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Analytical method development and validation of fluvoxamine maleate in bulk and its formulation by Uv spectroscopy

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Abstract
The development of the UV Spectrophotometry method for Fluvoxamine maleate quantification is included in the current study effort. A unique, straightforward, and accurate method for estimating the amount of Fluvoxamine maleate in bulk has been devised dosing form for pharmaceuticals. The ideal circumstances for the drug analysis were determined. Beer's law is followed when using 0.1N hydrochloric acid as a solvent with a concentration of 5–10 µg/ml at λ max of 246 nm. The absorbance and concentration have a linear relationship, as indicated by the calibration curve. With a r^2 of 0.9999, the line equation Y = 0.026x + 0.0803 was discovered. The developed procedure was proven to be exact and accurate when validated in accordance with ICH requirements. Fluvoxamine maleate can be accurately estimated using the suggested method for both pharmaceutical dose forms and bulk forms. The analysis's conclusions were supported by recovery studies and statistical validation.

Keywords: Fluvoxamine maleate, UV spectrophotometry, accuracy, validation

Introduction
A specific kind of selective serotonin reuptake inhibitor (SSRI) is Fluvoxamine maleate. It functions by reestablishing the natural neurotransmitter serotonin's equilibrium in the brain, which reduces obsessive or compulsive behavior. Mechanism of action of Fluvoxamine as an anti-depressant and anti- obsessional drug is that it works by specifically inhibiting serotonin (5-hydroxytryptamine [5-HT] reuptake in brain neurons. By obstructing the membrane pump mechanism for neuronal 5-HT reuptake, Fluvoxamine potently and selectively inhibits pre-synaptic neuronal reuptake of 5-HT. This decreases 5-HT turnover and promotes serotonergic transmission. In a chemical way with the empirical formula $C_{19}H_{25}F_3N_2O_6$, molecular weight 434.41g, Fluvoxamine maleate is a 2-aminoethoxy ({5- methoxy-1-[4(trifluoromethyl)phenyl] pentylidene}) amine that belongs to the chemical series of 2-aminoethyl oxime ethers of aryl ketone in the treatment of a variety of depressed conditions. It dissolves in methanol, ethanol, and water [1-3].

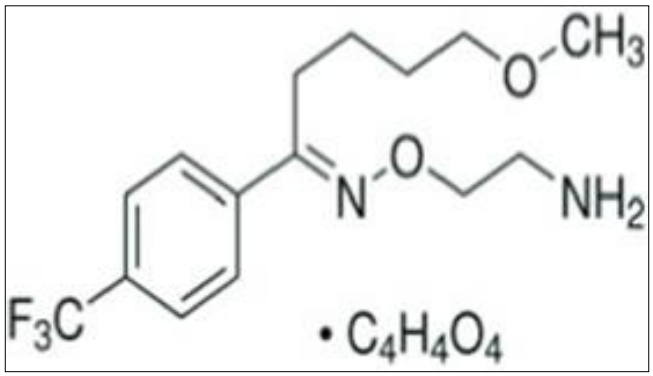

Fig 1: Structure of fluvoxamine maleate

Materials and Methods
Instruments: UV-Visible Double Beam Spectrophotometer, Thermo Scientific, Evolution 201) with 1cm matched Quartz cells, micro pipette of variable volume and Digital Balance.

Chemicals
Fluvoxamine maleate (API and formulation), 0.1N Hydrochloric acid, distil water.

Determination of absorption maxima
To determine the maximum absorption wavelength (λmax) of Fluvoxamine maleate was scanned in between the 200–400 nm range. The drug had a maximum absorption at 246 nm.

Preparation of standard [4, 5]
Accurately weigh about 100 mg of Fluvoxamine maleate (API), transfer it into a 100 ml volumetric flask, and dissolve it with 0.1N HCl then sonicate it. Pipette 10 ml of the stock solution above, then transfer it into a 100 ml volumetric flask and use the same solvent to make up the volume. Using a UV-Visible spectro photometer, the wavelength of maximum absorption (λmax) of a drug in a solvent solution at a concentration of 1 mg/ml was scanned between the 200-400 nm ranges. The λ max was observed at 246nm.

