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. 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. Using a comprehensive computer assisted literature review; this article discusses the analytical methodologies for quantifying MFA 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. Although, 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 were reported in the literature, HPLC stands out first for the quantification of MFA.
Keywords: Mefenamic acid; analytical methods; high performance liquid chromatography; spectroscopy; fluorimetry.

1. INTRODUCTION

MFA (Fig. 1) is a non-steroidal anti-inflammatory drug. It is an analgesic, antipyretic and weaker anti-inflammatory drug. It is used as pain reliever for tooth ache, menstrual pain etc [1]. MFA is official in IP [2], BP [3], USP [4] and EP [5]. MFA designated as anthranilic acid, which is a white to off-white, crystalline powder with a melting point ranging from 230-231°C. MFA is structurally 2-(2,3-dimethylanilino) benzoic acid [6] with molecular formula C₁₅H₁₅NO₂ and molecular mass 241.28 g/mol respectively [6,7]. The MFA is an achiral compound and the optical activity is unspecified [8]. A review of the literature shows that many methodological approaches are in the process of being formulated and validated for MFA may be used alone or in conjunction with other medications [9]. The drug is a Biopharmaceutical Classification System (BCS) type II drug which means it has a low water solubility and high permeability [10].

This review article provides readers with an abundance of details on the different analytical methods for determining MFA. Among the published analytical methods for estimating MFA, HPLC was found to be the most efficient and validated, followed by spectrophotometric and other methods. Distribution of analytical methods described in the literature for the determination of MFA is shown in Fig. 2. This review shows the highlight of analytical method for quantitation and determination of MFA in both pharmaceutical products and biological samples described in the literature. For this purpose the search focused on the following database: PubMed, Scopus and Web of Science whose period ranged from 1990 to 2021.

1.1 Mechanism of Action

MFA binds to the COX-1 and COX-2 prostaglandin synthetase receptors inhibiting prostaglandin synthetase activity. Pain effects are temporarily reduced when these receptors play a role as a key mediator of inflammation and a role for prostanoid signaling in activity-dependent plasticity [11].
2. ANALYTICAL STATUS ON MFA

Drug research is crucial in the pharmaceutical industry as it is used from the early stages of drug development to the post-marketing stages. Analytical methods lead to valuable knowledge about medicines such as bioavailability and bioequivalence tests, drug molecule physical and chemical stability and dosage form design, impurity quantification and detection as well as substance quality quantification of branded products and also used to test pharmacokinetic criteria for medicinal drug control. As per the WHO, drug quality management is a set of approaches used to guarantee the quality and purity of pharmaceuticals. These methods are widely carried out by using chromatography (e.g., High-Performance Liquid Chromatography (HPLC), Gas Chromatography (GC) and Thin-Layer Chromatography (TLC). In addition, many analytical techniques such as Ultra Violet Spectroscopy (UV), Mass Spectroscopy (MS) and fluorimetry are used to assess drug purity from the reports available on the literature, many instrumental analytical tools like atomic absorption spectrometry and turbidimetry are also used.

2.1 Spectroscopy Techniques of MFA

Spectrophotometric instruments are one of the most reliable instruments in pharmaceutical science for qualitative and quantitative drug analysis because they are simple, inexpensive and precise.

Asad Raza studied the spectrophotometric determination of MFA in pharmaceutical preparations using a Hitachi U-1100 UV–Visible spectrophotometer with a 1.00 cm glass cell based on the charge transfer complexation of MFA as an n-electron donor and chloranil as a π-acceptor results in a violet chromogen with a wavelength of 540 nm. The absorbance and concentration of the analysed drug in the range of 10–60 µg/ml were found to have a linear relationship with a strong correlation coefficient (0.9996) under ideal conditions [12]. Istabraq Qahtan Rashad et al studied the spectrophotometric determination of MFA using metal reagent by oxidative coupling reaction which involves an oxidative coupling reaction of MFA with metal in an alkaline medium with potassium periodate as an oxidizing agent to produce a water-soluble and stable substance with a maximum absorption at 533 nm. In a concentration range of 2.4–24 µg/ml MFA with a molar absorptivity of 7.2x103 L/mol cm, Beer’s law holds true which proves the suggested approach to be efficient. This procedure has been used to determine MFA in a variety of pharmaceutical formulations with great success [13].

