin Hydrochloride**	**HPTLC**	**Stationary phase: silica gel G60 F254 aluminium sheets Mobile Phase: Methanol: Ammonium sulphate: Triethylamine (9: 2.7: 0.5 v/v/v) λ_{max}: 237 nm Range: TH: 4-28 ng/band MH: 100-700 ng/band**	**[8]**
8.	**Rosuvastatin and Teneligliptin Hydrobromide Hydrate**	**HPTLC**	**Stationary phase: Silica gel 60F 254 plates Mobile phase: Ethyl acetate: Toluene: Acetonitrile: Formic Acid (6:3.5:0.5:0.2 v/v/v/v) Rf values: ROS: 0.37 ± 0.01 TEN: 0.76 ± 0.01 Range: 50-500 ng/spot**	**[9]**
9.	**Rosuvastatin Calcium and Teneligliptin Hydrobromide Hydrate**	**UV**	**Model: UV-1800 Shimadzu Method: First-order Derivative: λ_{max}: TEN:230.03 ROSU:222.66 Range: 1-42 µg/ml**	**[10]**
10.	**Teneligliptin**	**UV**	**Model: l700AD Shimadzu Λmax: 246 nm Range: 5-10 µg/ml**	**[11]**
11.	**Teneligliptin and its impurity in Tablet**	**RP-HPLC**	**Column: C18 (250 mm x 4.6 mm, 5µm) Mobile Phase: Potassium dihydrogen phosphate: Acetonitrile (80:20 v/v) Flow Rate: 1 ml/min λ_{max}: 242 nm Range: TEN: 500-3000 µg/ml**	
11.	**Teneligliptin and its impurity in Tablet**	**RP-HPLC**	**Column: C18 (250 mm x 4.6 mm, 5µm) Mobile Phase: Potassium dihydrogen phosphate: Acetonitrile (80:20 v/v) Flow Rate: 1 ml/min λ_{max}: 242 nm Range: TEN: 500-3000 µg/ml Impurity B and Impurity G: 5-30 µg/ml**	**[12]**
12.	**Teneligliptin**	**RP-HPLC**	**Detector: UV Column: Zorbax C18column (100 mm × 4.6 mm, 5µm) Mobile phase: Acetonitrile: phosphate: buffer (55:45 v/v) Flow Rate: 1.2 ml/min λ_{max}: 210 nm Range: 10-100 mcg/ml**	**[13]**
13.	**Teneligliptin and Metformin HCl**	**RP-HPLC**	**Column: thermo, C18, (250 mm x 4.6 mm,5 µm) Mobile Phase: KH_2PO_4: Methanol (60:40 v/v) Flow Rate: 1.0 ml/min λ_{max}: 280 nm Retention Time: TNG: 4.421 min MET: 3.421 min Range: TNG: 50 µg/ml -150 µg/ml MET Hcl: 50 µg/ml -150 µg/ml**	**[14]**

14.	**Teneligliptin**	**RP-HPLC**	**Column: Kromasil C18 analytical column (150 mm x 4.6 mm, 5.0 µm) Mobile Phase: A: Acetonitrile: Water: Trifluoroacetic acid B: Acetonitrile: Trifluoroacetic acid Flow Rate: 1.0 ml/min λ_{max}: 245 nm Retention Time: 11.2 min Range: 50-150 µg/ml**	**[15]**
15.	**Teneligliptin**	**UV**	**Model: Shimadzu UV 1700 AD Solvent: Methanol λ_{max}: 246 nm Range: 10-50 µg/ml**	**[16]**
16.	**Teneligliptin and Metformin**	**UV**	**Model: UV-1800 double beam spectrophotometer (shimadzu) Method: Simultaneous equation method: Solvent: Methanol λ_{max}: 237 nm Range: 5-25 µg/ml**	**[17]**
17.	**Teneligliptin and Metformin**	**UV**	**Model: UV-1800 double beam Solvent Methanol Method: Simultaneous equation method: Solvent: Methanol λ_{max}: TEN: 219.60 nm MET: 223.33 nm Range: TEN: 100 µg/ml MET: 30 µg/ml**	**[18]**
18.	**Teneligliptin**	**RP-UFLC**	**Column: Phenomenex Kinetex C18 (250 mm x 4.6 mm, 5 µ) Mobile Phase: Methanol: ACN (60:40 v/v) Range: 10-50µg/ml**	**[19]**
19.	**Teneligliptin and Teneligliptin Sulfoxide**	**LC-MS/MS**	**Range: TEN: 5-1000 ng/ml TEN SUL: 2.5-500 ng/ml Retention Time: TEN:1.83 min TEN SUL:1.53 min**	**[20]**
20.	**Teneligliptin Hydrobromide and Metformin Hydrochloride**	**UV**	**Method: 1. Simultaneous equation method λ_{max}: TEN: 230 nm MET: 245nm 2.Absorbance ratio method λ_{max}:TEN: 230 nm MET: 240nm Range: TEN: 2-12 µg/ml MET: 5-55µg/ml**	**[21]**
21.	**Gemigliptin and Teneligliptin**	**UPLC**	**Column: C-18 (100 mm x 2.1 mm,2.7 µm) Retention Time: GEM: 6.56 min TEN: 4.12 min Range: GEM: 509.8-1529.4 ng/ml TEN: 510.6-1531.7 ng/ ml**	**[22]**
22.	**Teneligliptin**	**RP-HPLC**	**Column: Cosmosil C18(250 mm x 4.6 mm, 5µ) Detector: UV-3000-M Mobile Phase: Phosphate buffer pH:3 (70:30 v/v) Flow Rate: 0.8 ml/min λ_{max}: 246 nm Range:10-50 µg/ml**	**[23]**

