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"Formulation And Evaluation of Oro-Dispersible tablet of Atorvastatin calcium using Natural superdisintegrant''

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ABSTRACT:

This study set out to extract and describe it using UV spectroscopy. In addition, a thorough analysis of Atorvastatin Calcium's solubility profile over a range of media was conducted to comprehend its dissolving characteristics. In order to accurately identify and evaluate the Hibiscus Rosa-Sinensis mucilage powder with a comprehensive analysis of the physical and chemical characteristics of orodispersible tablets made with this natural excipient, extensive in-vitro drug release investigations were carried out. These studies provided important new information on the kinetics of drug release and the general functionality of the tablets, indicating a high degree of potential for medical use. A detailed stability analysis was performed on the optimized formulation, which confirmed its resilience and maintained efficacy over time. These findings collectively underscore the promising application of Hibiscus Rosa-Sinensis mucilage in pharmaceutical formulations, particularly for enhancing the solubility and bioavailability of poorly soluble drugs like Atorvastatin Calcium. This research paves the way for future advancements in drug delivery systems and underscores the importance of natural excipients in pharmaceutical development.

Keywords: Orodispersible tablets, Super disintegrating, Hibiscus rosa-sinensis, Atorvastatin.

1 Introduction

Oro-Dispersible Tablet:
Oral administration is thought to be the most cost-effective, appropriate, and safest route of drug delivery, it is now the norm in the pharmaceutical business.[1] Because it is so simple to administer, the oral cavity is a popular choice for medication administration.[2] Oro-dispersible drug delivery system are Novel Drug Delivery techniques that make the tablets disintegrate in the mouth without chewing and water, and immediate release and enhanced bioavailability, with better patient compliance. [3]

Mechanism of action of Oro-dispersible Tablet: The orodispersible tablet containing drug, fast dissolving granules and disintegrating agents. The oral dispersible tablets come in contact with saliva in the mouth results, swelling of disintegrating agents that will create channels for saliva. [4]

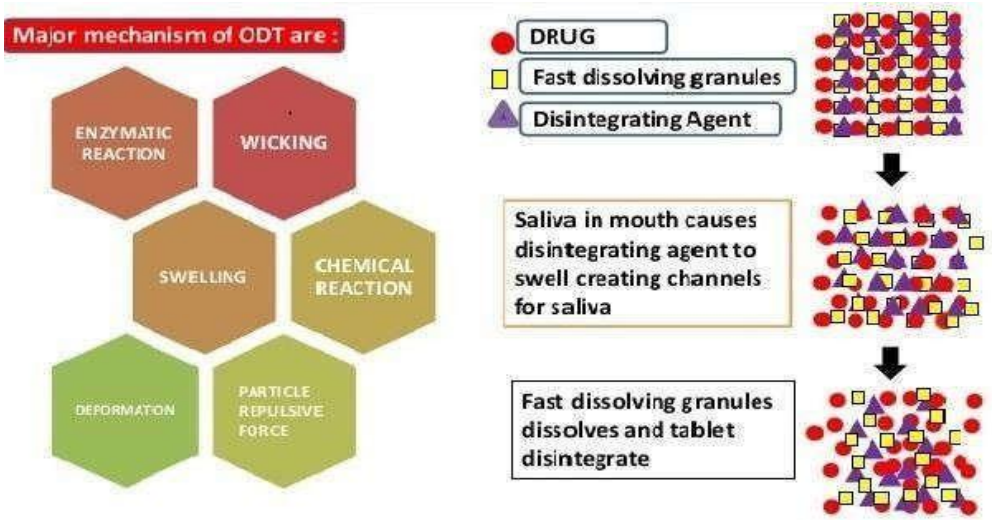


Fig.1 Mechanism of orodispersible tablet

Disintegrants:
A substance or combination of ingredients known as disintegrants is added to the medicine formulation to aid in the tablet's content disintegrating into smaller particles that dissolve more quickly than tablets without disintegrants.[5] Disintegranting agents include, among others, pre-gelatinized starch, modified starch, and MCC.

