IJBPAS, September, 2022, 11(9): 4036-4050

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

METHOD DEVELOPMENT AND QUANTITATIVE ANALYSIS OF IBUPROFEN GEL BY USING HPLC AND FTIR METHOD

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Received 16th Oct. 2021; Revised 20th Nov. 2021; Accepted 20th Jan. 2022; Available online 1st Sept. 2022

https://doi.org/10.31032/IJBPAS/2022/11.9.6348

ABSTRACT

The purpose of this study was to analyze the gel (pain relieving) by using the experimental design techniques and by different instruments. The first part of the project was to select a compound and suitable method for the analysis of the compound. The non-steroidal anti inflammatory drug (gel form) was selected because it is playing an important role in today's life. The compound selected was Ibuprofen gel. The trade name of the product was NUROFEN 5%

Gel manufactured by Crookes Healthcare Ltd. HPLC reverse phased method[2] was used for this analytical study. By using the ultra violet spectrometry, the λ_{max} of ibuprofen was found to be at 222 nm and this wavelength was subsequently used in the method to analyse the ibuprofen. In second part of the study, the ibuprofen gel analyze by using FTIR, the Quantitative analyses of ibuprofen gel, this performed on the IRE crystal of FTIR by using the diffusion reflectance method. In this method, gel was analyzed by casting film of gel on the IRE crystal and also by using physical clamping device. In this method also different concentrations of the drug were taken, from that calibration curve were obtained. Also in FTIR, the area of gel was taken and it puts in the given equation. And then FTIR reveals the quantity by using diffusion reflectance FTIR system. Interference from degraded products was observed in the chromatograms. The main study was to determine both HPLC and FTIR together and comparing the result with the quantity achieved.

Keywords: HPLC, FTIR, IRE crystal, Ultraviolet Spectroscopy, Reverse phase chromatography

INTRODUCTIONS

Ibuprofen is the most popular and widely used over the counter (O.T.C.) non-opoid analgesic product, since it was placed on the drugstore shelves in May 1984. In United Kingdom during 1950s, Dr. Stewart Adams and his colleagues discovered the NSAID drug called Ibuprofen **[1]**. Pharmacology of Ibuprofen shows that, inhibiting the prostaglandin synthesis, the NSAID drug ibuprofen also inhibits the cyclooxygenase (COX). COX-1, COX-2 and COX-3 are the 3 types of the cyclooxygenase. In which, the cox-1 and cox-2 inhibited by the ibuprofen. By the inhibition of the cox-2, ibuprofen shows the analgesic, antipyretic and anti-inflammatory effect, whereas platelet aggregation and GI mucosa by inhibition of the cox-1 **[2]**. Ibuprofen belongs to group of chiral 2-arylpropionic acid non- steroidal anti inflammatory drug (NSAID). The IUPAC name of ibuprofen is 2-(4-isobutylphenyl) propionic acid and the other brand name like Motrin, Advil, Nuprin **[3]**. Molecular formula of ibuprofen is $C_{13}H_{18}O_2$. Molecular mass is 206.28. Ibuprofen mainly use as antipyretic, analgesic and anti inflammatory drugs. It also used in the rheumatoid arthritis and osteoarthritis, also in prostate and colon cancer **[4]**. The 400mg dose of ibuprofen has the equal or more useful than a combination form of 650mg of aspirin and 60mg of codeine to relieve the pain in the dental surgery **[5]**. Ibuprofen gel is use in the muscular pain. Ibuprofen, like other 2-

arylpropionate derivatives (including ketoprofen, flurbiprofen, naproxen *etc*), contains a chiral carbon (chirality center) in the α-position of the propionate moiety. As such, there are two possible enantiomer of ibuprofen, with the potential for different biological effects and metabolism for each enantiomer. Ibuprofen is having two enantimers like S and R. And the S-enantiomer is in active form and it acts as analgesic and anti-inflammatory agent. But the R-enantiomer is in inactive form. Under the trade name of Advil, Nuprin and the Motris, the substances of ibuprofen which are marketed is a racemic mixture of the R and S **[6]**. The S-enantiomer of ibuprofen which is also called as dexibuprofen, which was in active form for both in vivo and in vitro, but in further invivo testing, the inactive form of Ibuprofen means R-enantiomers converted into S-enantiomer by the existence of an isomerise **[7-9]**. Ultraviolet spectroscopy is used to determine the PKa values, Partition coefficient and solubilities of the drugs. This method also used in drug degradation, to monitor reaction kinetics of drugs **[10]**.

MATERIALS AND METHODS:

Chemical: Methanol, Acetonitrile, 2% phosphoric acid were purchased from Fisher scientific (Loughborough, UK). Valerophenone 99%, Sodium hydroxide, potassium bromide and potassium thio-cynate were purchased from Sigma Aldrich (Dorset, UK).

