REVIEW ON DEVELOPMENT AND VALIDATION OF LIQUID CHROMATOGRAPHIC METHODS FOR ESTIMATION OF MEFENAMIC ACID AND RABEPRAZOLE IN SYNTHETHIC MIXTURE

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CERTIFICATE

This is to certify that Journal Club-I Submission on the topic of "**REVIEW ON VARIOUS SPECTROSCOPIC METHODS OF MEFENAMIC ACID AND RABEPRAZOLE**" was submitted by Nagi Simran Harminder Singh Enrollment No:**212060824002** at Department of Pharmaceutical Quality Assurance, A-One Pharmacy College, Enasan, Ahmedabad. The seminar has been prepared under my supervision and is to my satisfaction.

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REVIEW ON VARIOUS SPECTROSCOPIC METHODS OF MEFENAMIC ACID AND RABEPRAZOLE

Abstract:
Mefenamic acid (MFA) is a non-steroidal anti-inflammatory drug that belongs to the anthranilic acid derivative family. It is used to relieve mild to moderate pain. Rabeprazole (RBP) is an proton pump inhibitor which inhibits gastric acid secretion. Proton-pump inhibitors (PPIs) have been proven efficacious in healing NSAID-associated ulcers, as they provide potent and long-lasting inhibition of gastric acid secretion. The present review article includes a compilation of articles on the various properties along with an extensive literature survey on the reported analytical methods of MFA and RBP. Using a comprehensive computer assisted literature review; this article discusses the analytical methodologies for quantifying MFA and RBP both in active pharmaceutical ingredient and pharmaceutical dosage forms. This is the first review article in this series with focus on the analytical profile of MFA. This review focuses on several methods like High Performance Liquid Chromatography (HPLC), Thin Layer Chromatography (TLC), spectrophotometry, fluorimetry, turbidimetry, Atomic Absorption Spectroscopy (AAS), Mass Spectroscopy (MS) and electro analytical methods of MFA and RBP.

Keywords: Mefenamic acid (MFA), Rabeprazole (RBP), Spectroscopic methods, NSAIDS, Proton pump Inhibitors

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INTRODUCTION:

A non-steroidal anti-inflammatory medication is MFA (Fig. 1). It functions as an analgesic, an antipyretic, and a less potent anti-inflammatory. It is used to treat various types of pain, including toothaches and menstrual cramps [1]. In IP [2], BP [3], USP [4], and EP [5], MFA is recognised as official. Anthranilic acid, often known as MFA, is a white to off-white, crystalline powder having a melting point between 230 and 231 °C. MFA is structurally 2- (2,3-dimethylanilino) benzoic acid, with a molecular mass of 241.28 g/mol and the formula C15H15NO2 [6,7]. The optical activity of the MFA, an achiral molecule, is unknown [8]. According to a review of the literature, numerous methodological techniques are now being developed and validated for the use of MFA either alone or in combination with other drugs [9]. The medicine has a low water solubility and high permeability, making it a Biopharmaceutical Classification System (BCS) category II drug [10]. This review article gives readers a wealth of information on the many analytical techniques for calculating MFA. HPLC was discovered to be the most effective and validated of the published analytical procedures for measuring MFA, followed by spectrophotometric and other techniques. This review highlights the key analytical techniques for quantifying and identifying MFA in both pharmaceutical goods and biological samples that have been previously reported in the literature. The search was restricted to the following databases for this purpose: PubMed, Scopus, and Web of Science, with a 1990–2021 time frame.

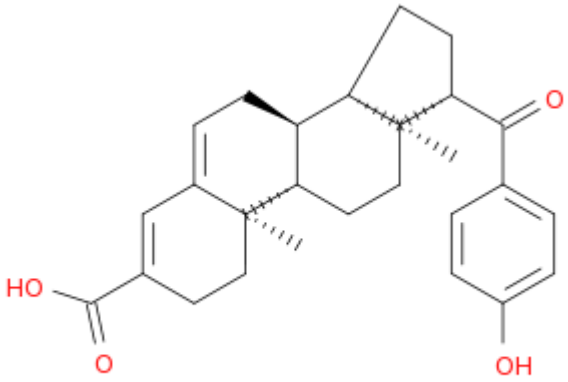

Figure 1: Structure of MFA

Proton pump inhibitor with benzimidazole substitution, rabeprazole. By inhibiting H+, K+-ATPase on the secretory surface of the partial cellular cells, the sodium salt of rabeprazole, a proton pump inhibitor in the stomach, can reduce gastric acid secretion without altering cholinergic or histamine H2-receptors. To eradicate Helicobacter pylori, sodium rabeprazole is typically prescribed in combination with other medications. Additionally, rabeprazole is one of the medications used to treat duodenal ulcers. Additionally, it is used to treat Zollinger-Ellison syndrome and gastroesophageal reflux disease, both of which are associated with excessive stomach acid production. It is also used in cases of gastric ulcers caused by bacteria where it is used with antibiotics [11]

