RESEARCH ARTICLE

Development and Validation for the Estimation of Fenofibrate in Pharmaceutical Dosage form by Reversed-phase High-performance Liquid Chromatography

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ABSTRACT

Very simple, exact, precise and accurate reversed-phase high-performance liquid chromatography (RP-HPLC) methods used to estimate the amount of fenofibrate in both the bulk and tablet formulations. The reversed-mobile phase buffer and ACN in the proportion (40:60) v/v at a flow rate of 1.0 mL/min were used to create the Princeton (C18) (250 mm x 4.6 mm, 5) column. At 240 nm wavelength, the detection procedure was approved. The RT was established to be 3.905 minutes under fenofibrate's optimum circumstances. The calibration curve had a range of 87 to 232 g/mL and a correlation coefficient of 0.9994. All-important parameters' RSD values were below 2.0%. A 99.13 and a 100.44% recovery rate, respectively, were shown to exist. In accordance with ICH requirements, the established technique was evaluated for linearity, specificity, precision, accuracy, and system applicability. The feasibility and repeatability of the suggested technique for determining the amount of the commercially available dosage forms of fenofibrate in tablet and bulk form were also demonstrated.

Keywords: Fenofibrate, Reversed-phase high-performance liquid chromatography, Intracerebral brain hemorrhage guidelines, Validation.

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INTRODUCTION

Propan-2-yl 2-[(4-chlorophenyl) carbonyl] phenoxymethyl propanoate is the chemical name for fenofibrate (FEN) (Figure 1).[1] People at risk for cardiovascular disease primarily use it to lower cholesterol levels. Like other fibrates, it raises high-density lipoprotein (HDL) levels, reduces triglycerides, and lowers low density lipoprotein (LDL) and very low density lipoprotein (VLDL) cholesterol levels. It also lowers levels of LDL and VLDL cholesterol.[2] The drug is a white in colour that is soluble in acetone, acetone dimethyl sulfoxide, methanol, dimethylformamide, and water only very slightly.[3] Following a thorough review of the literature, it was discovered that numerous high-performance liquid chromatography (HPLC) methods were published used for the quantification of fenofibrate in both formulations.[4-19] As a result, pharmaceutical scientists may find it challenging to implement an analytical methodology to identify FEN in the existence of its deprivation

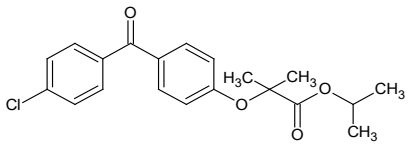

Figure 1: Fenofibrate (Chemical structure).

yields. Since the recommended technique is simple, accurate, repeatable, and simple for regular estimation of FEN in both formulations. According to intracerebral brain hemorrhage (ICH) recommendations, the procedure was validated.[20]

METHODOLOGY

Chemicals and Reagents

Pharmacological quality fenolip-145, a tablet formulation, was purchased commercially from Cadila Pharmaceuticals Ltd., Ahmedabad, as a gift sample of fenofibrate.

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Table 1: Chromatographic condition

Chromatographic condition	
Mobile phase	Acetonitrile :Water (pH adjusted to 3.0 with ortho phosphoric acid) (60:40) v/v
Flow rate	1.0 mL/min.
Column	Princeton C18 (250 mm × 4.6 mm, 5 µ)
Detector wavelength	240 nm
Column temperature	30ºC
Injection volume	10 µL
Runtime	20 minutes
Diluent	Water: ACN (50:50)
Retention time	3.905 minutes

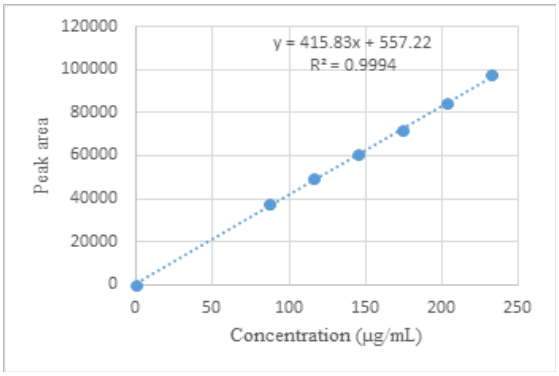

Figure 2: Linear curve of Fenofibrate (FEN).

