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Review Article

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Spectrophotometric and chromatographic methods for estimation of Pantoprazole in combined dosage forms

Shailendra Suryawanshi Sanjay[*1], Zaranappa[1], Chaluvaraju K. C.[1], Veena M. K.[1] and Ajith Kumar[4]

[1]Department of Pharmaceutical Chemistry, Government College of Pharmacy, Rajiv Gandhi University of Health Sciences, Bengaluru, Karnataka, India
[2]Department of Pharmacognosy,Government College of Pharmacy, Rajiv Gandhi University of Health Sciences, Bengaluru, Karnataka, India

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ABSTRACT

Pantoprazole is a Proton Pump Inhibitors (PPI'S) used in various commercial pharmaceutical formulations for the treatment of acid related gastrointestinal disorders such as bleeding peptic ulcer, for prophylaxis of acute stress ulcers, short term treatment of erosions & ulceration of the esophagus caused by gastro esophageal reflux disease and also used in the treatment of ulcer induced by Non-Steroidal Anti-Inflammatory Drugs. The various commercial pharmaceutical formulations of Pantoprazole in combination with other drugs such as, Diclofenac, Domperidone, Ondansetron, Cinitapride, Mosapride, Rabeprazole, Esompeprazole, Itopride, Levosulpride, Itopride hydrochloride, Ketoprofen, Valsartan, Benzimidazole sulfoxides are available in pharmaceutical market. In order to meet the standards of pharmacopoeial limits of the drug Pantoprazole in various pharmaceutical dosage forms many analytical methods have been developed and validated for the routine quality control. Keeping this in view various analytical tools developed for the analysis of Pantoprazole in combined dosage forms were reviewed briefly in the present study. The methods adopted were UV Spectrophotometric and High Performance Liquid Chromatographic (HPLC).

Keywords: Pantoprazole, Estimation, Spectrophotometric, Chromatographic, Proton Pump Inhibitors.

INTRODUCTION

Pantoprazole [1,2] chemically,5-Difluoromethoxyl benzimidazole -2-yl-3,4-dimethoxy-2-pyridyl methyl sulfoxide belongs to the class of substituted benzimidazole and it is a long acting proton pump inhibitor. It acts by suppressing gastric acid secretion by inhibiting H^+ K^+ ATPase at the secretory surface of the parietal cells and blocks the final step of gastric acid secretion. Pantoprazole is more acid stable and has higher bioavailability than omeprazole. It is well absorbed from the Gastro Intestinal Tract (GIT). Its bioavailability is 77% and shows dose dependent responsewith more acid stability and available for intra-venous administration, particularly employed in bleeding peptic ulcers. It has lower affinity for cytochrome P450 than Omeprazole and Lansoprazole and has minimal drugs interaction. Pantoprazole is freely soluble in water and very slightly soluble in phosphate buffer pH7.4 and available aswhite to off white crystalline powder.

As the Pantoprazole is available in many brands in combination with other drugs, the quality control of these pharmaceutical formulations play a vital role in drug industries. The reason being, these formulations may contain

impurities, related substances, degraded products and toxic substance along with the drug contents, which may cause the harmful pharmacological effects in patients. Hence, to launch such formulations in the market they have to be analysed for their purity and drug contents. Keeping this in view various analytical tools developed for the estimation of Pantoprazole with other drugs were reviewed briefly in the present communication. The chemical structure of Pantoprazole and other drugs used in combination with Pantoprazole were presented in **Figure1-13.**