23.	**Teneligliptin**	**UV**	**Model: UV-2450, Shimadzu, Japan** **Mobile Phase: Methanol: water (50:50 v/v)** **λ_{max}: 245 nm** **Range: 10-35 µg/ml**	**[24]**
24.	**Teneligliptin and Metformin**	**Stability indicating RP-HPLC**	**Column: Kromasil C18 (250 mm x 4.6 mm, 5 µm)** **Mobile Phase: Buffer: Acetonitrile: Methanol (65:25:10 v/v/v)** **Diluent: Acetonitrile: water (50:50 v/v)** **Flow Rate: 1.0 ml/min** **λ_{max}: 254 nm** **Retention Time:** **TNG: 2.842 min** **MET: 2.017 min** **Range:** **TNG: 5-30 µg/ml** **MET:125-750 µg/ml**	**[25]**
25.	**Teneligliptin Hydrobromide Hydrate and Metformin Hydrochloride**	**UV**	**Solvent:** **MET HCl: Methanol, Water** **TENE: water** **λ_{max}:** **TEN: 233 nm** **MET HCl: 249.20 nm** **Range: 6-16µg/ml**	**[26]**
26.	**Teneligliptin Hydrobromide Hydrate and Glimepiride**	**RP-HPLC HPTLC**	**RP-HPLC:** **Mobile Phase: Acetonitrile: phosphate buffer (65:35 v/v)** **Flow rate: 1ml/min** **λ_{max}: 246 nm** **Retention Time:** **Teneligliptin hydrobromide hydrate: 5.8 min** **Glimepiride: 9.41 min** **Range:** **Teneligliptin hydrobromide hydrate: 5-25 ng/ml** **Glimepiride: 0.25-1.25 ng/ml** **HPTLC:** **Stationary Phase: Merck TLC aluminium sheets of silica gel60F** **Mobile Phase: Toluene, Methanol, Triethylamine (1: 3: 1 v/v/v)** **λ_{max}: 246 nm** **Rf value:** **Glimepiride: 0.48** **Teneligliptin hydrobromide hydrate:0.60** **Range:** **Glimepiride: 2000-20000 ng/spot** **Teneligliptin hydrobromide hydrate: 100-1000 ng/spot**	**[27]**
27.	**Teneligliptin Hydrobromide**	**Stability indicating RP-HPLC**	**Column: Kromasil C8** **Mobile Phase: Phosphate buffer (pH-5): Acetonitrile (70: 30 v/v)** **Flow Rate: 1.0ml/min** **λ_{max}: 246 nm** **Range: 10-60 µg/ml**	**[28]**
28.	**Teneligliptin**	**RP-HPLC UV**	**HPLC System: Shimadzu HPLC series 1100** **Column: Shodex C18-4E (250 mm x 4.6 mm, 5 µm)** **Mobile Phase: Methanol: Phosphate buffer (pH 7.2) (70:30 v/v)** **Flow Rate: 1 ml/min** **λ_{max}: 245.6 nm** **Range: 10-60 µg/ml**	**[29]**