Apparatus: 10ml and 100ml volumetric flask. 100ml and 500ml glass beaker. 1ml, 2ml, 5ml pipette. Small glass bottles, Small and medium size glass tubes. Conical flask, Whatman filter paper (quantitative) 0.9 and 24.0cm no.1

Standard: ibuprofen standard sample (3.6gm of ibuprofen sodium salt)

Gel sample: Nurofen 5% gel (Gold shield pharmaceuticals, UK)

Mobile Phase, Equipment and chromatographic conditions: The concentration of mobile phase was 70% (v/v) Acetonitril and 30% (v/v) 2% phosphoric acid (20ml phosphoric acid in 1000ml water). The chromatographic analysis for given drug were carried out by using PerkinElmer series 200 liquid chromatogram (PerkinElmer Technologies corporation, UK), Auto injector, and also with UV/VIS detector. Software version of chromatograph is 6.3.1.0504. The name of the instrument is PE HPLC 3. The column utilized for the analysis is Uroshere 100-5 C18 (150 X 4.6mm, 5µm particle size), XF13 and order no is 15EE181ESJ (B118Y535). The flow rate was used in the process was 1.0ml/min. Pressure is maintained within 620-640psi.

Preparation for HPLC:

Standard sample: Standard ibuprofen: 10mg into the 100ml methanol. From this solution 1ml were taken out by using the 1ml glass pipette into another 10ml methanol, which made solutions of 0.001% like this solutions. 2ml, 3ml, 4ml, 5ml were taken and made the solutions of 0.002%, 0.003%, 0.004%, and 0.005% **(Table 1)**.

Ibuprofen gel (unknown sample): 200mg of ibuprofen gel and 2ml of 1% Sodium Hydroxide solution were added into 100ml methanol and the sample were dissolved by sonication using the ultrasonic bath for around 1hour. From the 0.01% digested gel solution 3ml to 10ml methanol This digested solution was used as sample for the HPLC system.

Internal standard for HPLC: In quantitative analysis, internal standard is used as reference standard **[11]**. In analysis of ibuprofen gel, valerophenone was used as the internal standard. The IUPAC name is 1-phenyl-1-pentanone. The molecular formula of the valerophenone is C11H14O and Molecular mass is 162.23g/mol **[12]**. Also used as the carbonyl reductase inhibitor **[13]**. In the ibuprofen gel, because of the different concentrations the peak areas of are different for ibuprofen gel but the relative area of the internal standard was constant.

Preparation for FTIR:

Standard sample: The weighed quantity of Ibuprofen standard, KBr and KSCN were mixed in given quantity **(Table 2)**. By using mortar and pestle mixed well and used in FTIR.

Gel sample (Unknown sample): The glass (quartz) container was accurately weighed. In that glass container, 0.4gm of gel was taken and it was reweighed. Then gel was dried in the oven at 105ºC till overnight. Reweigh the container, and weight of the container was calculated by subtraction. Then, 1mg of KSCN was mixed in the dry gel powder and made up the quantity 100mg with KBr and used in FTIR.

Calibration curve method:

For determining the unknown concentration of a compound in a given solution, and quantitative analysis of compounds by calibration curve method is a standard method of analysis using reverse phase Which gives the standard equation of line Y = MX + C and a regression analysis of 0.9998 which is the most recommended one for plotting a calibration curve **[14, 15]**.

High performance liquid chromatography:

For standard: All the recorded standard ibuprofen concentrations were taken (0.001%, 0.002%, 0.003%, 0.004%, and 0.005%). From each concentration 1ml was

taken and it mixed with the same quantity of the internal standard (0.01% Valerophenone). 40µl of the mixed standard were injected onto the column, under the given chromatographic conditions.

For gel sample: 1ml was taken out from the unknown concentration digested gel solution. It was mixed with the 1ml (0.01%) internal standard. And then, 40µl of the mix solution will inject onto the column, under the given chromatographic conditions. The average area was reported from the unknown concentration.

Confirmatory test for digested gel sample and standard solution (1):

In this method, 3ml of 0.01% (approximately) digested gel solution and 1ml of 0.01% standard solution were mixed in 10ml volumetric flask with methanol. And then, 40µl of the mix solution will inject into system and the average areas of the mixture were reported.

For digested gel sample and standard solution (2):

3ml of 0.01% (approximately) digested gel solution and 2ml of 0.01% standard solution mixed in 10ml volumetric flask with methanol. And then, 40µl of the mix solution will inject system and average area reported.

Fourier transforms infrared spectroscopy: By using the Thermo Nicolet Nexus FTIR system, the ATR-FTIR diffusion experiments will be taken. This will be fitted with a smart ATR-FTIR diamond necessary. Mercury cadmium telluride A band (MCT-A) as detector setting will be applied. And the controlling software will be Omnic® 7.2. In the experiment there will be direct contact occurs with diamond

Calculations: Concentrations of the ibuprofen standard:

For U.V. Analysis: **(Table 3)**

Therefore the wavelength (λ) of ibuprofen standard was found to be 222nm.