Preparation of formulation [6, 7]
Take 20 tablets of Fluvoxamine maleate and ground it using a pestle and mortar. Weigh off the equivalent of 100 mg of powder from this, transfer it into a 100 ml volumetric flask, dissolve it with 0.1N HCl, sonicate the solution for 15 min, filter it, and add water to make up the remaining volume. Next, the solution is run through the UV spectrophotometer, namely the 200-400 nm range. The λmax was observed at 246nm.

Assay: The maximum absorbance was observed at 246nm, the observances was measured for the Fluvoxamine maleate and calculated the assay using following formula.

$$\% \text{ Assay} = \frac{\text{Sample absorbenc}}{\text{Standard absorbenc}} \times \frac{\text{Wt.of Std}}{\text{Dilution of std}} \times \frac{\text{Wt.of Sample}}{\text{Dilution of Sample}} \times \frac{\text{Purity}}{100} \times \frac{\text{Wt.of Tablet}}{\text{Lable claim}} \times 100$$

% Purity=100.20

Validation [8, 9]

Linearity

The method's linearity was performed across a concentration range of 5-25µg/ml of the intended concentration. A precisely weighed 100 mg pure drug was added to a 100 ml dry volumetric flask, which was then cleaned, dried, and filled with a little volume of water to make the volume reach 100 ml. As a result, the drug concentration (Stock solution-I) was 1000µg/ml. From here, 10 ml of the solution were pipette out into a 100 ml volumetric flask, and distilled water (Stock solution-II, 100µg/ml) was added to bring the volume up to the mark. Concentrations 5, 10, 15, 20, and 25µg/ml were prepared from above prepared Stock solution-II, calibration curve was plotted and the correlation coefficient was calculated. The acquired absorbance readings are plotted against the Fluvoxamine maleate concentration to create the calibration graph. Correlation coefficient of the linearity was found for method and reported in Table 1.

Limit of detection

LOD for Fluvoxamine maleate by the proposed method was determined on the response and slope of the regression coefficient.

Limit of quantization

Limit of quantization for Fluvoxamine maleate by the proposed method was determined on the response and slope of the regression coefficient.

Precision

The precision of an analytical method is the degree of agreement among individual test results when the method is applied repeatedly to multiple samplings of homogenous samples. It provides an indication of random error results and was expressed as coefficient of variation.

Intra and inter-day precision

A variation of results within the same day (intraday), variation of results between days (inter day) was analyzed. Intra-day precision was determined by analyzing Fluvoxamine maleate for five times in the same day at 246 nm. Inter day precision was determined by analyzing drug daily once for five days at 246 nm.

Accuracy

Accuracy is the closeness of the test results obtained by the method to the true value. The recovery technique was performed to judge the accuracy of the proposed method. For this, known quantities of the Fluvoxamine maleate solution were mixed with definite amounts of pre-analyzed formulations and the mixtures were analyzed. The total amount of Fluvoxamine maleate was determined by using the proposed method and the amount of added drug was calculated by the difference.

Ruggedness and robustness

The solutions were prepared and analyzed with change in the analytical conditions like different laboratory conditions and different analysts.

Results and Discussion

Linearity

The method's linearity was done across a concentration range of 5-25µg/ml of the intended concentration. A precisely weighed 100 mg pure drug was added to a 100 ml volumetric. Concentrations 5, 10, 15, 20, and 25µg/ml were prepared from above prepared Stock solution calibration curve was plotted and the correlation coefficient was calculated. The acquired absorbance readings are plotted against the Fluvoxamine maleate concentration to create the calibration graph**.** Correlation coefficient is less than 2 and the linearity was found for method reported in table.