Harinder Singh et al established development of UV spectrophotometric method for estimation of MFA in bulk and pharmaceutical dosage forms. The slope, intercept, correlation coefficient, identification and quantization limits were determined using Beer’s law. The suggested approach has been successfully used to analyze the drug in both its pure and tablet delivery forms [14]. Hendriwasito et al studied MFA determination in tablet formulations using a selective and accurate spectrophotometric method based on prussian blue formation. This method showed that after 15 minutes of incubation, visible spectrophotometric measurements at 715 nm were obtained under optimal conditions of 15 mmol/L potassium ferricyanide and 2.5 mmol/L ferric chlorides in 0.5 mol/L acetic acids [15]. A spectrophotometric approach for MFA was developed by Dr. Safila Naveed et al. [16]. This study compared the assay results of three separate brands of MFA (Mefnac, Ponstan, Dolar). Our findings show that the ponstan is 106.470%, Mefnac is 100.588 % while the percentage assay for Dolar is 100%. G. Mathai et al. established a spectrophotometric method of assay of MFA in tablets which involves dissolving the tablet powder in 1,4-dioxane and measuring the absorbance at 353.2 nm [17].

Nerdy Nerdy studied the UV spectrophotometry method for the determination of MFA in suspension dosage form and the solvent is sodium hydroxide (NaOH) 0.1 N solution. The determination of the Mefenamic acid suspension preparation uPondex®, Omestan® and Novastan® were that contain not less than 90.0% and not more than 110.0% of the amount stated on the label. The results meet the requirements of the validation test of analysis method with the parameter percent recovery 100.08% for accuracy, relative standard deviation 0.04% for precision, the correlation coefficient 1.0000 for linearity, range 8 µg/ml to 12 µg/ml, limit of detection limit 0.0118 µg/ml and limit of quantitation 0.0356 µg/ml [18]. Mallinath M. Langade developed spectrophotometric determination of MFA in bulk and tablet formulation. The reaction of the drug with ferric chloride in the presence of potassium
ferricyanide is the basis of the process. Beer's law was followed in the concentration range of 10 to 40 µg/ml [19].

N. A. Alarfaj et al. described spectrophotometric determination of MFA in pharmaceutical preparations. The first method (I) was based on the reaction of MFA as N-donor with p-chloranilic acid as a π-acceptor. The absorbance concentration ranges from 10-300 g/mL for a red-colored substance with a peak at 520 nm. The oxidation of MFA with N-bromosuccinamide is used in the second method (II). The third method (III) is based on the creation of an oxidative binding compound in the presence of ferric chloride solution by reacting MFA with 3-methylbenzo-thiazoline-2-one hydrazone as a chromogenic reagent [20].

Nief R. Ahmed et al studied indirect spectrophotometric method for the determination of MFA in pharmaceutical formulations. The method involves the oxidation of MFA by iron(III) followed by the complexation of iron(II) with o-phenanthroline resulting in a red-colored complex (ferroin) with a maximum absorbance at 510 nm. Beer's law is obeyed in the concentration range of 0.4-2.0 µg/ml [21]. Raju Chandra et al developed validation for the estimation of MFA from marketed tablet and the λmax was found to be 370 nm, the limit of detection and limit of quantification was 0.3 and 0.9 ppm respectively. The inter-day and intra-day mean recoveries by 98.56 % and 97.13 % for UV-spectrophotometer [22].

S O Idowu et al established novel colorimetric assay of MFA. This study was based on a diazo coupling reaction with diazotized 4-amino-3,5-dinitrobenzoic acid (ADBA) as the chromogenic derivatizing reagent. According to optimization tests, the coupling reaction was extremely fast, taking less than one minute to complete [23] (Table 1).