Superdisintegrants:
Super disintegrants are substances that, when used in lesser quantities, enable a rapid disintegration period. Super-disintegrants are added to tablets to enhance their disintegration, which is beneficial for both the tablet's bioavailability and its ability to dissolve in saliva. [6]and mucilages with super-disintegranting properties are available.
[7]

Mechanism of Superdisintegrants:
Super Disintegrate is required in the formulation of ODT because Fast Dissolving Tablets require faster disintegration. The Super Disintegrate that is employed is more effective intragranularly, has a higher disintegration efficiency, and works well at
low concentrations.

Hibiscus Rosa Sinensis: Hibiscus rosa-sinensis is a species of tropical hibiscus, a flowering plant in the Hibisceae tribe of the family Malvaceae, endemic to East Asia. It is often referred to by vernacular names such as Chinese hibiscus, China rose, Hawaiian hibiscus, rose mallow, and shoeblackplant. [8]

Phytography: It comes by the name "shoe flower" as well. Hibiscus rosa-sinensis is a tiny tree or shrub with glossy leaves that grows to a height of 2.5–5 m (8–16 ft) and a width of 1.5–3 m (5–10 ft).[9] The flower is often used as a pre-treatment in hair care. In some areas of India, it's also utilized for shoe shining. It serves as a pH indicator as well. When applied, the flower turns basic liquids green and acidic solutions dark pink or magenta.

Fig. 2: Hibiscus Rosa Sinensis

In Chinese herbology, hibiscus rosa-sinensis is said to have several medicinal applications. It could have some use in cosmetic skin care; for instance, it has been demonstrated that an extract from Hibiscus rosa-sinensis flowers acts as an anti-solar agent by absorbing UV light.

Pharmacological action:

Lowers LDL cholesterol: One gram of the leaf extract taken daily, in conjunction with a proper diet and exercise regimen, was found to assist individuals regulate their weight and decrease their LDL cholesterol levels. While nothing is as effective as magic, these leaf extracts can support your efforts.[10] It has been demonstrated that the polyphenols and flavonoids found in Hibiscus Rosa Sinensis leaves can successfully cure IBS by reducing chronic inflammation in the body.Treatment for IBS is attributed to the flavonoids found in the leaves. Hibiscus leaf extracts promote quicker healing of cuts and wounds when applied topically.

Atorvastatin Calcium drug:

A drug used to decrease blood cholesterol is atorvastatin, which belongs to the statin medicine family. By means of anti-inflammatory and other mechanisms, it also stabilizes plaque and averts strokes.[11] Similar to other statins, atorvastatin functions by preventing the liver tissue-resident enzyme HMG-CoA reductase from doing its job, which is essential for the body's synthesis of cholesterol. Oral atorvastatin is rapidly absorbed, and it takes around 1-2 hours to reach its maximum plasma concentration (Tmax). While the drug's absolute bioavailability is only about 14%, its systemic availability for HMG-CoA reductase activity is roughly 30%.

Mechanism of action:

A synthetic lipid-lowering drug is atorvastatin. The rate-limiting enzyme that transforms 3-hydroxy-3-methyl-glutaryl-coenzyme A into mevalonate, a precursor of sterols, including cholesterol, is HMG-CoA reductase, which is inhibited by atorvastatin. Very low-density lipoprotein (VLDL) is formed in the liver from triglycerides (TG) and cholesterol, which are then released into the plasma to be delivered to peripheral organs. VLDL is converted to low density lipoprotein (LDL), which is mostly catabolized via the high affinity LDL receptor.[12]

By inhibiting HMG-CoA reductase and cholesterol production in the liver and by increasing the number of hepatic LDL receptors on the cell surface to improve LDL absorption and catabolism, atorvastatin reduces plasma cholesterol and lipoprotein levels. Both the

quantity and generation of LDL particles are decreased with atorvastatin. Along with a positive alteration in the quality of circulating LDL particles, atorvastatin causes a significant and long-lasting increase in LDL receptor activation.