HPLC analysis of ibuprofen standard: **(Table 4), (Graph 1)**

Internal standard: 99% valerophenone

HPLC analysis for ibuprofen standard and internal standard: **(Table 5), (Graph 2)**

The equation was found to be y=152.6x, and the R^2 value was found to be 0.999

Digestion of ibuprofen gel: To prepare 1% w/v, Label claim 5%Ibuprofen, 5% in 35gm of gel = 5/100 X 35 =175/100 = 1.75gm Therefore, 35gm of gel contains 1.75gm of ibuprofen, then 1gm of gel = 1.75/35 = 0.05gm of ibuprofen 20gm of gel contains 1gm of ibuprofen. Therefore, 20gm gel in 100ml methanol gives 1%. And 200mg of gel in 100ml methanol gives 0.01%. From 0.01% gel solution 3ml taken out in volumetric flask and it filled with methanol till 10ml mark,

which made 0.003% solution (approximately).

HPLC analysis for ibuprofen gel sample and internal standard: **(Table 6)**

Response factor:

At high concentration = (Concentration of internal standard X peak area of ibuprofen standard) / (Concentration of ibuprofen standard X peak area of internal standard)

= (0.01 X 886525.95) / (0.005 X 1163658.52) = (8865.2595) / (5818.2926) = 1.52

At low concentration = (Concentration of internal standard X peak area of ibuprofen standard) / (Concentration of ibuprofen standard X peak area of internal standard) = (0.01 X 177603.59) / (0.001 X 1182496.67) = (1776.0359) / (1182.49667) = 1.50.

Average of response factor= 1.52 + 1.50 / 2 = 1.51

Response factor = (Concentration of internal standard X peak area of unknown) / (Concentration of unknown X peak area of internal standard)

1.51 = (0.01 X 639378.03) / (concentration of unknown X 1200186.76)

Concentration of unknown = 6393.78 / 1812282.008 = 3.52 X 10^{-3} = 0.00352mg/ml

1ml of mixture contains 0.00352mg of ibuprofen,

Therefore, 10ml of mixture contains (10 X 0.00352) = 0.0352mg of ibuprofen.

10ml of mixture made from the 3ml of gel solution and methanol. So, 3ml of gel solution contains 0.0352mg of ibuprofen

Therefore, 100ml of gel solution contains 'x' mg of ibuprofen.

x = 0.035 X 100 / 3 = 1.1667mg/100ml

100ml of gel solution made from the 200mg of gel. If, 200mg of gel contains 1.1667mg of ibuprofen, therefore 1000mg of gel contains 'y' mg of ibuprofen.

y = 1.1667 X 1000 / 200

y = 5.83mg/gm

So, 1gm of gel contains 5.83mg of ibuprofen.

%weight = practical yield / theoretical yield X 100

= 1.1667 / 200 X 100 = 0.5833%

% weight of ibuprofen was found in gel 0.5833%.

HPLC analysis for ibuprofen gel sample (0.003% appr.) + Ibuprofen standard sample (0.001%) and internal standard: **(Table 7)**

Calculations:

X= 0.5326

X+0.001= 0.7046

X+0.001/x =0.7046/0.5326

0.5326x+ 0.0005326 = 0.7026x

0.1720x = 0.0005326

X= 0.0005326/ 0.1720 =0.0030

HPLC analysis for other concentrations: **(Table 8), (Graph 3)**

0.003% of gel sample (appr.) = 0.7020 (peak area)

003% of gel sample (appr.)+ 0.001% ibuprofen standard = 0.8462 (peak area)

0.003% of gel sample (appr.)+ 0.002% ibuprofen standard = 0.9971 (peak area)

And from the graph, the value was found to be= -4.7

For FTIR:

1. Weight of container : 9245.0mg
2. Weight of container + gel = 9645.0mg
3. Weight of container and gel after drying in oven for 105ºC for overnight = 9421.4mg

Weight of gel = (Weight of container + gel) – (weight of container)

= 9645.0 – 9245.0= 400mg

And, weight of gel after dry = (Weight of container and gel after drying) – (Weight of container)

= 9421.4 – 9245 = 176.4mg

Potassium bromide and potassium thio-cyanate were triturated with dry ibuprofen gel powder to make 100mg. To calculate the practical quantity of Aspirin in each tablet we can us the following formula, Y = MX + C. After plotting a calibration curve of Aspirin we will be able to get the value of X and R2. The concentrations were used in the FTIR are as below:

For gel sample (dry powder): **(Table 9)**

1. Peak 1: (**Table No.10), (Graph 4)**

   The equation is $Y_1=0.205X_1 + 0.11$ which is similar to Y = MX + C. Therefore, The peak length (Y_1) of gel sample for peak 1 is 0.22.