Table 1. Spectrophotometric method for analysis of MFA

| Compound | Method | Solvent | λmax | LOD   | Reference |
|----------|--------|---------|------|-------|-----------|
| MFA      | Spectrophotometric method | Distilled water | 540nm | 2.16 µg/ml | [12] |
| MFA      | Spectrophotometric method (oxidation coupling reaction) | NaOH | 533nm | 0.19 µg/ml | [13] |
| MFA      | Spectrophotometric method | Distilled water | 285nm | 5.60 µg/ml | [14] |
| MFA      | Spectrophotometric method | Ethanol | 715nm | 0.31 µg/ml | [15] |
| MFA      | Spectrophotometric method | Water | 288nm | ---- | [16] |
| MFA      | Spectrophotometric method | 1,4dioxane | 353.2nm | ---- | [17] |
| MFA      | Spectrophotometric method | 0.1N NaOH | 286nm | 0.0118 µg/ml | [18] |
| MFA      | Spectrophotometric method | Ferric chloride and ferric cyanide | 730nm | 10-40 µg/ml | [19] |
| MFA      | Spectrophotometric method | p-chloroanilic acid | 520nm | 2.50 µg/ml | [20] |
|          |        | N-bromosuccinamide | 360nm | 0.51 µg/ml | | |
|          |        | Thiazoline-2-one hydrazone | 602nm | 0.06 µg/ml | | |
| MFA      | Spectrophotometric method (Indirect) | Ferric chloride | 510nm | 0.065 µg/ml | [21] |
| MFA      | Spectrophotometric method | Methanol and water | 370nm | 0.03ppm | [22] |
| MFA      | Spectrophotometric method (colorimetry diazotization) | 4-amino-3,5-dinitrobenzoic acid | 490nm | 1 µ g/ml. | [23] |

a λmax-maximum wave length; b LOD -linearity
2.2 Chromatographic Technique Available for MFA

2.2.1 Thin layer chromatography (TLC)

For the simultaneous determination of MFA (MFA) and its two toxic impurities, Martha M. Morcoss et al established and validated a process. The proposed TLC- densitometric system using a mobile phase consisted of of chloroform: acetic acid: ammonia (70:30:2:2, v/v/v/v) and TLC aluminum plates 60 F254 was used as a stationary phase and the separated bands were UV-scanned at 225 nm [24]. Harrizul Rivai et al. studied and validated thin layer chromatography-densitometry method for analysis of MFA in tablet. The accuracy and reliability of the method was assessed by evaluation of linearity (50-300 μg/ml), precision intra-day and inter-day relative standard deviation values were always less than 2, accuracy (102.45 % ± 1.36% for Sample A and 100.28% ± 1.90% for Sample B) in accordance with ICH guidelines [25]. The detailed information is depicted in Table 2.

2.2.2 High performance liquid chromatography

Nina maron et al described liquid chromatography using photodiode array UV detection set at the wavelength range 249-367 nm [26]. Mohammad-Reza Rouini et al documented liquid chromatography method for determination of MFA in human serum [27]. The RP-HPLC-DAD technique for MFA relied on chromatographic separation on a C18 column with 0.05 M.

KH₂PO₄ buffer: acetonitrile(40:60, v/v) as a mobile phase at a constant flow rate of 1 ml/min and UV detection at 225 nm range of 7–50 was reported by Martha M. Morcoss et al. [24]. Fouadfadhil al-qaim et al established assay of MFA by HPLC analytical method. A simple HPLC test technique was constructed and validated [28].

