ESTIMATION OF NON-STEROIDAL ANTI-INFLAMMATORY DRUGS BY RP-HPLC TECHNIQUE OF ANALYSIS

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ABSTRACT

Analytical method development and its validation is an important aspect in drug discovery process and Reverse Phase-High Performance Liquid Chromatography (RP-HPLC) is the most common analytical method utilized for analysis of drug due to its accuracy, selectivity and sensitivity. Development and validation of analytical method providing accurate and precise data to ensure drug for its quality and safety. Several methods of analysis are reported/available for estimation of NSAIDs including RP-HPLC. This review article briefly discusses about analytical methods available for the estimation of Non-Steroidal anti-inflammatory drugs specially focusing on RP-HPLC.

KEYWORDS: - NSAIDs, analysis of NSAIDs, RP-HPLC, Analytical method

INTRODUCTION

The technique of RP -HPLC is so called because of its improved performance when compared to other chromatographic techniques. Since high pressure is used when compared to other chromatography, it is so called as high pressure liquid chromatography.[1]

In reverse phase technique, stationary phase is a non-polar in nature and polar mobile phase is used. Hence, polar components get eluted first and non-polar compounds are retained for longer time. Due to the polar nature of the most of the drugs and pharmaceuticals, they are eluted faster and not retained for a longer time, which is advantageous. Different columns used are ODS (Octadecyl silane), C18, C8, C4, etc.[1]

The advancement in chromatography technique is largely due to the introduction of the versatile technique called liquid chromatography, which is frequently called high-performance liquid chromatography. That terms can be abbreviated as HPLC. Non-steroidal anti-inflammatory drugs(NSAIDs)are among the most frequently prescribed drugs worldwide and are used for relief of inflammatory ,chronic(e.g., rheumatoid arthritis, osteoarthritis, and gout), and acute (e.g., headache, postoperative pain, and orthopedic fractures) pain conditions [2]. The anti-inflammatory activity of NSAIDs and most of their other pharmacological effects are related to the inhibition of the conversion of arachidonic acid to prostaglandins, which are mediators of the inflammatory process. NSAIDs are also potent inhibitors of cyclooxygenase ; thereby reducing the production of prostaglandins, prostacyclin, and thromboxane products [3].Table1 represents the classification of NSAIDs based on their chemical structure [4].

Table 1
Chemical classification of non-steroidal anti-inflammatory agents[4].

CLASS	DRUGS
1.Salicylic acid derivatives	Acetyl salicylic acid (aspirin), sodium salicylate, salicylamide.
2.p-aminophenol derivatives	Paracetamol
3.2- Aryl propionic acid derivatives	Ibuprofen, ketoprofen, naproxen.
4.Enolic acid derivatives	Meloxicam, piroxicam, tenoxicam, droxicam.
5.Arylalkanoic acid derivatives	Indomethacin, Diclofenac, aceclofenac, etodolac, sulindac.
6.N-Arylanthranilic acids (fenamic acid)	Mefenamic acid , tolfenamic acid, meclofenamic acid
7.Selective COX-2 inhibitors	Celecoxib, rofecoxib, etoricoxib, parecoxib.
8.Sulphonilides	Nimesulide.
9.Benzoxazocine derivatives	Nefopam.

Table 2
Chromatographic condition for NSAID class 1 drugs: Salicylic acid derivatives

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Aspirin[23]	Tablet	Hypersil BDSC18 column (100×4.6 mm , 3µm)	Sodium perchlorate buffer (pH2.5):acetonitrile : isopropyl alcohol(85:14:1%v/v)	UV detection at 275 nm
Salicylamide[5]	Bulk API dosage form	C18 (250 cm × 4.6 mm, 5µm) column	Buffer: acetonitrile (40:60v/v). pH adjusting to 3.2	UV-detection at 245 nm

Table 3
Chromatographic condition for class 2 drugs: p-aminophenol derivatives

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Paracetamol[21]	Tablet	Phenomenex C18 column (250 mm ×4.6 mm, 5µm)	Acetonitrite :water (60:40 v/v)	UV detection at 210 nm

Table 4
Chromatographic condition for class 3 drugs: 2-Arylpropionic acid derivatives