Therefore, $Y_1=0.205X_1 + 0.11$

$0.22= 0.205X_1 + 0.11$

$X_1 = 0.5365$mg

2. Peak 2: (**Table 11), (Graph 5)**

The equation is $Y_2=0.206X_2 + 0.02$ which is similar to Y = MX + C

Therefore,

The peak length (Y_1) of gel sample for peak 1 is 0.42

Therefore, $Y_2=0.206X_2 + 0.02$

$0.42\ 0.206X_2 +0.02$

$X_2 = 0.5339$mg

3. Peak 3: (**Table 12), (Graph 6)**

The equation is $Y_2=0.158X_2 + 0.055$ which is similar to Y = MX + C

Therefore,

The peak length (Y_1) of gel sample for peak 1 is 0.14

Therefore, $Y_3=0.158X_3 + 0.055$

$0.14 = 0.158X_3 + 0.055$

X_3 = 0.5379mg

Average= $X_1 + X_2 + X_3 / 3$ = 0.5365 + 0.5339 + 0.5379 /3 = 0.5361mg

Therefore, 2mg of gel (dry) powder contains 0.5361mg of Ibuprofen

Dilution factor of gel = 0.05gm (50mg)

After solving the equation= 0.5361 X 50 / 2 = 13.40mg

Weight of gel before drying= 400mg, Weight of gel after drying = 176.4mg

% weight = practical yield / theoretical yield X 100 = 13.40 / 176.4 X100= 7.82 %

Therefore % weight of ibuprofen in gel was found to be 7.82%.

RESULT:

Ultraviolet visible spectroscopy: All the concentration of the ibuprofen standard (0.001%w/v, 0.002%w/v, 0.003%w/v, 0.004%w/v, and 0.005%w/v) showed the absorption at the 222nm, therefore the result of the UV visible spectroscopy was help to the set the wavelength in the high performance liquid chromatography.

High performance liquid chromatography for standard: By using the Urosphere C18 column, peak for the different concentration of the Ibuprofen and the baseline separation from the internal standard in the mixture were achieved. In the graph, the retention time for different concentrations was almost in range of 3.88. The retention time for the internal standard was 5.02. From the above concentrations of the ibuprofen with internal standard, the equation was found to be Y= 152.62X (Y= peak area, X= concentration) and the R^2 value is 0.996.

Linearity: There was excellent linear relationship (r^2 = 0.996) were obtained from the different concentrations of the ibuprofen sample and the internal standard.

For gel sample: Under the same conditions of the chromatograph, the digested gel sample was ran with internal standard and then the peak area was obtained, that peak area added in the equation Y=152.17X. After solved the equation, the value for X was found to be 0.00352mg/ml. And then, the concentration of ibuprofen in 1gm of gel was found to be 5.83mg. The % weight of ibuprofen in gel was found to be 0.5833%

Fourier transforms infrared spectroscopy: The percentage weight of ibuprofen in gel was found to be 7.82%.

DISCUSSION

The value of R^2 for Ibuprofen was found to be 0.9996, which represents the linearity of regression. The method developed on HPLC for the analysis gel of ibuprofen was specific, reproducible, accurate and sensitive. In FTIR, the readings were recorded from different concentration and graph was plotted. The calibration curves of FTIR were

quiet similar to the HPLC calibration curve. The R^2 value of given curves were found to be 0.994, 0.988, 0.992, 0.991, 0.984. The assay procedure of standard and unknown was used to determine the standardization of the product. The aim of the study was development of a practical HPLC method and analyzes the Ibuprofen contained in gel form. From the study of linearity, sensitivity, intra-day and inter-day precision, accuracy and reproducibility, the liquid chromatographic assay was established. The most reproducible results were obtained with octadecyl stationary phase (Bio SiL HL C18, 5 mm, 250_ 4.6 mm column) on the chromatographic system consisting Bio Rad 2800 solvent pump and Bio Rad 1801 UV_ Vis Detector. The detection was performed at 222 nm in sensitivity range 0.01 AUFS. HPLC method was carried out on Uroshere 100-5 C18 (150 X 4.6mm, 5µm particle size) column using Acetonitril: 2% phosphoric acid (70:30 v/v) as mobile phase at a flow rate of 1.0 ml/min. Each concentration is supposed to be injected in triplicate and the mean value of peak area is supposed to be taken for the calibration curve. A linear response in peak area ratios was successfully observed over the concentration range 0.05- 0.1mg/ml for ibuprofen. In comparison of the both techniques like HPLC and FTIR, this was showed almost similar data.