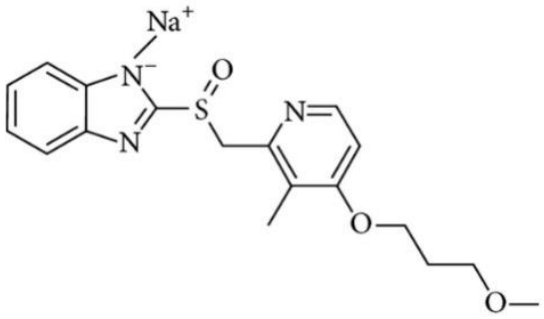

Figure 2: Structure of Rabeprazole

Table 1. Spectrophotometric method for analysis of MFA

Sr. No.	Drug	Method	Description	Reference
1.	MFA	Spectrophotometric method	Solvent: Distilled Water λmax: 540 nm LOD: 2.16 µg/ml	12
2.	MFA	Spectrophotometric method (oxidation coupling reaction)	Solvent: NaOH λmax: 533 nm LOD: 0.19 µg/ml	13
3.	MFA	Spectrophotometric method	Solvent: Distilled Water λmax: 285 nm LOD: 5-60 µg/ml	14
4.	MFA	Spectrophotometric method	Solvent: Ethanol λmax: 715 nm LOD: 0.31 µg/ml	15
5.	MFA	Spectrophotometric method	Solvent: Water λmax: 288 nm	16
6.	MFA	Spectrophotometric method	Solvent: 1,4dioxne λmax: 353 nm	17
7.	MFA	Spectrophotometric method	Solvent: 0.1 N NaOH λmax: 286 nm LOD: 0.0118 µg/ml	18
8.	MFA	Spectrophotometric method	Solvent: Ferric chloride and ferric cyanide λmax: 730 nm LOD: 10-40 µg/ml	19
9.	MFA	Spectrophotometric method	Solvent: p-chloroanilic acid λmax: 520 nm LOD: 2.50 µg/ml	20
10.	MFA	Spectrophotometric method	Solvent: N-bromosuccin amide λmax: 360 nm LOD: 0.51 µg/ml	21
11.	MFA	Spectrophotometric method	Solvent:Thiazoline-2-one hydrozone λmax: 602 nm LOD: 0.06 µg/ml	22
12.	MFA	Spectrophotometric method (Indirect Method)	Solvent: Ferric chloride λmax: 510 nm LOD: 0.065 µg/ml	23
13.	MFA	Spectrophotometric method	Solvent: Methanol & Water λmax: 370 nm LOD: 0.03 ppm	24
14.	MFA	Spectrophotometric method (colorimetry diazotization)	Solvent: 4-amino-3,5-dinitrobenzoi c acid λmax: 490 nm LOD: 1 µg/ml	25

Table 2. TLC for analysis of MFA

Sr. No.	Drug	Method	Description	Reference
1.	MFA	TLC	Stationary Phase: Aluminium plates 60 F254 Mobile Phase: Chloroform :acetone: acetic acid: ammonia solution(70:30:2 :2)v/v/v/v λmax: 225 nm LOD: 0.3-2 µg/band	26
2.	MFA	TLC	Stationary Phase: Silica gel 60 F254 Mobile Phase: Chloroform :methanol (9.0:0.1,v:v) λmax: 320 nm LOD: 50-300 µg/ml	27

