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Review Article

A Review of Different Analytical Techniques: Bumetanide

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Abstract

Bumetanide is a potent diuretic. It acts by blocking NKCC-1 cation - chloride co-transporter. The purpose of the present review work is to highlight different analytical methods available for Bumetanide estimation in pharmaceutical preparations and biological samples. Analytical methods such as UV, HPLC HPTLC, GC-MS, LC-MS etc were found from the literature.

Keywords: Bumetanide; HPLC; Methanol; Helium

Introduction

Bumetanide [1] ($C_{17}H_{20}N_2O_5S$) chemically known as 3-butylamino-4-phenoxy-5-sulfamoylbenzoic acid, is an antiepileptic drug. Bumetanide (Figure 1) is synthesized from 4-chlorobenzoic acid (Mo. Wt. 364.417g/mol). It is used to treat oedema due to heart failure, liver failure, or kidney problems and high blood pressure. Bumetanide acts by blocking NKCC1 cation-chloride co-transporter and in turn reduced chloride concentration in neurons of brain. This leads to more hyperpolarization activity by GABA, useful for treatment of neonatal seizures.

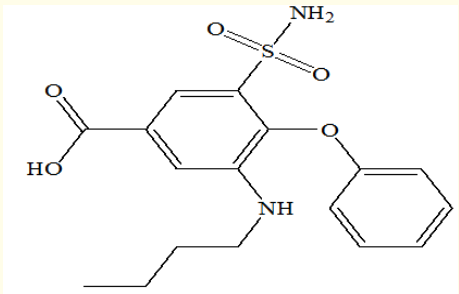

Figure 1: Structure of Bumetanide.

Bumetanide analysed by using different analytical techniques is referenced in this paper. Analytical techniques found in prior-art include spectrophotometry [2,3], spectrofluorimetry [4] (Table 1), HPLC [5-25] (Table 2), LC-MS [26-34] (Table 3), GC-MS [35-38] (Table 4), capillary electrophoresis [39-41] (Table 5), CE-ESI-MS [42], HPTLC [43], Luminescent methods [44] (Table 6).

Reagent	λ (nm)	Linearity µg/ml	Ref
Borate buffer of (pH 9.0) Phosphate buffer of (pH 7.0)	252	5-75	[2]
Phosphate buffer (pH 3.6) Phosphate buffer (pH 2.0) Hydrochloric acid Distilled water	336.21 346.19 345.02 345.13	1-60	[3]
Acetonitrile	619	0.2-1	[4]

Table 1: Review of Spectrophotometric methods.

Mobile phase(v/v)	λ(nm)	Type of Column	Linearity (µg/ml)	Ref
HPLC Acetic acid: Acetonitrile: Water (0.1: 80: 20)	220	C18 column (250 mm × 4.60 mm i.d, 5µm)	0.1-100	[5]
HPLC Methanol: Water (70:30)	335	ODS2C18 250mm×4.6mm i.d, 5µm	1-10	[6]
HPLC Phosphate buffer solution (pH 7.8) – Acetonitrile (70:30)	216	Alitima C8 column (4.6mm×250mm 5µm)	0.6-1.6	[7]
HPLC Methanol-Water-Acetic acid (60:40:0.5)	231	RP-8 (Varian) 250 x 4.6 mm, 10 µm	0.04-0.18	[8]
HPLC Glacial acetic acid: Tetrahydrofuran: Water: methanol (2:5:45:50)	254	Bondapak C18 column	--	[9]
HPLC 0.1% O-pthalaldehyde and Acetonitrile	254	C18 250mm×4.6mm5µm	0.315-1.875	[10]
HPLC Acetonitrile –Water (50:50)	228	kromasil C-18	-	[11]
HPLC Methanol: Water (75:28)	264	Kontron phenomenex column (4.6mm×250mm 5µm)	0.038-0.608	[12]
HPLC 0.05mol/L potassium dihydrogen phosphate -acetonitrile (50:50)	267	-	20-60	[13]
HPLC Methanol-water (75: 25)	328	Hypersil ODS2 column	0.208-1.040	[14]
HPLC Methanol-Water (60: 40)	220	kromosil ODS (5µm×4.6, 200mm)	0.013-0.13	[15]
UPLC Water: Acetonitrile (30: 70)		Acquity SB C18, 2 x 100 mm, 1.8µm, 5m	12.5-75	[16]
HPLC Acetonitrile–Water (50: 50)	--	**µBondapak** C18 column	50-499	[17]
HPLC Acetonitrile -0.01 M Phosphoric acid (35:65)	235	C8 reversed phase column (4.8 x 150 mm)	10-100	[18]
HPLC 50 mmol L−1 Phosphate buffer (pH = 3.0); solvent B: Acetonitrile.	214	Agilent Zorbax XDB-C18 column (150mmlength×4.6mm i.d., 5 lm particle size)	5-250	[19]
HPLC 0.05 M Phosphate buffer (pH 3) - Acetonitrile	230	HP Hypersil ODS (&)) 5-flrn column, 200 mm x4.6 mm I.D.	-	[20]
HPLC Eluent A-Water: Triethylamine: Phosphoric acid pH-3.3: Acetonitrile (530ml:145µl:650µl:470ml) Eluent B- Water: Triethylamine: Phosphoric acid pH-3.3: Acetonitrile (800ml: 145µl: 380µl: 200ml)	223	Lichrospher 100 RP-18 OctaDecylSilyl encapped (5 mm) column	-	[21]
HPLC Methanol: Water: Glacial acetic acid (66:34:1)	228	Bonded phase C18 column	5-2000	[22]
HPLC Methanol: Water: Glacial acetic acid (70:30:0.1)	228	Reverse phase C-18 radial capression cartridge	Plasma (2.5-100) Urine (10-500)	[23]
60% (v/v) Methanol in aqueous potassium dihydrogen orthophosphate (O.l%, w/v); Phosphoric Acid(pH- 4)	338	**µ**Bondapak C18	1-100	[24]
Methanol: Water: Glacial acetic acid (65:35:1)	235	Reverse phase C 18	-	[25]