Table 1

Concentration	Standard stock solution dilutions
0.01%	10mg standard powder in 100ml methanol
0.001%	1ml solution of 0.01% in 10ml methanol.
0.002%	2ml solution of 0.01% in 10ml methanol
0.003%	3ml solution of 0.01% in 10ml methanol
0.004%	4ml solution of 0.01% in 10ml methanol
0.005%	5ml solution of 0.01% in 10ml methanol

Table 2

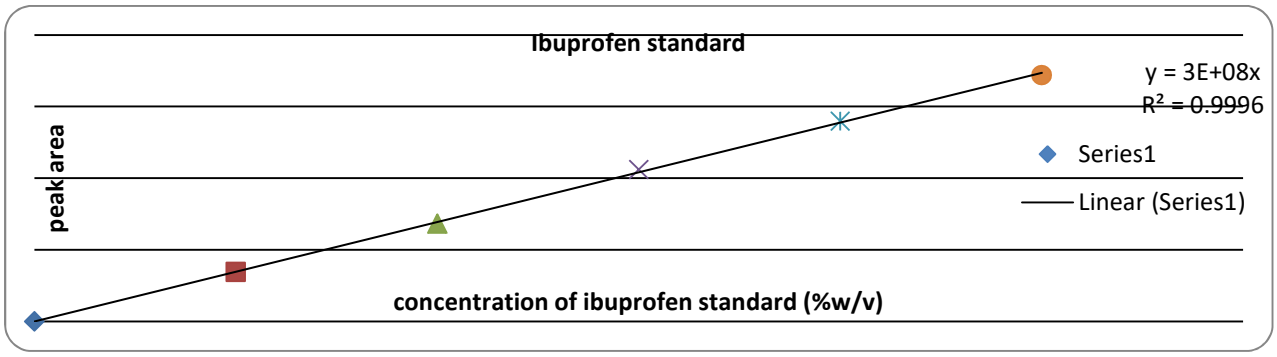
Number	Concentrations
1.	1mg of Ibuprofen standard+ 98mg of KBr+ 1mg of KSCN
2.	2mg of Ibuprofen standard+ 97mg of KBr+ 1mg of KSCN
3.	3mg of Ibuprofen standard+ 96mg of KBr+ 1mg of KSCN
4.	4mg of Ibuprofen standard+ 95mg of KBr+ 1mg of KSCN

Table 3

Concentrations (%w/v)	Absorbance
0.001	0.336
0.002	0.663
0.003	0.972
0.004	1.298
0.005	1.592

Table 4

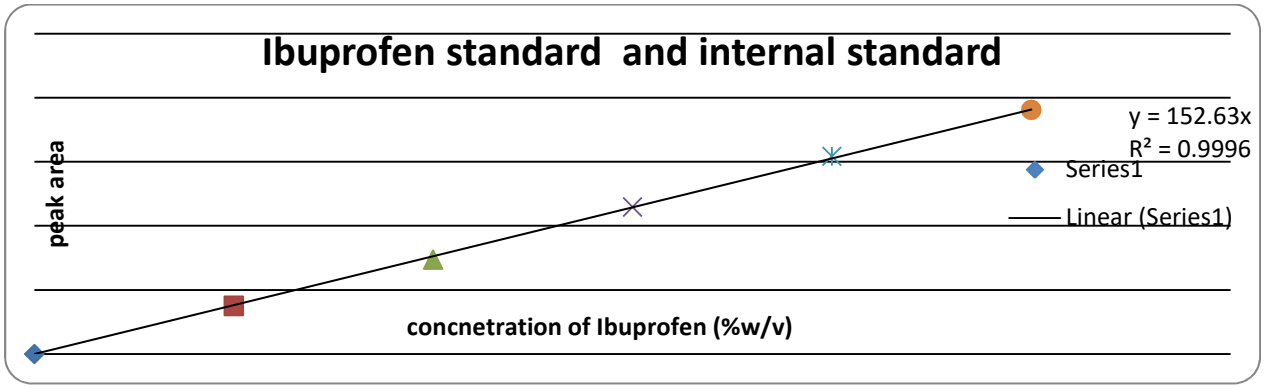
Concentrations (%w/v)	Peak area
0.001	344958.47
0.002	682923.55
0.003	1059969.82
0.004	1397684.67
0.005	1719796.89



Graph 1

Table 5

Concentration (%w/v)	Peak area of ibuprofen standard	Peak area of internal standard	Ratio of peak area
0.001	177603.59	1182496.67	0.1501
0.002	313696.38	1064104.44	0.2947
0.003	535413.09	1166531.68	0.4589
0.004	706459.99	1144419.02	0.6173
0.005	886525.95	1163658.52	0.7618