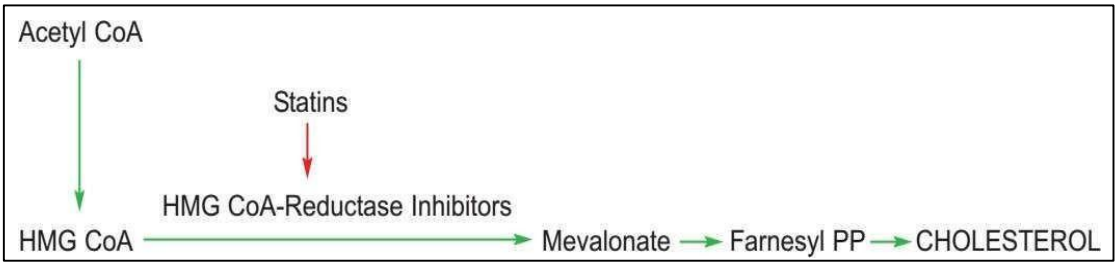


Fig. 3: Mechanism of action of Atorvastatin Calcium

Cyclodextrin: - Cyclodextrins are widely employed in pharmaceutical formulation design, primarily as a solubilizing agent to improve the solubility of medications that are poorly soluble. Cyclodextrins are cyclic oligosaccharides that are produced by the enzymatic breakdown of starch and include six, seven, or eight glucopyranose units (α, β, and y, respectively). The complexing agent has the ability to cover up the medication's unpleasant taste. In inclusion, cyclodextrin suppresses the bitter taste by forming a complex with it, which prevents the complexed molecule from reacting with the taste buds in the buccal cavity. [13]

Inclusion Complexes: [14]

It is composed of up of two or more molecules, of which one is the "guest" molecule and the other is the "host" molecule.The drug molecule or the lipophilic moiety of the molecule is implemented into the central cavity of the polar cyclodextrin cavity, which is occupied by water molecules that are in an energetically unflavored state and can therefore be easily replaced by a suitable guest molecule that is less polar than water, as illustrated in figure 4. This process results in the formation of inclusion complexes

Physical Mixture:

The solid physical mixture of drug and cyclodextrin are prepared simply by mechanical trituration. In the laboratory scale, the cyclodextrin and drug are mixed together scrupulously by trituration in a mortar-pestle and passes through suitable sieve to get the desired particle size in the final product. In industry scale, the physical mixtures are prepared on the basis of extensive blending of the drug with cyclodextrin in a rapid mass granulator usually for 30 minutes.[15]

Kneading Method:

This process involves kneading cyclodextrin like a paste rather than dissolving it. To create a slurry, cyclodextrin is added together with a tiny quantity of water or ethanol during trituration. Subsequently, the medication is mixed with the slurry and stirred. After air drying, a powder-like complex forms in the slurry.

Precipitation Method:

Boiled to produce a concentrated, transparent liquid. Giving the inclusion complicated precipitate is the solution. Centrifugation, decanting, or filtering are three methods for gathering the precipitate. The precipitate was washed with a tiny quantity of water or another water-miscible solvent, such as acetone, methanol, or ethyl alcohol.

2. Material and method [16]

Extraction of hibiscus rosa-senesis leaves mucilage: The Hibiscus rosa sinensis (China rose) from the campus garden, which is a resource for collecting plants and herbs. The

collected leaves were meticulously cleaned, dried for 24 hours in the shade, and then dried again in an oven set at 30 to 40 degrees Celsius. The grinder helped to minimize size. After being put through sieve number 22, powdered leaves were utilized for further analysis.

Extraction of mucilage includes 2 steps.

Step 1: Extraction of Mucilage: 100g of powdered leaves were in beaker with 500ml of distilled water. The mixture was then heated to 60°C, stirring constantly, for three to four hours, allowing the mucilage in the water to be sufficiently released. After separating marc from the filtrate by filtering the concentrated solution through muslin fabric, it was chilled to 3–4°C.

Step 2: Isolation of Mucilage: To precipitate the mucilage, acetone was added to the mucilage extract in a volume three times that of the filtrate. After being cleaned with acetone, the precipitated mucilage was collected using muslin cloth for filtering. The mucilage was further dried at a temperature below 40°C in a hot air oven. After being ground and put through filter No. 80, the dried mucilage was then sealed in an airtight container.

Characterization of prepared mucilage powder:[17]

Organoleptic Characterization of Isolated Mucilage: The extracted mucilage was characterized for various parameters like color, odor, taste, texture and fracture etc.

Percentage Yield: The percentage yield was calculated in the percentage amountof hibiscus rosa sinesis mucilage sample used before the extraction process and the amount of powder of mucilage obtained after the extraction. The Percentage Yield was calculated by the using following formula.