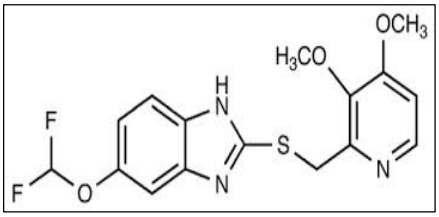

Fig 1: Chemical structure of Pantoprazole

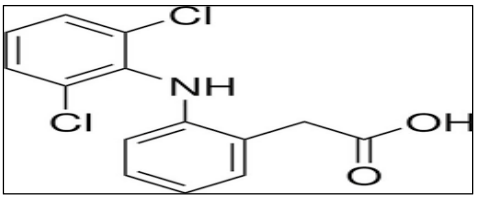

Fig 2: Chemical structure of Diclofenac

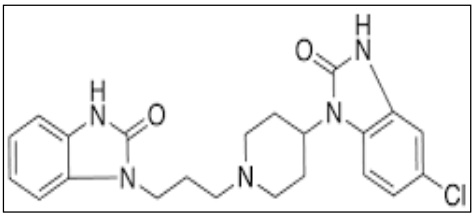

Fig 3:Chemical structure of Domperidone

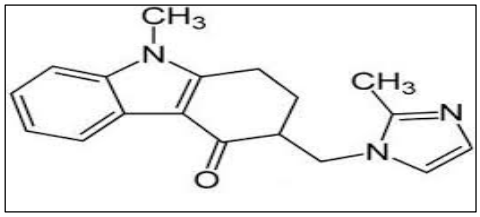

Fig 4: Chemical structure of Ondansetron

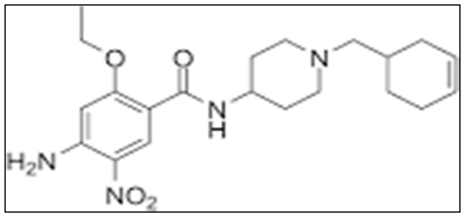

Fig 5: Chemical structure of Cinitapride

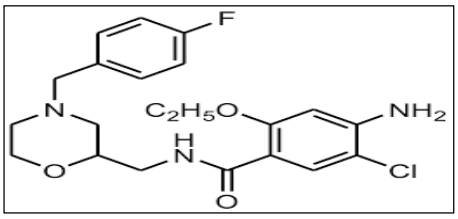

Fig 6: Chemical structure of Mosapride

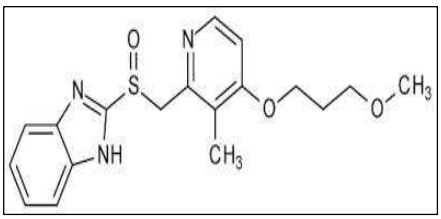

Fig 7: Chemical structure of Rabeprazole

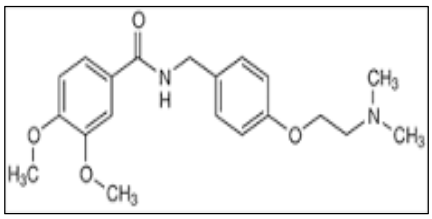

Fig 9: Chemical structure of Itopride

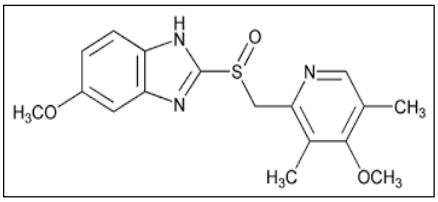

Fig 8:Chemical structure of Esomeprazole

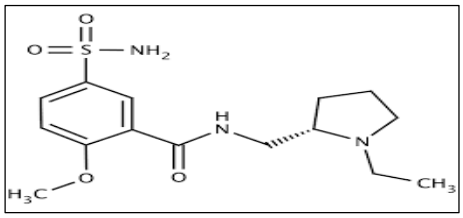

Fig10:Chemical structure of Levosulpride

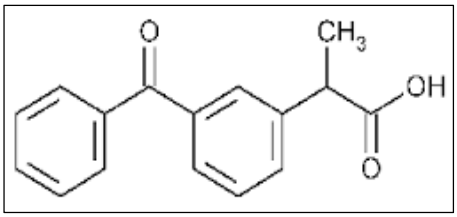

Fig 11: Chemical structure of Ketoprofen

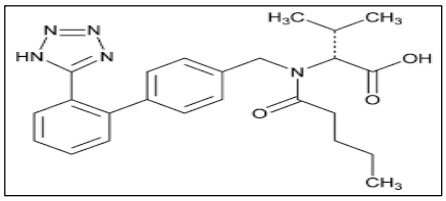

Fig 12: Chemical structure of Valsartan

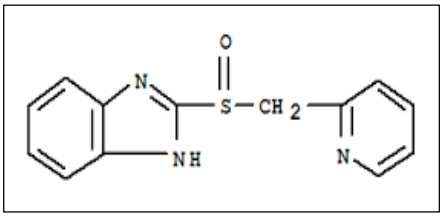

Fig 13: Chemical structure of Benzimidazole sulfoxide

Naik K*et al.*,have developed a validated derivative spectrophotometric method for simultaneous estimation of Diclofenac and Pantoprazole in combined capsule dosage form. The zero crossing technique was used for the estimation. The wavelengths 290.2 nm and 276.2 nm of first derivative spectrum were selected for the estimation of Diclofenac and Pantoprazole respectively without mutual interference. The linearity of Diclofenac and Pantoprazole was found to be in the concentration range of 15-75 µg/ml and 5-25 µg/ml respectively [3].

Kumar PR *et al.*,have reported simultaneous estimation of Domperidone and Pantoprazole in solid dosage form by UV spectrophotometry. In this research work simultaneous equation method and Q – absorbance analysis methods were used for estimation. The method involves solving the simultaneous equation and Q- value analysis based on measurement of absorptivity at 216 nm, 287 nm and 290 nm respectively. The linearity of Domperidone Pantoprazole was found between the concentration range 1-15 µg/ml, 0-50 µg/ml respectively [4].

Kakde RB *et al.*,have reported three wavelength spectrophotometric method for estimation of Pantoprazole and Domperidone in pharmaceutical preparation. The absorbance value at 331 nm was used for the estimation of Pantoprazole and Domperidone showed zero absorbance. The absorbance value for Domperidone was estimated by taking difference of absorbance at two wavelengths 284 nm and 364.5 nm. Both drugs obeyed the Beer's range between the concentration ranges of 10-50 µg/ml [5].