Table 2: Review of liquid chromatographic methods.

Method	Mobile phase (v/v)	Linearity ng/ml	Ref
LC-MS	1% Acetic acid-Acetonitrile.	2-200	[26]
LC-MS	Acetonitrile-Water (50:50)	0.3-1	[27]
LC-MS	---	0.3-200	[28]
LC-MS	Methanol: Water(50:50)	1-1250	[29]
LC-MS	1% Acetic acid in water-acetonitrile	1-500	[30]
LC-MS	1% Aqueous formic acid : Acetonitrile (50:50)	1-200	[31]
UPLC-MS	Acetonitrile: 1% Formic acid (50:50)	2-500	[32]
UPLC-MS/MS	10 mM Ammonium acetate -Methanol	1.25-12.5	[33]
UPLC-MS/MS	15mmol/L Ammonium acetate solution –Methanol	-	[34]

Table 3: Review of liquid chromatography–Mass spectrophotometric methods.

Method	Carrier gas	Linearity µg/ml	Column	Ref
GC-MS	Helium	2.5-5	Fused-silica cross-linked methyl silicone capillary column	[35]
GC-MS	Helium	-	HP-1 capillary	[36]
GC-MS	Helium	Horse urine 0.5-5	Capillary Column VF-DA	[37]
GC-MS	Helium	Human urine 2.5-20	Combipal and Factor Four Capillary Column VF-DA	[38]

Table 4: Review of GC-MS methods.

Mobile phase	Linearity µg/ml	λ (nm)	Ref
CE 5 mM of triethylamine, 0.1 lM of fluorescein, and 5% of n-butanol	2.5-125	473	[39]
CE H_3BO_3–$Na_2B_4O_7$ (pH 8.98)	1-50	--	[40]
CE Citrate buffer (pH-5) Phosphate buffer(pH-7) Borate buffer(pH 7-10)	--	350	[41]
CE-ESI-MS 40 mM Ammonium formate buffer (pH 9.40)	0.9-165	214	[42]

Table 5: Review of Capillary electrophoresis (CE) methods.

Method	Mobile phase	Linearity µg/ml	λ (nm)	Ref
HPTLC	Toluene: Ethyl acetate: Formic acid (7:3.5:0.5 v/v/v)	100-800	335	[43]
Luminescent	Methanol	50-5000	325	[44]

Table 6: Review of other methods.

Conclusion

Different analytical methods such as UV, HPLC, UPLC, Capillary electrophoresis and hyphenated techniques such as LC-MS, GC-MS, and CE-ESI-MS were reported in previous research for estimation of Bumetanide. Determination of Bumetanide in biological samples, bulk and pharmaceutical dosage forms were also reported. This review article will be very useful for the researchers to compare any new analytical method developed with that of the previously available methods for the estimation of Bumetanide.

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