Table 3. HPLC method for analysis of MFA

Sr. No.	Drug	Method	Description	Reference
1.	MFA	RP-HPLC	Stationary Phase:A reversedphase 10 km PBondapak Phenyl column (10 pm, 300 x 3.9 mm) Mobile Phase: Methanol-glacial acetic acid-water (85:2:15, v/v) Detector: Polychrom 9060 detector. Flow Rate (ml/min): 1 Wavelength (nm): 278 Linearity (µg/ml): 25-150	28
2.	MFA	RP-HPLC	Stationary Phase:A reversedphaseNovaPak Cl8 column Mobile Phase:AcetonitrileTHFwater-glacial acetic acid (15:40:45:2, v/v) Detector:Photodiode array detector Flow Rate (ml/min):1 Wavelength (nm): 278 Linearity (µg/ml): 25-150	29
3.	MFA	HPLC	Stationary Phase:C8 Techsphere column Mobile Phase: Acetonitrile–water (50:50, v/v, pH 3) Detector: 486 tunableabsorbanc e detector Flow Rate (ml/min): 1 Wavelength (nm): 280 Linearity (µg/ml): 25-2000	30
4.	MFA	HPLC	Stationary Phase:ZORBAX Eclipse plus C18 column (150 × 4.6 mm2 Mobile Phase:0.05 M KH2PO4 buffer: acetonitrile (40:60, v/v) Detector: Diode array detector VL (G131SD) Flow Rate (ml/min):1 Wavelength (nm):225 Linearity (µg/ml):7-50	31
5.	MFA	RP-HPLC	Stationary Phase: A reverse phase column Chromolith (RP-18e, 100 mm x 4.6 mm, 5 µm) Mobile Phase:0.1% formic acid in deionised water or : 100% acetonitrile Detector: UV-Visible detector Flow Rate (ml/min): 1 Wavelength (nm): 275 Linearity (µg/ml): 5-250	32
6.	MFA	HPLC	Stationary Phase:Alltima C18 column (250x4.6 mm) Mobile Phase:Methanol : Ammonium acetate (67:33 v/v) Detector: UV2075 PLUS intelligent UV detector Flow Rate (ml/min):1 Wavelength (nm):254 Linearity (µg/ml):10-60	33
7.	MFA	HPLC	Stationary Phase:Alltima C18 column (250 x 4.6 mm, 5.0 µm) Mobile Phase:Triethylamine aqueous buffer adjust pH = 2 by H3 PO4 (85%): Methanol: Acetonitrile); (35: 20: 45 v\v\v %) Detector:uv visible detector Flow Rate (ml/min):2 Wavelength (nm):220 Linearity (µg/ml): 0.05-50	34
8.	MFA	HPLC	Stationary Phase: ODS-3 C18 column at 25 °C (4.6 x 250 mm Mobile Phase:Acetonitrile, acetic acid, and water (75:1:24) Detector:Uv Detector Flow Rate (ml/min): 1 Wavelength (nm):282 Linearity (µg/ml): 1.29-806	35
9.	MFA	RP-HPLC	Stationary Phase: Reverse phase C8 column Mobile Phase:Buffer : acetonitrile + THF in the ratio of 55:45 v/v Detector: DetectorSPD-20 A VP Flow Rate (ml/min):1	36

			Wavelength (nm):285 Linearity (µg/ml): 0.5-2	
10.	MFA	HPLC	Stationary Phase:C18 column (150×460 mm) Mobile Phase:50 mM solution of monobasic ammonium phosphate, and adjusted with 3M ammonium hydroxide to a pH of 5.0 as the buffer solution Detector:UV-Visible detector Flow Rate (ml/min):1 Wavelength (nm):280 Linearity (µg/ml): R2 =0.99 19	37
11.	MFA	HPLC	Stationary Phase: Atlantis d C18 column Mobile Phase: 0.025 M dibasic potassium phosphate (pH = 6.0, adjusted with phosphoric acid) and acetonitrile (65:35, v:v) Detector: photodiode array detector Flow Rate (ml/min):1.5 Wavelength (nm):278 Linearity (µg/ml): 0.05 – 10	38
12.	MFA	HPLC	Stationary Phase: Agilent ZorbaxEclipse XDB-C18 (150 mm x 4.6 mm) Mobile Phase: Acetonitrile and 2% triethylamine (60:40) Detector: UV-Visible detector Flow Rate (ml/min):1 Wavelength (nm):280 Linearity (µg/ml): 25-5000	39
13.	MFA	HPLC	Stationary Phase: ODS packing L1, 250 x 4.6 mm, 5 µ,column Mobile Phase:Acetonitrile : 0.05 M monobasic ammonium phosphate buffer : tetrahydrofuran (46 : 40 : 14) Detector: UV/Vis detector Flow Rate (ml/min):1 Wavelength (nm):254 Linearity (µg/ml):5-30	40
14.	MFA	HPLC	Stationary Phase: C18 Mobile Phase:Methanol:water (70:30)v/v Detector:uv/vis detector Flow Rate (ml/min):1.25 Wavelength (nm):370 Linearity (µg/ml): R2=0.993	41
15.	MFA	HPLC	Stationary Phase: C18 (250x4.6mm) Coloumn Mobile Phase:Acetonitrile : 0.05 M monobasic ammonium phosphate buffer : tetrahydrofuran (46 : 40 : 14) Detector: UV/Vis detector Flow Rate (ml/min):1 Wavelength (nm):254 Linearity (µg/ml):5-30	42
16.	MFA	HPLC	Stationary Phase: L-1, Techsphere ODS column Mobile Phase:Acetonitrile:acetica cid:water (72.5:1:26.5, v/v/v) Detector:SPD-10 A VP UV/vis detector Flow Rate (ml/min):1.5 Wavelength (nm):279 Linearity (µg/ml):100-300	43