Mujbile S *et al.*,have reported a method for the simultaneous estimation of Ondansetron and Pantoprazole in solid dosage form by UV first derivative spectroscopy. The zero crossing point for Pantoprazole and Ondansetron was observed at 288.5 nm and 310 nm respectively. Water was used as solvent for the estimation. The Beer's range was observed between the concentration range of 0.5-2.5 µg/mL and 5-25 µg/mL for Ondansetron and Pantoprazole respectively [6].

Keyur PD *et al.*,have reported a method for the simultaneous estimation of Levosulpride and Pantoprazole by first and second order derivative spectroscopy in capsule dosage form using 0.1N hydrochloric acid as solvent. The absorbnce measurement was carried out at 266.7 nm and 257.20 nm for Pantoprazole and Levosulpride respectively. In second order derivative spectroscopic method the absorbnce measurement was carried out at 280 nm and 244 nm for Pantoprazole and Levosulpride respectively. Both methods obeyed the Beer's range in the concentration range of 15-40 µg/mLand 30-80 µg/mLfor Pantoprazole Levosulpride respectively[7].

Mevada ZN *et al.*,have developed a method for the simultaneous estimation of UV- Spectroscopic method for Pantoprazole and Cinitapride in combined dosage form. The absorbance measurement was carried out at 279 nm and 289.6 nm for Pantoprazole and Cinitapride respectively. The Beeer's range was observed between the concentration range of 1-5 µg/mL for Pantoprazole and 13-65 µg/mL for Cinitapride [8].

Birajdar AS *et al.*,have reported UV-Spectrophotometric method for the estimation of Mosapride and Pantoprazole in a fixed dose combination. The absorbance maximum absorbance of Mosapride was found to be at 274 nm and the maximum absorbance of Pantoprazole was found to be at 288.2 nm [9].

Addo RT *et al.*,have developed and validated a UPLC method for the rapid and simultaneous estimation of of proton pump inhibitors. The estimation was performed on a UPLC instrument equipped with a quarternary solvent delivery system and also the samples were monitored under the refrigerator. The C-18 analytical column controlled under was used as stationary phase. Solvent system composed of acetonitrile and water were used as mobile phase in the gradient chromatographic mode. The detection of separated components was performed using photo diode array detector and scanning range was 210 nm to 400 nm [10].