Graph 2

Table 6

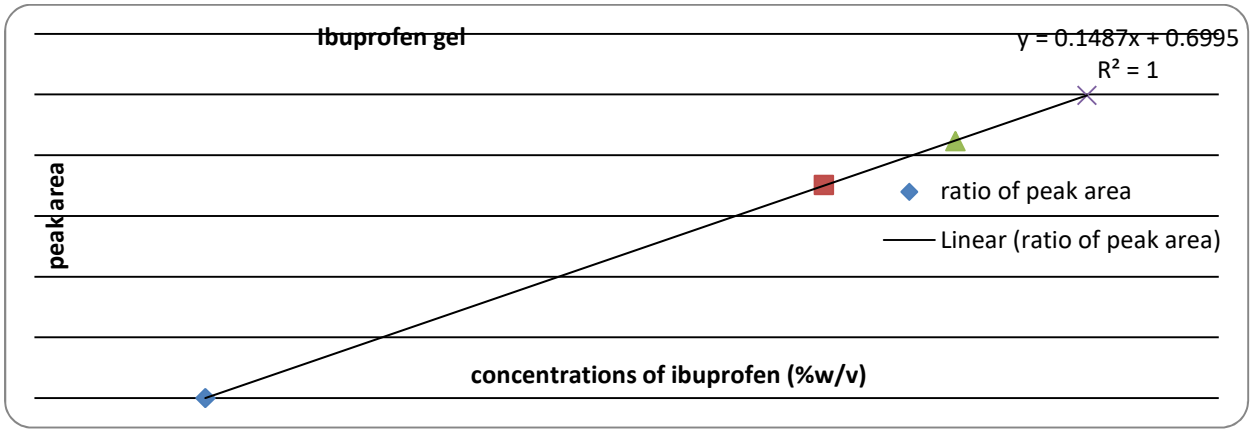
Concentrations (0.003% appr.)(%w/v)	Peak area of ibuprofen gel sample	Peak area of internal standard	Ratio of peak area
1.	624584.34	1178894.71	0.5298
2.	639191.62	1201208.30	0.5321
3.	654358.13	1220455.48	0.5361
Average	639378.03	1200186.76	0.5326

Table 7

Concentrations (0.003% approximately of gel + 0.001% of standard)	Peak area of ibuprofen	Peak area of internal standard	Ratio of peak area
1.	834723.50	1187148.96	0.7031
2.	834580.59	1184481.08	0.7045
3.	831192.26	1176572.89	0.7064

Table 8

Concentrations	Peak area of ibuprofen	Peak area of internal standard	Ratio of peak area
0.003% of gel sample (appr.)	871311.83	1241226.15	0.7020
0.003% of gel sample (appr.)+ 0.001% ibuprofen standard	1053882.02	1245384.39	0.8462
0.003% of gel sample (appr.)+ 0.002% ibuprofen standard	1252527.33	1256078.43	0.9971



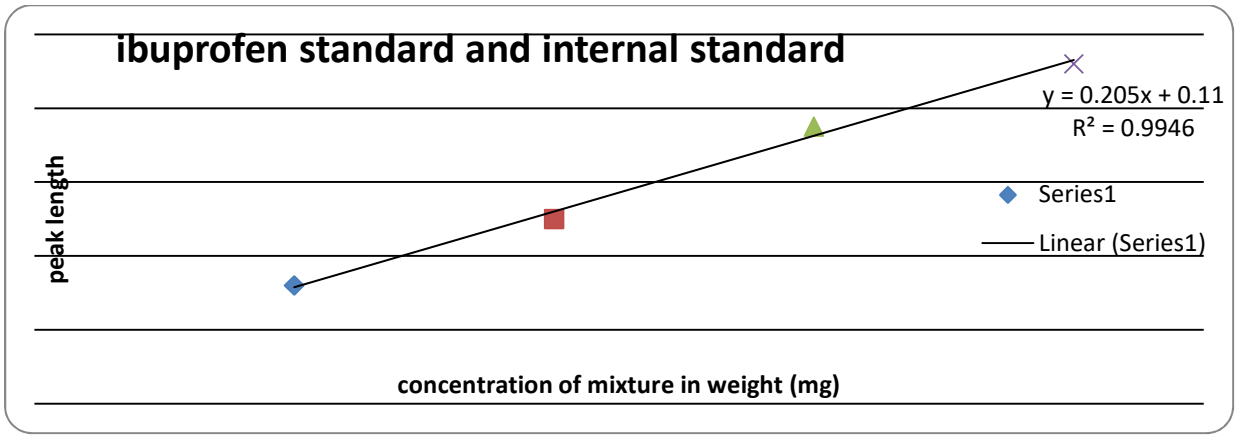
Graph 3

Table 9

Peaks	Peak length of internal standard	Peak length of ibuprofen standard	Ratio of length
Peak 1	6.8	1.5	0.22
Peak 2	6.8	2.9	0.42
Peak 3	6.8	1	0.14