Table 1: Linearity of Fluvoxamine maleate 246 nm & statistical data of the regression equation

S. No.	Concentration (µg/ml)	Absorbance	Fluvoxamine maleate	
1	5	0.213	Parameters	246 nm
2	10	0.338	Std. dev.	0.154
3	15	0.467	Correlation	0.999
4	20	0.601	Slope	0.026
5	25	0.731	Y- intercept	0.080

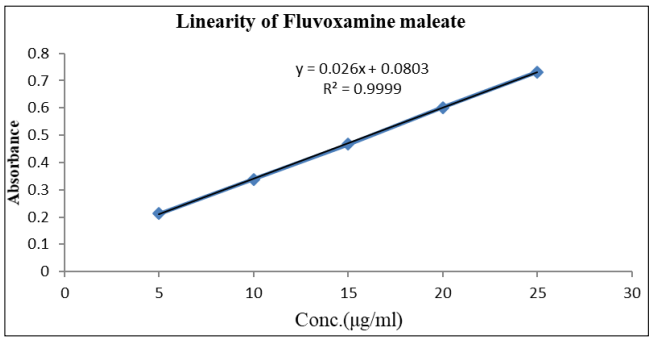

Fig 2: Linearity of Fluvoxamine maleate

Limit of detection

LOD for Fluvoxamine maleate by the proposed method was determined on the response and slope of the regression coefficient.

Limit of quantization

Limit of quantization for Fluvoxamine maleate by the proposed method was determined on the response and slope of the regression coefficient.

Table 2: LOD &LOQ values of Fluvoxamine maleate

Parameter	Formulae	LOD &LOQ values
LOD(µg/ml)	LOD =3.3×σ/S	19.54
LOQ(µg/ml)	LOQ =10×σ/S	59.23

Where, σ = Standard deviation,
S = Linearity curve slope.

Precision

The precision of an analytical method is the degree of agreement among individual test results when the method is applied repeatedly to multiple samplings of homogenous samples. It provides an indication of random error results and was expressed as coefficient of variation.

Intra and inter-day precision

A variation of results within the same day (intraday), variation of results between days (inter day) was analyzed. Intra-day precision was determined by analyzing Fluvoxamine maleate for five times in the same day at 246 nm. Inter day precision was determined by analyzing drug daily once for five days at 246 nm.

Table 3: Precision of Fluvoxamine maleate

Conc. (µg/ml)	Inter day			Intra day		
	Absorbance Mean	SD	%Assay	Absorbance Mean	SD	%Assay
5	0.335	1.39	98.79	0.340	1.30	99.99
10	0.336	1.30	101.98	0.341	1.35	100.98
15	0.333	1.35	101.59	0.339	1.40	101.59
20	0.335	1.45	101.00	0.341	1.35	101.59
25	0.334	1.30	101.05	0.342	1.40	101.13

Accuracy

Accuracy is the closeness of the test results obtained by the method to the true value. The recovery technique was performed to judge the accuracy of the proposed method. For this, known quantities of the Metformin hydrochloride solution were mixed with definite amounts of pre-analyzed formulations and the mixtures were analyzed. The total amount of Metformin hydrochloride was determined by using the proposed method and the amount of added drug was calculated by the difference.

Table 4: Accuracy of Fluvoxamine maleate

Sample (%level)	Amount Taken (µg/ml) (Sample)	Amount Added (µg/ml) (API)	Amount Recovered (µg/ml)	%Recovery	Mean
80	5	4	5.75	98.99	99.45%
80	5	4	5.72	99.58	
80	5	4	5.73	99.80	
100	5	5	7.12	102.00	102%
100	5	5	7.15	102.50	
100	5	5	7.09	101.50	
120	5	6	8.33	101.80	102.21%
120	5	6	8.36	102.20	
120	5	6	8.39	102.63	

Ruggedness and robustness

The solutions were prepared and analyzed with change in the analytical conditions like different laboratory conditions and different analysts.