Springerlinkhas published a RP-HPLC method for the determination of Pantoprazole, Rabeprazole, Esomeprazole, Domperidone and Itopride in pharmaceutical products. The effective separation of drugs was carried out using Hypersil RP C-18 column as stationary phase with acetonitrile: 0.05M potassium di hydrogen phosphate buffer of pH 4.7 as mobile phase in the ratio of 280:270 v/v. The flow rate of mobile phase was 1 mL/minute with the UV detection at 210 nm [11].

Shitole S *et al.*,have developed and validated RP-HPLC method for estimation of chiral purity of S (-) Pantoprazole sodium and Mosapride capsule dosage form. The chromatography was achieved by using Chiralcel OJ-RH analytical column (4.6 mm x 150 mm, 5µ). The column temperature was 25^0 C. The mobile phase consisting of 10 mM sodium perchlorate buffer: acetonitrile (75:25 v/v) was used at flow rate of 0.5 mL/minute. The detection was carried out at 290 nm. The retention time of S (-) Pantoprazole and of S (+) Pantoprazole were found to be 14.7 minute and 17.4 minute respectively. The method was validated for, linearity, accuracy, precision, specificity, system suitability criteria, filter validation and solution stability [12].

Debnath M *et al.*,have reported an isocratic method development and validation for simultaneous estimation of Levosulpiride and Pantoprazole in bulk sample as well as in tablet dosage forms by using RP-HPLC. The analytical method was developed on a Phenomenex column C-18 (250 mm x 4.6 mm, 5µ) using buffer (p^H adjusted to 2.8 with 1% OPA): methanol (50:50 v/v) as mobile phase. The flow rate was 1.0 mL/minute. The separated components were detected by using UV- detector at 232 nm. The run time was 7 minute. The retention time of Levosulpiride and Pantoprazole was found to be 1.533 minute and 5.098 minute respectively [13].

Amaranth BM *et al.*,have developed and reported RP-HPLC method for the simultaneous estimation of Pantoprazole and Ondansetron Hydrocloride in bulk and in a synthetic mixture. The Hypersil ODS C-18 column (250 mm x 4.6 mm, 5µ) was used as stationary phase and the mobile phase composed of acetonitrile: buffer adjusted to p^H 3.6 (60:40 v/v) was used for the chromatographic separation of both the drugs. The flow rate was 1.0 mL/minute. The UV detector ware used to detect the effluent at 210 nm. The retention time of Pantoprazole and Ondansetron Hydrocloride was found to be 3.265 minute and 4.092 minute respectively [14].

Mamatha K *et al.*,have developed and validated RP-HPLC method for simultaneous estimation of Levosulpiride and Pantoprazole in combined pharmaceutical dosage form. The C-18 column (Hypersil BDS 4.6 x 250 mm 5µm) was used as stationary phase. The mobile phase composed of dipotassium orthophosphate buffer: acetonitrile (70:30 v/v) was used. The flow rate was 1.2 ml/minute. The retention time of Levosulpiride and Pantoprazole was found to be 8.77 minute and 2.77 minute respectively. The both drugs showed the linearity between the concentration 1-7 µg/mL with correlation coefficient 0.999 [15].

Umadevi RK *et al.*,have developed validated HPLC method for simultaneous estimation of Ciprofloxacin and Pantoprazole. The separation was carried out by using C-8 column [Phenomenex Luna 5µ (250x4.6 mm, 5 µm). The solution composed of acetonitrile: water: triethylamine (60:40:0.1%v/v/v) pH adjusted to 4.0 with orthophosphoric acid was used as mobile phase. The flow rate was 1 mL/minute. The detection was carried out by using UV-detector at 280 nm. The retention time for Ciprofloxacin and Pantoprazole was found to be 2.6 minute and 4.0 minute respectively [16].

Vidyadhara S *et al.*,have developed and validated method for simultaneous estimation of Cinitapride and Pantoprazole in solid dosage forms by RP-HPLC. The chromatography was carried out on C-18 column using isocratic mode using acetonitrile: phosphate buffer (50:50 v/v, p^H 6.8) as mobile phase. The flow rate was 1.0

mL/minute. The UV detection was carried out at 281 nm. The retention time of Cinitapride and Pantoprazole were found to be 4.5 minute and 5.4 minute respectively. The linearity of Cinitapride and Pantoprazole was found to be 1.5-10.5 µg/mL and 20-140 µg/mL respectively [17].