Methanol, acetonitrile, hydrochloric acid, orthophosphoric acid, NaOH, and analytical-grade hydrogen peroxide were all used during the project.

Instrumentation

Lab Solution software and a PDA detector from Shimadzu were utilized.

Chromatographic Conditions

The combination of buffer and acetonitrile as a mobile phase in the proportion (40:60) v/v was used for chromatographic separation on a reversed-phase princeton C18 (250 mm x 4.6 mm, 5) column at room temp. The detecting procedure was carried out at 240 nm in wavelength. A 10 µL were injected, and pH was fixed to 3. Table 1 displays the chromatographic condition that has been optimized.

Preparation of Fenofibrate Standard Solution

The diluent of 5.0 mL was added to a 10.0 mL volumetric flask that contained 14.5 mg of precisely weighed FEN. Make the volume to 10.0 mL. A volumetric flask with a capacity of 10.0 mL was pipetted with 1-mL of the resultant solution, and diluent was added to a volume of 10.0 mL to provide a solution with a FEN concentration of 145 g/mL.

Preparation of Fenofibrate Sample Solution

Weighed and coarsely pulverized twenty pills. A volumetric flask with a 10.0 mL capacity was filled precisely with 14.5 mg of FEN powder. Then it was filled with 5.0 mL of diluent. To homogenize the flask contents, sonication was used for 10 minutes. Then, diluent was used to dilute this solution to the proper concentration.

Method Validation

Accuracy

The degree of agreement between the value is communicated as the analytical procedure's accuracy and the average real value or a known reference value. 80, 100, and 120% of the label claim were used in the calculations. The effectiveness of FEN for assessing the presence of pharmaceuticals in the sample was assessed using standard addition and recovery assays.

Precision

By calculating the region of the six recognized working values for FEN and the %RSD, the accuracy of the system was estimated (RSD). It was able to evaluate the precision of the assay procedure by comparing test samples of FEN against valid working standards six times independently and computing the %RSD (RSD). Additionally, several analyzers on several days validated the approach's intermediate precision.

Linearity

We produced FEN linearity test solutions at doses between 87 and 232 g/mL. The stock solution was diluted to the necessary concentrations to create the linearity test solutions. The calibration data's least-squares linear regression analysis demonstrated linearity. Areas of peak were designed against the equivalent concentrations, and resulting curves were then subjected to linear regression analysis. In Figure 2, the linear curve is displayed.

Limit of Detection (LoD) and Limit of Quantitation (LoQ)

The effectiveness of the system was established by assessing a number of variables. It was conventional using 6 duplicate doses of the reference solution. 4997 theoretical plates were established to exist, with a peak area RSD of 0.8 and a tailing factor of 1.45 (Table 2).

RESULTS AND DISCUSSION

The reversed-phase high-performance liquid chromatography (RP-HPLC) method was established to determine FEN in bulk and tablet formulations. The technique was changed by adjusting the columns, flow velocity, mobile phase, and using columns of varied lengths to produce a straightforward and efficient approach. The choice of diluent was made based on how soluble the medication was. Since fenofibrate was only marginally soluble in water, acetonitrile and water were utilized as a diluent in a ratio of 1:1. The method was

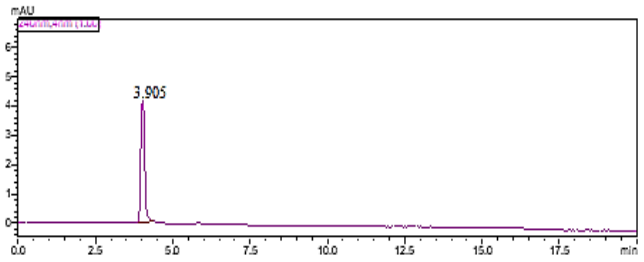

Figure 3: Fenofibrate (Standard Chromatograph).