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Ibuprofen[6]	Tablet	Thermo hypersil BDS, (150 ×4.6mm ,5µm)	Buffer (HPLC grade water : triethylamine :orthophosphoric acid 1000:1.0:0.5 ml)	UV detection at 220 nm
Ketoprofen[20]	Tablet	LiChrosorb C18 column (250mm×4.6mm , 5µm)	Methanol : 0.1 M ammonium acetate buffer pH6.9: triethylamine : acetonitrite (73:20:5:2 v/v/v/v)	UV detection at 230 nm
Naproxen[7]	Human plasma	Ace C18 column (250mm×4.6mm , 5µm) with guard column (4mm×3mm, Phenomenex	20Mm phosphoric acid buffer (pH7) (0.1% trifluoroacetic acid :acetonitrite(v/v)	UV detection at 225nm

Table 5
Chromatographic condition for class 3 drugs: Enolic acid derivatives

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Meloxicam[8]	Tablet	Micro Bandapak 125A C18 (10 µ) column	Methanol : water (70 :30 v/v)	UV detection at 230 nm
Piroxicam[9]	Pure sample(API)	Inertsil , ODS – 3V, (150mm ×4.6mm, 5µ)	Methanol : buffer pH(3) (55:45%v/v)	PDA detection at 240 nm
Tenoxicam[10]	Blood plasma	ODS hypersil C18 column	0.1M5 KH_2PO_4:ACN(6:4%v/v)	UV detection at 381 nm

Table 6
Chromatographic condition for class 4 drugs: Arylalkanoic acid derivatives

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Diclofenac sodium[11]	Bulk and Tablet formulations	Hypersil C18 column (250mm×4.6mm,5µm)	Acetonitrite: Phosphoric acid buffer pH7(50:50%v/v)	UV detection at 220 nm
Aceclofenac[17]	Tablet	Promesil C18 (250mm×4.6mm,5µm)	Water: acetonitrite(55:45 v/v)	PDA detection at 277 nm
Etodolac[12]	Combined dosage form	C18 column (250mm×4.5mm)	Water :acetonitrite (50:50%v/v),pH adjust at 5.6 by orthophosphoric acid	UV detection at 232 nm
Sulindac[13]	Human serum	Hypersil C18 column (10 cm × 5mm,3µm 0	Methanol :acetate buffer: acetonitrite (59:29:12)	UV detection at 328 nm

Table 7
Chromatographic condition for class 5 drugs: N-Arylanthralinic acid derivatives (fenamic acid)

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Mefenamic acid[18]	Bulk API	Grace , alltima C18 (250mm×4.6mm,5µm)	(1%triethylamine aqueous buffer , adjust pH 2 by H_3PO_4(85%):methanol :ACN (35:20:45)	UV detection at 220nm
Tolfenamic acid[19]	Meat / milk	C18 column (250mm×4.6mm,5µm)	0.1% phosphoric acid :ACN(45:55%v/v)	PDA detector at 230nm

Table 8
Chromatographic condition for class 6 drugs: COX -2 inhibitors

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Celecoxib[14]	Micro emulsion	C18 column	Methanol: water (75:25)	UV detection at 250 nm
Rofecoxib[24]	Human plasma	Sherisorb ODSI column	acetonitrite: Methanol: 0.067KH_2PO_4 (27:20:53 %v/v/v) pH6.95 adjust by using NaOH	DAD at 244 nm
Etoricoxib[15]	Pharmaceutical dosage forms	Hypoersil ODS C18 (250×4.6mm,5µm)	ACN: 0.05M KH_2PO_4(pH4.2) (46:54%v/v)	UV detection at 280 nm

Table 9
Chromatographic condition for class7 drugs: Sulphonilides

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Nimesulide[16]	Tablet	ODS column	Water : methanol (30:70%v/v)	UV detection at 254 nm

Table 10
Chromatographic condition for class 9 drugs: Benzoxazocine derivatives

Name of Drug	Sample Matrix	Chromatographic Condition	Mobile Phase	Detection
Nefopam[22]	Human plasma	C18 symmetry column (150mm×4.6mm,5µm)	(15mM KH_2PO_4 with 5mM octane sulfonic acid pH3.7):ACN (77:33)%v/v	UV detection at 210 nm

Conclusion

This review briefs about the analytical methods development and validation of NSAIDs in various pharmaceutical formulations, bulk and biological samples alone or in combination with other drugs by using RP-HPLC.

Purpose of using RP-HPLC method is for estimation of NSAIDs and validated that method as per ICH guideline. Beneficial properties of RP-HPLC method for estimation of NSAIDs is its high sensitivity, accuracy and reproducibility.

Also the article will be very beneficial for many researchers working in the area of estimation of NSAIDs as they can refer most of the RP-HPLC methods of estimation of NSAIDs by referring this single article.

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