Table 2: Reported Method for Estimation of Dapagliflozin

Sr. No.	Title	Method	Method Description	Ref. No.
1.	Dapagliflozin	Stability indicating RP-HPLC	Stationary Phase: ZORBAX C_{18} column (250 x 4.6 mm, 5 µm) Mobile Phase: Phosphate Buffer: Acetonitrile: Methanol (55:40:05, %v/v/v) Flow Rate: 1.0 ml/min λ_{max}: 225 nm Retention Time: 2.12 min Range: 10-120 µg/ml	[30]
2.	Dapagliflozin Propanediol Monohydrate and Metformin Hydrochloride	Stability indicating HPTLC	Stationary Phase: Pre-coated silica gel $60F_{254}$ Mobile Phase: Methanol: Ethyl Acetate: Ammonium Acetate (6:4:0.1, v/v) λ_{max}: 220 nm Retention Factor: DAPA: 0.79 MET: 0.31 Range: DAPA: 20-100 ng/spot MET: 500-2500 ng/spot	[31]
3.	Dapagliflozin and Saxagliptin	Stability indicating RP-HPLC	Stationary Phase: BDS C_{18} column (150 x 4.6 mm,5 µm) Mobile Phase: Ammonium Acetate Buffer: Acetonitrile (40:60, %v/v) Detector: DAD Flow Rate: 1.0 ml/min λ_{max}: 220nm Retention Time DAPA: 2.207 min SAXA: 2.889 min Range: DAPA: 0-15 µg/ml SAXA: 0-8 µg/ml	[32]
4.	Dapagliflozin and Saxagliptin	HPLC	Stationary Phase: SPOLAR C_{18} column (250 x 4.6 mm, 5 µm) Mobile Phase: Acetonitrile: Phosphate Buffer, pH 5.8 (26:74, %v/v) Detector: UV Detector Flow Rate: 0.96 ml/min λ_{max}: 236 nm Retention Time DAPA: 3.5 min SAXA: 5 min Range: DAPA: 0.2-300 µg/ml SAXA: 0.1-150 µg/ml	[33]
5.	Dapagliflozin and Metformin Hydrochloride in pharmaceutical dosage form	Stability indicating HPLC	Stationary Phase: THERMO fisher ODS C_{18} column Mobile Phase: Water: Acetonitrile (65:35, %v/v) Detector: UV-Visible Detector Flow Rate: 1.0 ml/min λ_{max}: 240 nm Retention Time: DAPA: 5.41 min MET: 2.13 min Range: DAPA: 1-6 µg/ml MET: 100-600 µg/ml	[34]
6.	Dapagliflozin in pharmaceutical dosage formulations	RP-HPLC	Stationary Phase: C_{18} column (250 x 4.6mm, 5µm) Mobile Phase: Acetonitrile: Water (40:60, %v/v) Detector: UV-Visible Detector Flow Rate: 1.0 ml/min λ_{max}: 277 nm. Retention Time: 7.029 min Range: 1-16 µg/ml	[35]
7.	Dapagliflozin Forced	RP-HPLC	Stationary Phase: C_{18} column (250 x 4.6mm, 5µm) Mobile Phase: Acetonitrile: Water (50:50, %v/v)	[36]