Teena Oswal et al identified an HPLC process for emulgel MFA. An isocratic reversed phase HPLC technique for the calculation of MFA has been developed on a Grace alltima C18 column (250 x 4.6 mm) with a mobile phase of methanol: ammonium acetate (pH 6) (67:33 v/v) at a flow rate of 1 ml/min. The detection wavelength was 254 nm [9]. MFA was determined in pharmaceutical formulation and waste water by RP-HPLC, on a Grace alltima C18 column (250 x 4.6 mm, 5.0 μm). MFA has a retention time of 7.85 (± 0.36) minutes which was reported by Mohammad Anas Alfeen et al. [29]. Apichartatipairin et al published MFA in a topical emulgel by HPLC method. The technique employed a C18 column (5 μm; 250 x 4.6 mm) with acetonitrile, acetic acid, and water in a 75:1:24 ratio as the mobile phase. The temperature of the column was kept constant at 25°C [10]. For the detection of MFA in pharmaceutical formulations and its degradation products, an RP-HPLC stability indicating technique was devised employing a C8 column and a mobile phase including a combination of buffer: acetonitrile :THF in the ratio of 55:45 v/v. Ḥayedeh Bagheri Sadeghi et al described extraction of MFA by polymer-grafted silica gel solid phase extraction and validation by HPLC Using UV/Vis detector and the chromatographic separations were performed. Separations were performed on a C18 column (150 x 460 mm) with a 50 mM monobasic ammonium phosphate solution and a pH of 5.0 buffer solution adjusted with 3M ammonium hydroxide [30]. Reverse phase HPLC assay for the determination of MFA in human plasma was documented by Mohammad M Hammami using photodiode array detector, RP-HPLC separation was performed on atlantis d C18 column and efficiently measured at 278nm. The mobile phase consisted of 0.025 M dibasic potassium phosphate (pH = 6.0), adjusted with phosphoric acid and acetonitrile and was delivered at a flow rate of 1.5 ml/min [31]. A. B. M. Helaluddin et al developed HPLC on MFA in human plasma by UV detector. Mobile phase consisting of acetonitrile and 2% triethylamine in a ratio of 60:40. Chromatographic separation was done using Agilent Zorbax Eclipse XDB-C18. The coefficient of determination r² of ≥ 0.99 [32]. R. Murali Krishna et al developed RP-HPLC and carried out using an ODS packing L1( 250 x 4.6 mm, 5 μ) column at 27°C. Acetonitrile: 0.05 M monobasic ammonium phosphate buffer: tetrahydrofuran (46 : 40 : 14) was used as a mobile phase and the flow rate was 1.0 ml/min [33] H. Padmalatha et al proposed RP-HPLC method for estimation of MFA. The column C18 (250 x 4.6 mm, 5 μm in particle size) was used at a flow rate of 1.0 ml/minute. Acetonitrile: 0.05 M monobasic ammonium phosphate buffer: tetrahydrofuran (46:40:14) is used as a mobile phase [34]. Raju Chandra et al developed validation for the estimation of MFA from marketed tablet by RP-HPLC method with C18.
column. Mobile phase used was methanol and water in the ratio of 70:30 (v/v) [22]. Shabananaz shah et al established physical and chemical analysis of MFA in various pharmaceutical dosage forms as well as stability testing were carried out utilizing a new RP-HPLC approach and mobile phase acetonitrile: acetic acid : water (72.5:1:26.5, v/v/v) at pH 3 and MFA was monitored with UV detection at 279 nm, eluting out at 3.98 min [35]. Studies are demonstrated in Table 3.

Table 2. TLC for analysis of MFA

| Title                                                                 | Mobile phase                                      | Stationary phase | λmax | LOD    | Reference |
|----------------------------------------------------------------------|---------------------------------------------------|------------------|------|--------|-----------|
| Different chromatographic methods for simultaneous determination of MFA and two of its toxic impurities | Chloroform :acetone: acetic acid: ammonia solution(70:30:2:2) v/v/v/v | Aluminium plates 60 F254 | 225 nm | 0.3-2 μg/band | [24] |
| Development and validation of thin layer chromatography-densitometry method for analysis of MFA in tablet | Chloroform :methanol (9.0:0.1:v/v) | Silica gel 60 F254 | 320 nm | 50-300 μg/ml | [25] |

λmax-maximum wave length; LOD -linearity

Table 3. HPLC method for analysis of MFA

| Stationary phase | Mobile phase | Detector | Flow rate (ml/min) | Wavelength (nm) | Linearity (μg/ml) | Reference |
|------------------|--------------|----------|--------------------|-----------------|-------------------|-----------|
| A reversed-phase 10 km PBondapak Phenyl column (10 pm, 300 x 3.9 mm) | Methanol-glacial acetic acid-water (85:2:15, v/v/v) | Polychrom 9060 detector. | 1 | 278 | 25-150 | [26] |
| A reversed-phase Nova- Pak Ci8 column | Acetonitrile THF-water-glacial acetic acid (15:40:45:2, v/v/v) | Photodiode array detector | 486 tunable absorbance detector | 1 | 280 | 25–2000 | [27] |
| C8 Techsphere column | Acetonitrile–water (50:50, v/v, pH 3) | 0.05 M KH2PO4 buffer; acetonitrile (40:60, v/v) | Diode array detector (G131SD) | 1 | 225 | 7–50 | [24] |
| A reverse phase column Chromolith (RP-18e, 100 mm x 4.6 mm, 5 μm) | 0.1% formic acid in deionised water or 100% acetonitrile | UV-Visible detector | 1 | 275 | 5-250 | [28] |
| Alltima C18 column (250x4.6 mm) | Methanol : Ammonium acetate (67:33 v/v) | UV2075 PLUS intelligent UV detector | 1 | 254 | 10-60 | [9] |