Jagatiya V *et al.*,have reported simultaneous estimation of Cinitapride and Pantoprazole sodium by RP-HPLC in their marketed formulation. The C-18 column (250 mm x 4.60 mm i.d, 5 µm) was used as stationary phase. The mobile phase composed of acetonitrile: water: triethylamine (80:20:0.05) was used for the effective chromatographic separation of both the drugs. The flow rate was 1.2 mL/minute. The separated components were monitored at 260 nm. The retention time of Cinitapride and Pantoprazole was found to be 5.26 minute and 1.72 minute respectively. The Cinitapride and Pantoprazole showed the linearity between the concentration range of 12-28 µg/mL and 24-56 µg/mL respectively [18].
Kumar KA *et al.*,have developed a validated RP-HPLC method for simultaneous estimation of Pantoprazole sodium and Itopride hydrochloride. Chromatographic separation was carried out using C-18 column as stationary phase through isocratic mode. The mobile phase composed of acetonitrile: phosphate buffer in the ratio of 40:60 v/v was used. The mobile phase was delivered at flow rate of 1 mL/minute with UV detection at 207 nm. the retention time of Pantoprazole sodium and Itopride hydrochloride was found to be 3.52 minute and 2.51 minute respectively [19].

Kaymakcoglu BK *et al.*,have reported determination and validation of Ketoprofen, Pantoprazole and Valsartan together in human plasma by HPLC. The chromatographic separation of Ketoprofen, Pantoprazole and Valsartan in plasma was carried out using Chromasil C-18 column (250 mm x 4.6 mm i.d., 5 µm particle size) using mobile phase composed of 0.02 M sodium dihydrogen phosphate buffer (pH 3.15): acetonitrile at ratio of 58:42 v/v. The mobile phase was delivered at flow rate of 1 mL/minute with UV detection at 225 nm and 272 nm [20].

Birajdar AS *et al.*,have reported RP-HPLC method for the estimation of Mosapride and Pantoprazole in a fixed dose combination. Chromatographic separation was carried out using C-18 column as and mixture of acetonitrile: 30 mM ammonium sulphate buffer (pH 5.5) in the ratio of 50:50 v/v as mobile phase. The flow rate was 1.0 mL/minute and the eluents Pantoprazole and Mosapride citrate were eluted at 5.68 minute and 8.85 minute respectively [21].

Reddy P *et al.*,have reported HPLC method for simultaneous estimation of Pantoprazole and Domperidone from tablet dosage form. The Hypersil BDS C-18 column (150 x 4.6 mm, 5 micron) was used as stationary phase. The solvent system composed of 0.05 M potassium dihydrogen phosphate buffer (pH 4.7): acetonitrile (720:280 v/v) was used as mobile phase for effective chromatographic separation. The flow rate of mobile phase was 1.0 mL/minute. The detection of eluted components was carried out at 280 nm using UV detector [22].

Gupta KR *et al.*,have studied stability indicating RP-HPLC method for simultaneous determination of Pantoprazole sodium and Itopride hydrochloride in bulk and capsule. Chromatographic analysis was carried out by using Phenomenex C-18 column (5 µm, 250 mm x 4.6 mm) as stationary phase. The mobile phase composed of phosphate buffer and acetonitrile in the ratio of 55:45 v/v with pH 5.0 was used for effective separation both drugs. The eluted components was monitored at 289 nm using UV detector [23].

Tanaka M *et al.*,have studied high performance liquid chromatographic separation of enantiomers of Pantoprazole and other Benzimidazole sulfoxides. The stationary phase consists of chiral cellulose bases are used for the chromatographic separation. The Chiralcel ODR and Chiralcel OJ-R columns was used and mobile phase composed of mixture of 50 mM sodium perchlorate solution and acetonitrile was used. The flow rate of mobile phase was 0.5 mL/minute. The separation factor was 1.26 and 1.13 for Pantoprazole and Benzimidazole sulfoxides respectively [24].

Sivakumar T *et al.*,have reported HPLC analysis and computer assisted optimization of liquid liquid extraction of Domperidone and Pantoprazole in human plasma. After the successive liquid liquid extraction the solute were qualified and quantified using HPLC. The separation was carried out using C-18 column with 10 mM phosphate buffer with (pH 7.0): methanol: acetonitrile (48.46:20:31.54 v/v) as mobile phase. The flow rate of mobile phase was 1.20 mL/minute with UV detection at 285 nm [25].