	degradation		**Detector: UV-Visible Detector Flow Rate: 0.5 ml/ min λ_{max}: 235 nm Retention Time: 4.11 min Range: 10-1200 ng/ml**	
8.	**Dapagliflozin and Saxagliptin in fixed-dose combination**	**UV**	**UV- Spectrophotometer: Lab India model-3000+ series λ_{max}: DAPA: 276 nm SAXA: 222 nm Solvent: Phosphate Buffer pH 6.8 Range: DAPA: 5-25 µg/ml SAXA: 5-25 µg/ml**	**[37]**
9.	**Dapagliflozin and Saxagliptin**	**HPTLC**	**Stationary Phase: Silica gel 60 F_{254} Aluminium plates Mobile Phase: Hexane: Methanol: Ethyl Acetate (4:2:4, v/v/v) λ_{max}: DAPA: 225 nm SAXA: 210 nm Retention Factor: DAPA: 0.6 SAXA: 0.18 Range: 50-550 ng/spot**	**[38]**
10.	**Dapagliflozin, Saxagliptin, Metformin**	**HPLC**	**Stationary Phase: Agilent C_{18} column (4.6 x 250 mm) Mobile Phase: Acetonitrile: Acidified aqueous phase Detector: DAD Flow Rate: 0.8 ml/min λ_{max}: 230 nm Retention Time: DAPA: 7.17 min SAXA: 3.78 min MET: 2.83 min Range: DAPA: 20-160 µg/ml SAXA: 80-300 µg/ml MET: 10-120 µg/ ml**	**[39]**
11.	**Dapagliflozin, Saxagliptin, Metformin**	**HPTLC**	**Stationary Phase: Merck HPTLC silica gel plates Mobile Phase: Chloroform: Methanol: Water: Acetic Acid (7.4:2.6:0.5:0.01, v/v) λ_{max}: 224 nm Retention Factor: DAPA: 0.66 SAXA: 0.50 MET: 0.14 Range: DAPA:250-3000 ng/spot SAXA:700-7500 ng/spot MET:150-1750 ng/spot**	**[40]**
12.	**Dapagliflozin and Metformin Hydrochloride**	**UV**	**UV- Spectrophotometer: ELICO Double beam SL 210 UV-Visible spectrometer Method: Q absorption ratio method λ_{max}: DAPA: 232 nm MET: 222 nm Solvent: Water Range: DAPA: 2-32 µg/ml MET: 1-20 µg/ml**	**[41]**
13.	**Metformin, Dapagliflozin and Saxagliptin**	**Stability indicating RP-UPLC**	**Stationary Phase: BEH C_{18} column (50 x 2.1 mm, 1.7 µm) Mobile Phase: Water: Methanol (70:30 %v/v) Flow Rate: 0.3 ml/min λ_{max}: 222 nm Retention Time: MET: 1.06 min DAPA: 1.50 min**	**[42]**

			SAXA: 2.17 min Range: MET: 250-1500 µg/ml DAPA: 2.5-15 µg/ml SAXA: 1.25-37.5 µg/ml	
14.	**Dapagliflozin in bulk drug and marketed tablet formulation**	**Stability indicating HPTLC**	**Stationary Phase: Merck HPTLC plates precoated with silica gel 60 F_{254} Mobile Phase: Methanol: Toluene: Ammonium Acetate (6.9:3:0.1, v/v/v) λ_{max}: 250 nm Range: 100-1000 ng/band Retention Factor: 0.29 ± 0.05**	**[43]**
15.	**Dapagliflozin in bulk and tablet dosage form**	**HPTLC**	**Stationary Phase: Merck TLC plates Silica gel 60F_{254} (10 x10 cm) Mobile Phase: Chloroform: Methanol (9:1, v/v) λ_{max}: 223 nm Range: 400-1200 ng/band Retention Factor: 0.21 ± 0.004**	**[44]**
16.	**Dapagliflozin and Metformin Hydrochloride**	**RP-HPLC**	**Stationary Phase: Cosmosil C_{18} column (250mm × 4.6mm, 5µm) Mobile Phase: Methanol: Potassium dihydrogen phosphate buffer with pH 3.0 (80:20, %v/v) Detector: UV Detector Flow Rate: 1.0 ml/min λ_{max}: 228nm Retention Time: DAPA: 5.2 min MET: 3.6 min Range: DAPA: 1-5 µg/ml MET: 100-500 µg/ml**	**[45]**
17.	**Metformin and Dapagliflozin**	**LC–MS/MS**	**Stationary Phase: Reversed-phase ACE 5CN (150 × 4.6 mm, 5 µm) column Mobile Phase: Acetonitrile-15 mM Ammonium Acetate, pH 4.5 (70:30% v/v) Range: DAPA:0.10-200 ng/ml MET:1.00-2000 ng/ml**	**[46]**
18.	**Dapagliflozin and Saxagliptin**	**UV**	**UV- Spectrophotometer: UV-spectrophotometric method λ_{max}: DAPA: 276 nm SAXA: 222 nm Solvent: Phosphate buffer pH 6.8 Range: DAPA: 5-25 µg/ml SAXA: 5-25 µg/ml**	**[47]**
19.	**Saxagliptin and Dapagliflozin**	**RP-HPLC**	**Stationary Phase: Discovery C_{18} column (250 x 4.6 mm, 5 µm) Mobile Phase: Acetonitrile: Ortho phosphoric acid (0.1%) (50:50, %v/v) Flow Rate: 0.98 ml/min λ_{max}: 210 nm Retention Time: DAPA: 3.49 min SAXA: 2.81 min Range: DAPA: 25-150 µg/ml SAXA: 12.5-75 µg/ml**	**[48]**
20.	**Saxagliptin and Dapagliflozin**	**HPLC**	**Stationary Phase: Eclipse XDB C_{18} (150 x 4.6 mm, 5 µm) Mobile Phase: 0.1% ortho phosphoric acid: acetonitrile (50:50, %v/v) Detector: UV Flow Rate: 1.0 ml/min λ_{max}: 254 nm Retention Time DAPA: 5.17 min**	**[49]**