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| Stationary phase | Mobile phase | Detector | Flow rate (ml/min) | Wavelength (nm) | Linearity (μg/ml) | Reference |
|------------------|--------------|----------|--------------------|-----------------|-------------------|-----------|
| Alltima C18 column (250 x 4.6 mm, 5.0 μm) | Triethylamine aqueous buffer adjust pH = 2 by H₃PO₄ (85%): Methanol: Acetonitrile; (35: 20: 45 v/v/v %) | Uv-Visible detector | 2 | 220 | 0.05-50 | [29] |
| ODS-3 C18 column at 25 °C (4.6 x 250 mm) | Acetonitrile, acetic acid, and water (75:1:24 ) | UVdetector | 1 | 282 | 1.29-806 | [10] |
| Reverse phase C8 column | Buffer : acetonitrile + THF in the ratio of 55:45 v/v | Detector-SPD-20 A VP | 1 | 285 | 0.5-2 | [7] |
| C18 column (150 x 460 mm) | 50 mM solution of monobasic ammonium phosphate, and adjusted with 3M ammonium hydroxide to a pH of 5.0 as the buffer solution | UV-Visible detector | 1 | 280 | R² =0.99 | [30] |
| Atlantis d C18 column | 0.025 M dibasic potassium phosphate (pH = 6.0, adjusted with phosphoric acid) and acetonitrile (65:35, v:v) | photodiode array detector | 1.5 | 278 | 0.05 – 10 μg/ml | [31] |
| Agilent Zorbax Eclipse XDB-C18 (150 mm x 4.6 mm) | Acetonitrile and 2% triethylamine (60:40) | UV-Visible detector | 1 | 280 | 250 - 5000 | [32] |
| ODS packing L1, 250 x 4.6 mm, 5 μ column | Acetonitrile : 0.05 M monobasic ammonium phosphate buffer : tetrahydrofuran (46 : 40 : 14) | UV/Vis detector | 1 | 254 | 5-30 | [33] |
| C18 (250 x 4.6 mm) | Acetonitrile : 0.05 M monobasic ammonium phosphate buffer : tetrahydrofuran (46 : 40 : 14) | UV/Vis detector | 1 | 254 | 5-30 | [34] |
| C18 column | Methanol:water (70:30) v/v | UV/Vis detector | 1.25 | 370 | R²=0.993 | [22] |
| L-1, Techsphere ODS column | Acetonitrile:acetic acid:water (72.5:1:26.5, v/v/v) | SPD-10 A VP UV/vis detector | 1.5 | 279 | 100–300 | [35] |
Table 4. Fluorimetric method

| Title                                                                 | Objective                                                                 | Evaluation                                                                 | Reference |
|----------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------|
| A Simple Spectrofluorimetric method for determination of MFA in pharmaceutical preparation and urine | The process includes oxidizing MFA using cerium (IV) to create cerium (III), | The fluorescence of cerium (III) after stimulation at 255 nm was measured at 354 nm. | [36]      |
| Spectrofluorimetric determination of anthranilic acid derivatives based on terbium sensitized fluorescence | The process is based on the conversion of radiative energy from anthranilates to terbium ions in alkaline methanolic solutions. | The detection limit of MFA was 1.4x10^-8 | [37]      |

2.3 Fluorimetric Method

A simple spectro fluorimetric procedure for assessment of MFA in pharmaceutical preparation and urine was reported by Ahash Bavi Tabriz. The process includes oxidizing MFA using cerium (IV) to create cerium (III) and the fluorescence of cerium (III) after stimulation at 255 nm was measured at 354 nm [36]. A sensitive and simple spectro fluorimetric approach was developed using terbium sensitized fluorescence. The process is based on the conversion of radiative energy from anthranilates to terbium ions in alkaline methanolic solutions, with detection limits 1.4x10^-8 reported by Pinelopi C. Ioannou et al. [37]. Studies are summarized in Table 4.