CONCLUSION

This review presents UV spectrophotometric methods and chromatographic methods such as High Performance Liquid Chromatography (HPLC) for the quantitative estimation of Pantoprazole in bulk and combined dosage formulation. These methods were quite common and most frequently used for quantification or confirmation of substance identity and its purity in pharmaceutical industries and research laboratories.

REFERENCES

[1] Shailendra SS; Zaranappa; KC Chaluvaraju; K Anil,*J Chem Pharm Res* **2016**;8(4):1180-1186.
[2] http://en.wikipedia.org/wiki/Pantoprazole.
[3] K Naik; G Parmar; J Ahiya; K Bodiwala; S Shah,*Asian J Research Chem.*,**2013**, 692), 155-7.
[4]PR Kumar; PB Prakash;MM Krishna; MS Yadav; A Deepthi,*Hindavi Publishing Corporation J Chem.*,**2006**, 3(3), 142-145.
[5] RB Kakde; SN Gedam; NK Chaudhary; AG Barsagade; Kale; AV Kasture,*Int J Pharm Tech Res,*. **2009**, 1(2), 386-9.
[6] S Mujbile; P Prasad; S Wate,*J Pharm Bio Sci*.,**2012**, 4(4), 5-8.
[7] PD Keyur; H Raj; SR Jatin; K Nilesh,*Uni J Pharm*.,**2013**, 2(1), 160-7.
[8] ZN Mevada; N Kalsariya; R Chauhan; S Shah; D Shah,*Int J Pharmaceut Sci Rev Res*.,**2012**, 14(2), 102-5.
[9] AS Birajdar; SN Meyyanathan;B Suresh,.*Int J Pharmaceut Stud Res.*,**2011**, 2(2), 29-36.
[10] RT Addo, K Davis, R Ubale, IS Owen, B Watkins. *AmAssoc Pharmaceut Sci.*,**2015**, 16(1), 30-31.[11] Springerlink,*Springer*.,**2007**, 6(5), 11-12.
[12] S Shitole; J Alhat; N Pawar,*Int J Pharmacy & Pharmaceut Res.*,**2015**, 4(2), 159-69.
[13] M Debnath; AS Kumar,*CIB Tech J Pharmaceut Sciences*,**2015**, 4(3), 26-35.
[14] BM Amaranth; M Srinivas,*Int J Pharm Tech Research.*,**2014**, 6(6), 1794-802.
[15] K Mamatha; VVLV Prasad; MA Haque; V Bakshi,*Int J Pharma Research and Health Sciences.*,**2014**, 2(6), 514-18.
[16] RK Umadevi; C Javali; MD Karvekar; PL Somashekar,*Universal J Pharmacy.*, **2014**, 3(6), 34-8.
[17] S Vidyadhara; YS Rao; A Ramu; RL Sasidhar; AJ Ramya,*Orient J Chem.*,**2013**, 29(3), 1213-20.
[18] V Jagatiya; J Patel,*Int J Chem Tech Research.*,**2012**, 4(4), 1396-401.
[19] KA Kumar; SV Janadharanan; YS Reddy; NV Kumar,*Int J Pharm Pharmaceut Sci*., **2013**, 5(1), 190-4.
[20] BK Kaymakcoglu; S Unsalan; SRollas,Pharmazie., **2005**, 6(1), 586-9.
[21] AS Birajdar; SN Meyyanathan; B Suresh,.*Int J Pharmaceut Stud Res.*,**2011**, 2(2), 29-36.
[22] P Reddy; Battu,*Int J Chem Tech Res***2009**, 1(2), 275-7.
[23] KR Gupta; B Rajesh; Chawla;SG Wadokar,*Orbital Res J Chem.*, **2010**, 2(3), 209-26.
[24] M Tanaka; H Yamazaki; H Hakusui,*JChairality*.,**1995**, 798, 612-5.
[25] T Sivakumar;R Manavalan;K Vallippan;*Original Res Papers*.,**2008**, 20(4), 549-62.