			SAXA: 2.74 min Range: DAPA: 0.05-2 µg/ml SAXA: 0.01-0.5 µg/ml	
21.	**Empagliflozin, Dapagliflozin, Canagliflozin**	**HPLC**	**Stationary Phase: Agilent Zorbax RX-C_8 column (150 mm x 4.6 mm, 5 µm) Mobile Phase: Acetonitrile: Aqueous 0.1% trifluoroacetic acid (40:60, %v/v) Detector: DAD Flow Rate: 1.0 ml/minutes λ_{max}: 210 nm Retention Time EMPA: 2.047 min DAPA: 2.819 min CANA: 4.889 min Range: EMPA: 2-2500 ng/ml DAPA: 3.5-2500 ng/ml CANA: 1.1-2500 ng/ml**	**[50]**
22.	**Metformin, Gliclazide, Pioglitazone, Dapagliflozin, Empagliflozin, Saxagliptin, Teneligliptin and Linagliptin**	**HPLC**	**Stationary Phase: Waters Reliant™ HPLC Columns (250 mm x 4.6 mm, 5 µm) Mobile Phase: Acetonitrile: Water (6:4, %v/v) Detector: DAD Flow Rate: 1.0 ml/min λ_{max}: 230 nm Retention Time: MET: 1.31 min SAXA: 6.44 min LINA: 4.96 min TENELI:1.96 min EMPA:3.42 min PIO: 2.71 min DAPA:8.41 min GLI:7.49 min Range MET:10-70 µg/ml GLI, PIO, SAXA, TENE: 50-350 µg/ml LINA:10-70 µg/ml EMPA:30-210 µg/ml DAPA:30-210 µg/ml**	**[51]**
23.	**Dapagliflozin and major degradation product and Metformin.**	**UHPLC**	**Stationary Phase: C_{18} column (100 x2.1 mm, 2.2 µm) Mobile Phase: Potassium dihydrogen Phosphate Buffer pH (3.5): Acetonitrile (50:50, %v/v) Detector: UV Flow Rate: 0.4 ml/ min λ_{max}: 225 nm Retention Time DAPA: 1.5 min MET: 0.9min Range: DAPA: 1-50 µg/ml MET: 0.5-100 µg/ml**	**[52]**
24.	**Dapagliflozin in its tablet dosage form**	**Stability indicating HPLC**	**Stationary Phase: Zorbax Eclips XDB C_{18} (150 x 4.6mm, 5µm) Mobile Phase: Buffer: Acetonitrile: Methanol (60:37:03, %v/v/v) Flow Rate:1.0 ml/ min λ_{max}: 220 nm Retention Time: 1.63 min Range: 12-36 µg/ml**	**[53]**
25.	**Dapagliflozin**	**RP-HPLC**	**Stationary Phase: Princeton C_{18} column Mobile Phase: Acetonitrile: Triethylamine (50:50, % v/v) Flow Rate: 1.0 ml/min λ_{max}: 224 nm Retention Time: 5.16 min Range: 10-70 µl/ml**	**[54]**

CONCLUSION:

The presented review depicts the information about the various methods available in the literature for the determination of Teneligliptin and Dapagliflozin including that the different analytical methods are reported for estimation Teneligliptin and Dapagliflozin individual and other combination like UV Spectroscopy, HPTLC, HPLC, UPLC, LC-MS etc. Hence all methods found to be simple, accurate, economic, precise and reproducible in nature. This review will help in future to develop the analytical methods for this new combination and also gives the knowledge about its characteristics of both drugs. This review provided a summary of the most recent, cutting-edge analytical techniques for determining Teneligliptin and Dapagliflozin, which will be useful for future studies on this combination. Knowing the important solvents and their available set of instruments in the analytical laboratory would also be helpful after reading the review.

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