2.4 Atomic Absorption Spectrometry (AAS)

Atomic absorption spectrometry was used to measure MFA in tablet dosage type. Sunil Jawla et al explained the formation of metal complexes of Diclofenac sodium and MFA with cupric chloride and cobaltous chloride in these processes. The first approach involves reacting all drugs with cupric chloride to produce light blue metal complexes which are then separated with dichloromethane and digested with 0.1 M nitric acid. Both drugs are estimated indirectly using AAS to determine copper content in shaped complexes. The second approach is focused on the creation in pink-colored cobaltous chloride complexes of both drugs. In cupric chloride method, MFA can be determined in the concentration range 2.5-23.0 μg/ml with mean percentage recovery 100.31 ± 0.79%. In cobaltous chloride method MFA can be measured in the concentration range 3.0-24.5 μg/ml with mean percentage recovery was 100.26 ± 0.76% [38].

2.5 Hyphenated Techniques

The hyphenated approaches are sophisticated, repeatable and adaptable method for estimating analytes in a variety of biological and medicinal samples [39]. Using Thermo Hypurity C18 (50 x 4.6 mm, 5 μ) column and a flow-rate of 0.75 ml/min. 2 mM ammonium acetate buffer and methanol (pH 4.5 adjusted with glacial acetic acid; 15:85, v/v) was used as a mobile phase. Atmospheric pressure ionization source was used to introduce the sample and Mahadeo Mahadik et al reported that the drug was detected at m/z 240 to 196.3 [40].

2.6 Mass Spectrometry

Hani Nasser Abdelhamid et al investigated MFA and its metallo drug using electrospray ionization mass spectrometry (ESI-MS). ESI-MS can be used for the molecular characterization of these adducts as MFA has a nominal mass of 241.2Da [41].
### Table 5. Turbidimetric method

| Title                                                                 | Objective                                                                                                                                                                                                 | Detector                  | Wave length | Linearity          | LOD       | Reference |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|--------------------|-----------|-----------|
| Determination of MFA using Ce(IV)sulfate as an oxidant reagent via   | The method was based on the reaction of Ce (IV) Sulfate with MFA in aqueous medium to form bluish green color precipitate for the ion-pair complex.                                                          | UV- Vis spectrophotometer | 465nm       | 0.3-7 mMol.L⁻¹,   | n7.35 µg/sample | [42]      |
| the use of the new mode of irradiation (array of six identical LEDs) and detection (twin solar cells) through turbidity measurement by CFIA. |                                                                                                                                                                                                          |                           |             | with correlation coefficient, r = 0.9954 |           |           |
| Determination of MFA Using a New Mode of Irradiation (Array of six identical LEDs) and detection (twin solar cells) through turbidity measurement by CFIA. | The method was based on the reaction of phosphomolybdic acid with MFA in aqueous medium to form blue color precipitate as an ion-pair complex.                                                                 | UV- Vis spectrophotometer | 288nm       | 0.3-7 or 0.3-10 mMol.L⁻¹, with correlation coefficient r = 0.9907 or 0.9556 | 4.92 µg/sample | [43]      |
2.7 Turbidimetric Method

Nagam S Turkie Al-Awadie et al published the determination of MFA in pure and pharmaceutical preparations using turbidimetric measurement (0-180°) by Ayah 6SX1-ST-2D solar cell CFI analyzer which is a new advanced analytic tool characterized by its speed and sensitivity. The approach used was aqueous medium in which Ce(IV) Sulfate react with MFA to generate a bluish green color precipitate for the ion-pair complex. Turbidity was determined by measuring the reflection of incoming light colliding with surface precipitated particles at a range of 0-180 degree [42].

MFA using a new mode of irradiation (Array of Six Identical LEDs) and detection (Twin Solar Cells) through turbidity measurement by CFIA was developed and validated by Nagam S. Turkie Al-Awadie et al. The approach relied on phosphomolybdic acid reacting with MFA in aqueous medium to produce a blue color precipitate as an ion-pair complex. The reflection of incoming light colliding with the surface precipitated particles at 0-180° was used to determine turbidity [43]. Studies are summarized in Table 5.

3. CONCLUSION

MFA is an NSAID, which is a common and effective medication that is used as potent analgesic and anti-inflammatory agent in the treatment of osteoarthritis, rheumatoid arthritis and other painful musculoskeletal illnesses. Various analytical techniques for determining MFA in pharmaceutical formulations and biological fluids are described in the drug’s analytical profile. The most developed and validated approach for determining MFA was found to be HPLC, which was accompanied by spectrophotometric and fluorimetric methods, hyphenated technique, turbidimetry, mass spectroscopy and electroanalytical methods.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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