Table 5: Ruggedness of Fluvoxamine maleate

S.No.	Assay (% of claim) Fluvoxamine maleate	
	Analyst 1	Analyst 2
1	98.79	99.99
2	101.98	100.98
3	101.59	101.59
4	101.00	101.59
5	101.05	101.13
Mean	101.05	101.05
SD	1.397	1.316
RSD	0.96	0.91

The optimum conditions for UV-spectroscopy method have been established by varying the parameters one at a time and keeping the other parameters fixed and observing the effects of products on the absorbance of the sample and colored species. Beer's law limits, molar Absorptivity, Sandal's sensitivity, %range of error and %relative standard deviation is summarized in Table 2. The regression analysis using the method of least squares was made for the slope (b), intercept (a) and correlation coefficient (r^2=0.999) obtained from different concentrations are given in Table 1. The results showed that the method have reasonable precision. To evaluate the validity and reproducibility of the methods, known amounts of pure drug were added to the previously analyzed pharmaceutical dosage forms and the mixtures were analyzed by the proposed methods. The percentage recoveries are given in Table.4. The interference studies veiled that the common excipients and other additives that are usually present in the injection dosage forms did not interfere at their regularly added levels.

Conclusions

Based on the aforementioned findings, the procedure outlined in this work for determining the amount of Fluvoxamine maleate in tablet formulation is simple, precise, repeatable, and sensitive. The suggested method might be used in quality control labs for routine analysis. According to ICH guidelines, the developed method was validated.

Acknowledgement

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References

1. Foda NH. Quantitative analysis of fluvoxamine maleate in tablet formulations by HPLC. J. Liq. Chromatogr,1995:18:1591–1601.
2. Skibinski R, Misztal G. Determination of moclobemide, paroxetine, and fluvoxamine in tablets by HPLC. Acta Polo. Pharm. Drug Res,2001:58:97–100.
3. Thaidala Sriveni, Vanamala Naveen, Vemula Sai Rupa, Aeruva Renuka, Sunil Porika, M Akiful Haque, *et al*. Development and Validation of Dolutegravir in Bulk and Formulation: An Anti-Retroviral Drug Using UV-

Spectroscopy. International Journal of Pharmaceutical Quality Assurance,2021:12(1):57-60.
4. Annapurna V, Jyothi G, Nagalakshmi V, Sailaja BBV. Spectrophotometric methods for the assay of fluvoxamine using chromogenic reagents. EJ. Chem,2010:7:1539–1545.
5. Vignali C, Moretti M, Quaiotti J, Freni F, Tajana L, Osculati A, *et al*. Distribution of Fluvoxamine and Identification of the Main Metabolite in a Fatal Intoxication. Journal of Analytical Toxicology,2020:45(4):e1-e5.
6. Elmali F, Alpdogan G, Sungur S, Aycan S. Polarographic determination of fluvoxamine maleate in tablets. Turk. J. Chem,2000:24:299–302.
7. Madhuri Lode, Rama Rao Tadikonda, Kiran Rapolu, Narender Boggula. Development and Validation by UV Spectrophotometric Method for the Determination of Sitagliptin in Bulk and its Formulation. International Journal of Development Research,2024:14(1):64716-64719.
8. Kim W, Fu Y, Dobson Stone C, Hsiao J, Shang K, Hallupp M, *et al*. Effect of Fluvoxamine on Amyloid-β Peptide Generation and Memory. Journal of Alzheimer's Disease,2018:62(4):1777-1787.
9. Banothu Bhadru, Narender Boggula, Tadikonda Rama Rao, Yelimeti Santhosha, Fathima Zainab. Method Development and Validation of Amlodipine Besylate in API and Pharmaceutical Dosage Form by UV Spectroscopy. International Journal of Research in Pharmacy and Pharmaceutical Sciences,2023:8(4):26-29.