Table 10

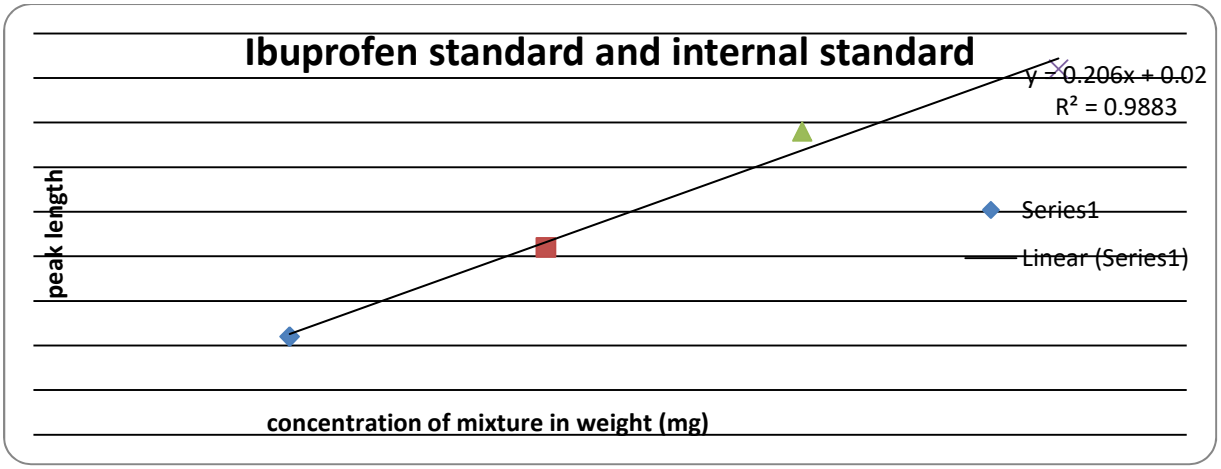
Number	Concentration in weight (mg)	Peak length of internal standard	Peak length of ibuprofen standard	Ratio of length
1.	1mg ibuprofen standard+ 98mg of KBr+ 1mg of KSCN	7.6	2.5	0.32
2.	2mg ibuprofen standard+ 97mg of KBr+ 1mg of KSCN	6.2	3.1	0.50
3.	3mg ibuprofen standard+ 96mg of KBr+ 1mg of KSCN	4.5	3.4	0.75
4.	4mg ibuprofen standard+ 95mg of KBr+ 1mg of KSCN	3.8	3.5	0.92



Graph 4

Table 11

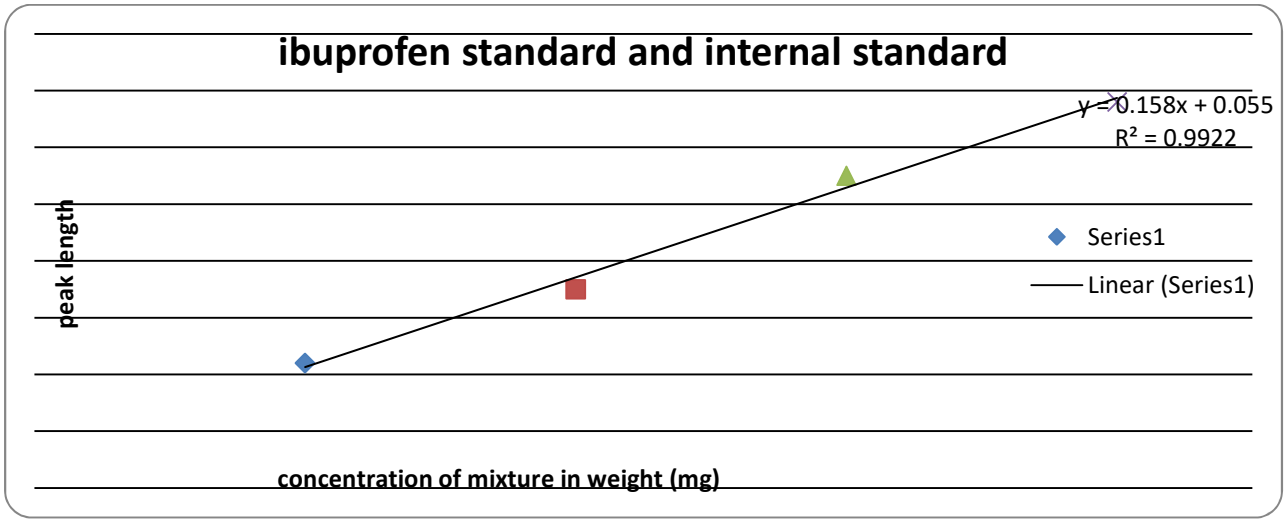
Number	Concentrations in weight (mg)	Peak length of internal standard	Peak length of ibuprofen standard	Ratio of length
1.	1mg ibuprofen standard+ 98mg of KBr+ 1mg of KSCN	7.6	1.7	0.22
2.	2mg ibuprofen standard+ 97mg of KBr+ 1mg of KSCN	6.2	2.6	0.42
3.	3mg ibuprofen standard+ 96mg of KBr+ 1mg of KSCN	4.5	3.1	0.68
4.	4mg ibuprofen standard+ 95mg of KBr+ 1mg of KSCN	3.8	3.1	0.82