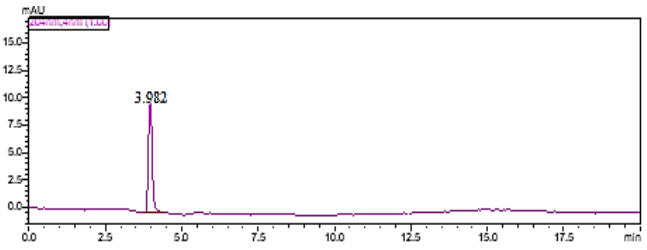

Figure 4: Fenofibrate (Sample Chromatograph).

developed using acetonitrile and buffer in a 60:40 v/v ratio as the mobile phase with a flow rate of 1-mL/min. The particle size of the princeton (C18) column used was 250, 4.6 mm,[5] provides highly-resolved drug peaks and separation of drug breakdown products. Fenofibrate was discovered at 240 nm in wavelength. A solution volume of around 10 µL was added to the chromatographic apparatus. The retention time was 3.905 minutes, with a runtime of 20 minutes overall. Figures show the chromatograms for the standard and sample respectively, 3 and 4.

Method Validation

System Suitability

By evaluating numerous parameters, the system's applicability was proven. The standard solution was injected six times in order to establish it. A total of 4997 theoretical plates were found, with a peak area RSD of 0.8 and a tailing factor of 1.45. (Table 2). The system was perfect for conducting the analysis because all of the system appropriateness traits were well within the allowed ranges.

Linearity

The calibration data's established linearity. Concluded absorption series of 87-232 g/mL for FEN, calibration plots were linear. With a correlation value of 0.9994, the calibration plots for FEN were produced using the equation y=415.83x+557.22 (Table 3).

Accuracy

It was discovered that the three levels' average percentage recovery values were between 100.74 and 98.65%. The proportion of recovery values (Table 4) that fell within the boundaries demonstrated the accuracy of the method.

Precision

FEN's intraday and interday performances were, respectively, 0.4 and 0.8.

Table 2: System suitability results

Parameter	*FEN*
Theoretical Plate	4997
Retention Time	3.905
Tailing factor	1.45
% RSD	0.8

Table 3: Linearity results

Parameter	*FEN*
Concentration Range (µg/mL)	87-232
Slope (m)	415.83
Intercept	557.22
Coefficient correlation (r^2)	0.9994

Table 4: Recovery results

Drug	*Spiked level (%)*	*Amount taken (µg/mL)*	*Amount found (µg/mL)*	*%Recovery*
FEN	80	116	116.86	100.74
	100	145	145.05	100.04
	120	174	171.65	98.65

%Recovery: Percentage recovery.

Table 5: Robustness results

Parameter	*Amount estimated [%] (Mean ± S.D.)*	*FEN* *RSD [%]*	
Wavelength change (240 ± 2 nm)	238	100.16 ± 0.0900	0.0908
	242	100.08 ± 0.1410	0.1417
Flow rate change (1.0 ± 0.1 mL/min)	0.9	99.37 ± 0.2054	0.2068
	1.1	99.56 ± 0.2001	0.2009

LoD and LoQ

It was determined that the LOD and LOQ for FEN were 23.12 and 70.08 g/mL, respectively.

Robustness

By properly altering the optimal conditions, the method's robustness was designed. Variations in wavelength and flow rate do not significantly affect the approach, according to the analysis of the data (Table 5). The developed approach was robust if the %RSD was 2%.

Fenofibrate Marketed Tablets Formulation Study

The fenofibrate assay tablet formulation revealed a value of 100.15%. Thus, it was determined that the procedure was precise.

CONCLUSION

The developed validated RP-HPLC approach was discovered to be quick, easy, specific, sensitive, linear, accurate, exact, and fairly priced. Therefore, it might be applied to the routine quality monitoring of fenofibrate during the preparation of the bulk and tablet forms.

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