Table 4. Fluorimetric methods of MFA

Sr. No.	Drug	Method	Description	Reference
1.	MFA	Fluorimetric method	The fluorescence of cerium (III) after stimulation at 255nm was measured at 354nm	44
2.	MFA	Fluorimetric method	The detection limit of MFA was1.4x10-8	45

Table 5. Turbidimetric methods of MFA

Sr. No.	Drug	Method	Description	Reference
1.	MFA	Turbidimetric method	Detector: UV- Vis spectrophotometer Wavelength: 465 nm Linearity: 0.3-7 mMol.L-1 , with correlation coefficient, r = 0.9954 LOD: n7.35 µg/sample	46
2.	MFA	Turbidimetric method	Detector: UV- Vis spectrophotometer Wavelength:288 nm Linearity: 0.3-7 or 0.3-10 mMol.L-1 , with correlation coefficient r = 0.9907 or 0.9556 LOD: 4.92 µg/sample	47

Table 6: Spectroscopic Methods of RPZ

Sr. No.	Drug	Method	Description	Reference
1.	RPZ	U.V visible spectroscopic	Solvent : Aqueous methanol MAX:284 nm	48
2.	RPZ	U.V visible spectroscopic	Solvent : Acetic acid medium λ Max : 470 , 420 nm LOQ : 4.176 , 2.273 Mg / ml	49
3.	RPZ	U.V visible spectroscopic	Solvent : RPZ sodium and aceclofenacc λ Max : 283 and 276 nm LOD :0.194 mg / ml	50
4.	RPZ	U.V visible spectroscopic	Solvent : RPZ sodium and diclofenac sodium λ Max : 285 nm LOD :0.517 mg / ml	51
5.	RPZ	U.V visible spectroscopic	Solvent : ceric ammonium sulfate λ Max : 516 nm LOD : 0.006391 mg / ml	52
6.	RPZ	U.V visible spectroscopic	Solvent : methanol λ Max : 280 nm LOD : 0.091 mg / ml	53
7.	RPZ	U.V visible spectroscopic	Solvent : methanol λ Max : 228 nm LOD : 1.08 mg / ml	54
8.	RPZ	U.V visible spectroscopic	Solvent : acetonitrile λ Max : 278 nm LOD : 0.40 mg / ml	55
9.	RPZ	U.V visible spectroscopic	Solvent : potassium dihydrogen orthophosphate buffer λ Max : 288 nm LOD : 1 mg/ml	56
10.	RPZ	U.V visible spectroscopic	Solvent : acetonitrile and phosphate buffer Max : 280 nm	57
11.	RPZ	U.V visible spectroscopic	Solvent : acetonitrile Max : 254 nm	58
12.	RPZ	U.V visible spectroscopic	Solvent : λ Max : 217 nm LOD : 0.000148 mg / ml	59
13.	RPZ	U.V visible spectroscopic	Solvent : RPZ sodium and lafutidine Max : 215 nm	60

Table 7: HPLC Methods of RPZ

Sr. No.	Drug	Method	Description	Reference
1.	RPZ	HPLC	Stationary phase : Mobile phase : methanol (30 : 70) Detector : Flow rate: 0.9 ml / min Wavelength : 284 nm Linearity : R2 of 1.0 in the range of 20 – 60 mg / ml	61
2.	RPZ	HPLC	Stationary phase : Mobile phase : MeOH : ACN : Water (60 : 10 : 30 v/v/v) Detector : Flow rate: 1.0 ml / min Wavelength : 280 nm Linearity : R2 of 0.999 in the range of 1 - 10 mg / ml	62

CONCLUSION:

MFA is an NSAID, a popular and efficient drug used to treat painful musculoskeletal conditions such as osteoarthritis, rheumatoid arthritis, and others by acting as a strong analgesic and anti-inflammatory agent. Rabeprazole sodium (RPS) belongs to a class of PPIs that suppresses gastric acid secretion by specific inhibition of the enzyme system of hydrogen/potassium adenosine triphosphatase (H^+/K^+ ATPase) at the secretory surface of the gastric parietal cell. The drug's analytical profile describes various analytical methods for detecting MFA and RPZ in pharmaceutical formulations and biological fluids. The HPLC method was found to be the most well-developed and validated method for determining MFA and RPZ, and it was followed by spectrophotometric and fluorimetric methods, hyphenated technique, turbidimetry, mass spectroscopy, and electroanalytical approaches.

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