Graph 5

Table 12

Number	Concentrations (mg)	Peak length of internal std.	Peak length of ibuprofen std.	Ratio of length
1.	1mg ibuprofen standard+ 98mg of KBr+ 1mg of KSCN	7.6	1.7	0.22
2.	2mg ibuprofen standard+ 97mg of KBr+ 1mg of KSCN	6.2	2.2	0.35
3.	3mg ibuprofen standard+ 96mg of KBr+ 1mg of KSCN	4.5	2.5	0.55
4.	4mg ibuprofen standard+ 95mg of KBr+ 1mg of KSCN	3.8	2.6	0.68



Graph 6

CONCLUSION:

Quantitative analysis of samples was occurred under chromatographic conditions and with operating procedures of HPLC. The results obtained were not in the standard limits of stated British Pharmacopeias + or – 5% of stated content of active pharmaceutical ingredient i.e. 95% to 105%. The quantitative analysis of Ibuprofen was performed by using two spectroscopic methods like HPLC and FTIR. Both methods were well explained by the data which obtained from the calibration and calculations. For any type of formulations of analgesics, both the methods were used. The analysis of Ibuprofen occurred by using the standard and sample. The optimization of two techniques together may involve the use of specified diffuse reflectance FTIR. The results of both techniques will be compared and that will achieve the complete integration of two methods.

Acknowledgment:

The authors would like to thank all those who were there with helping hand during research.

REFERENCE:

[1] Flower, J. Rod. The Development of Cox 2 Inhibitors. Nature Reviews Drug Discovery 2003. 2(3): p.179–191.

[2] H Kakuta, X Zheng, H Oda, S Harada. Cyclooxygenase-1-Selective Inhibitors Are Attractive Candidates for Analgesics That Do Not Cause Gastric Damage. Design and in Vitro/in Vivo Evaluation of a Benzamide-Type Cyclooxygenase-1 Selective Inhibitor. Journal of

medicinal. ACS Publications; 2008. 51(8): p.2400-2411.

[3] N.M. Davies. Clinical Pharmacokinetics. Faculty of Medicine, Department of Pharmacology and Therapeutics, University of Calgary, Alberta, Canada. 34th ed. 1998. p.101.

[4] J. Andrew, P. Andrew, et al. Cancer chemotherapy pharmacology. Department of Geriatrics, Zhongshan Hospital, Fudan University, Shanghai 200032, China. 50th ed. 2002. p. 277.

[5] K.D. Tripathi. Essential of Medical Pharmacology. MD Ex-director, professor and head of Pharmacology at the Maulana Azad Medical College, New Delhi. 6th ed; Jaypee Publication; 2008. p.192-193.

[6] John McMurry. Organic Chemistry. Professor Emeritus in the Department of Chemistry and Chemical Biology at Cornell University. 6th ed; ACS Publication; 2005. p.305.

[7] C.S .Chen, W.R. Shieh. Metabolic Stereoisomeric Inversion of Ibuprofen in mammals. Biochim Biophys Acta 1991. 1078(3): p.411-417.

[8] TS Tracy, SD Hall. Drug Metabolism and Disposition. Journal of Aspet 1992. 20(2): p.322-327.

[9] Reichel C, Brugger R, et al, Molecular Pharmacology. Journal of Aspet 1997. 51(4): p.576-582.

[10] David G. Watson. Pharmaceutical Analysis. Senior Lecturer in Pharmaceutical Sciences, School of Pharmacy, University of Strathclyde, Glasgow, UK. 2nd ed; Elsevier Publication; 2005. p. 87-111, 113-133, 267-311.

[11] Elizabeth Prichard. Practical Laboratory Skills Training Guides HPL. Royal Society of chemistry Publication;2003. p. 25

[12] R.G. Zepp, M.M. Gurnz. Journal of Physiological Chemistry A. 1998. 102(28): p.5716-5723.

[13] Y.Imamura, R. Narumi, H. Shimada. Inhibition of Carbonyl Reductase activity in pig heart by alkyl phenyl ketones. J Enzyme Inhibit Med Chem. 2007. 22(1): p.105–9

[14] Crouch, Stanley; Skoog, A. Douglas. Principles of Instrumental Analysis. Department of Chemistry, Bates College, Lewiston, MA, 04240, USA. 6th ed; Cengage Publication; 2014. p. 470-471.

[15] I. Lavagnini, F.Magno. A statistical overview on univariate calibration,

inverse regression, and detection limits, Application to gas chromatography/mass spectrometry technique, Mass spectrometry reviews. 2007. 26(1): p.1–18

[16] http://www.forumsci.co.il/HPLC/ion_chrm.html

[17] http://www.sigmaaldrich.com/catalog/ProductDetail.do?N4=V659|ALDRICH&N5=SEARCH_CONCAT_PNO|BRAND_KEY&F=SPEC.