Percentage yield = weight after extraction / weight before extraction ×100

Determination of Mucilage pH:

The pH of the mucilage was determined by using 1% w/v solution of mucilage in water and was determined by digital pH meter.

Swelling Index: It was determined by weighing a piece of 2 by 2 cm butter paper, dipping it in a Petridish filled with water, and then reweighing the butter paper. Then, after 24 hours, the swelling index was determined and the ultimate result was computed using the formulas. 10 mg of the powdered sample was stored in a butter paper and placed on a Petridish with 15 ml of water.

$SI = V_2 - V_1 / V1 \times 100$

Bulk Density and Tapped Density: Density was calculated as weight of the powder divided by the volume acquired by that weighed powder. The SI unit of density is gm/ml. The difference betweenthe bulk density and tapped density is that, in bulk density, bulk volume is used whereas in the tapped density, tapped volume is used which can be obtained by switching on the equipment for 100 times tapings.

Bulk density = mass of powder/bulk volume of powder.

Tapped density = Mass of powder / Tapped volume of powder

Angle of Repose:

Using the funnel method, the angle of repose of the powder was calculated by measuring the diameter and height of the powder cone and plugging the values into an equation. The powder was precisely weighed and dropped into the funnel, allowing the powder blend to flow freely through and onto the surface. The funnel was fitted and secured with its tip at a height (h) of 2 cm above graph paper, which is placed on a horizontal surface.

$\theta = \tan^{-1} (h/r)$

Solubility of drug [18]

50mg Atorvastatin calcium of was weighed and solubility of this sample was checkedin water, methanol and phosphate buffer by using calibration curve method. The drugwas found to be soluble in methanol.

Identification of λmax of Atorvastatin calcium

50mg of drug was weighed and was dissolved in 50ml of methanol (1mg/ml). 10ml ofthis solution was withdrawn and volume was made up to 100ml. Appropriate dilutions were made with methanol to give concentration of 10 µg/ml, scanned in UV range from 200- 400nm and spectrum was recorded.

Calculation of Rf value:

Rf value can be calculated by following formula:

Rf= Distance travelled by solute / Distance travelled by solvent

Detail of excipients:

Table No. 1: - Details of excipients

S.No.	Excipients	Purpose
1	Beta-cyclodextrin	Solubility enhancer
2	Hibiscus Rosa-senesis mucilage	Superdisintegrant
3	Microcrystalline Cellulose	Disintegrant
4	Mannitol	Diluent
5	Aspartame	Sweetening agent
6	Magnesium Sterate	Lubricant
7	Talc	Glidant

Pre-compression Parametres of powder: [19]

Bulk Density:

Bulk density is defined as the total mass of the powder divided by the bulk volume and is expressed as gm/ml. The Weighed blend of powder was taken from each formulation in a measuring cylinder and the initial volume of the powder (Vb) in the measuring cylinder was noted. This was calculated by using the formula:

Bulk density = Weight of the sample Bulk volume

Tapped Density:

It is the ratio of total mass of the powder to the tapped volume of powder. The volume was measured by tapping the powder for 100 times. After that the tapping was done for 100 times and the tapped volume was noted. Tapped density was calculated by using the following formula:

Tapped density = Weight of the sample
Tapped volume

Carr's index:

It helps in measuring the force required to break the friction between the particle and hopper. It is expressed in percentage. The Carr's index of the powder blend was determined by using the formula:

Carr's index (%) = Tapped density- Bulk density
Tapped density

Hausner's ratio: It is used for flow properties of the blend.If the hausner's ratio is less than 1.25 that indicates the powder has free flowing properties whereas more than 1.25 that indicates the powder has poor flow ability. It was calculated by following formula**:**

Hausner's ratio = Tapped density / Bulk density

Evaluation of Inclusion complex: [20]

Weight variation

The twenty tablets were selected randomly and their average weight was determined. Tablets were weighed individually and compared with averageweight. If more than two tablets deviate from the range, retest 20 tablets and not more than 2 tablets should deviate from 40 tablets**.**

Hardness:

Hardness of the tablet indicates the ability of tablet to withstand mechanical shocks while packaging, handling and transportation. The hardness of the tablet was determined by Monsanto hardness tester. Placed the tablet on the lower plunger and zero reading was taken from Monsanto tester scale. The range of Monsanto hardness tester is "0 to 20" kg. Three tablets of each formulation batch were tested randomly and the averagereading was recorded. It is expressed in kg/cm^2

Thickness:

Thickness of the tablets was calculated by the use of vernier calliper. The scale was set to zero and placed the tablet laterally between the jaws of vernier calliper.Take out the sample, clean the jaws and keep the caliper in place. There are three tablets of each formulation batch were checked randomly and standard deviation was measured. It is expressed in m.

Friability:

Friability of the tablet was determined using Roche friabilator. Tablets was Weighed before placing in friability apparatus. Place 10 tablets in the friabilator and were subjected to 100 revolutions for 4 minutes at 25 rpm and dropping the tablet at the height of 6 inches in each revolution. Taken out the tablet after 100 revolutions completed. A maximum loss of weight not greater than 1.0 % is acceptable for most tablets. Then friability was calculated by the given formula: Percentage friability = Initial weight - Final weight ×100

Initial weight

Disintegration time:

First suspend the assembly in the beaker containing 6.8 pH phosphate buffer at $37\pm0.5^{O}C$. The tablet was placed into each of the six tubes of the disintegrating apparatus and one disc was added to each tube. [21]

The test was repeated on 12 additional tablets, if 1 or 2 tablets failed to disintegrate. Not less than the 16 tablets of the total of 18 tablets pass the test. If the tablets adhered to the disc and the preparation under examination failed to comply, repeated the test and the disc was omitted.

Wetting time & Water absorption ratio:

A piece of tissue paper folded twice was placed in a small Petridis containing10 ml of water. A tablet was put on the tissue paper and the time required for the water to diffuse from the wetted absorbent paper throughout the entire tablet was then recorded using a stopwatch.

For water absorption ratio: The wetted tablets were the reweighed. The water absorption ratio and R was determined using following equation

$R = Wa\text{-}Wb/Wb\times100$

Wa = Weight of the tablet after water absorption Wb = Weight of the tablet before water absorption

In vitro Drug release study:

In vitro drug release study was determined by dissolution test apparatus. The water level was maintained in dissolution vessel up-to the specific mark and adjusted or maintained temperature from heater knob.[22] 900 ml of phosphate buffer pH 6.8 was poured in dissolution vessel and adjusted temperature between 37±0.5 C. Withdrawn 5 ml sample

at every 5 minutes interval and replaced by equal volume of fresh dissolution medium. Filtered the samples using what man's filter paper and analyzed for drugrelease of the samples by UV-visible spectrophotometer at λ max
245.5 nm using phosphate buffer pH 6.8 as blank.

Stability study: [23]

A selected sample of tablets were subjected to stability. The samples were testing at a time interval of 0 and 4th week. The stability study waskept at (25±2 O° C) and (40°C ± 2 °C) and relative humidity (75% ± 5%) and were tested at time interval of 0 and 4th week. Samples in both studies were tested for their appearance, retention factor to evaluate the stability of the tablets.[24]

3. Result and Discussion

Extraction and characterization of Hibiscus Rosa-Senesis mucilage powder:

Extraction of Hibiscus Rosa-Senesis mucilage: The mucilage was extracted Hibiscus Rosa-Senesis.

Characterization of Hibiscus Rosa- Senesis mucilage powder: The prepared powder was evaluated as follows:

Table no.2:- Characterization of Hibiscus Rosa Senesis mucilage powder:

S.NO.	Parameters	Result
1	Color	Green
22	Odour	Odorless
3	Taste	Bitter
4	Percentage Yield	12.6%±0.611
5	pH of Mucilage	6.87±0.043
6	Solubility of Mucilage	Soluble in hot water and insoluble inorganic solvents
7	Bulk density	0.47±0.005
8	Tapped density	0.67±0.015
9	Carr's index	14.5±0.208
10	Angle of repose	39.63±0.650
11	Hausner's ratio	1.42±0.017

Preformulation Study: Determination of wavelength using UV spectroscopy: The maximumwavelength of Atorvastatin Calcium was found to be 245.4nm.

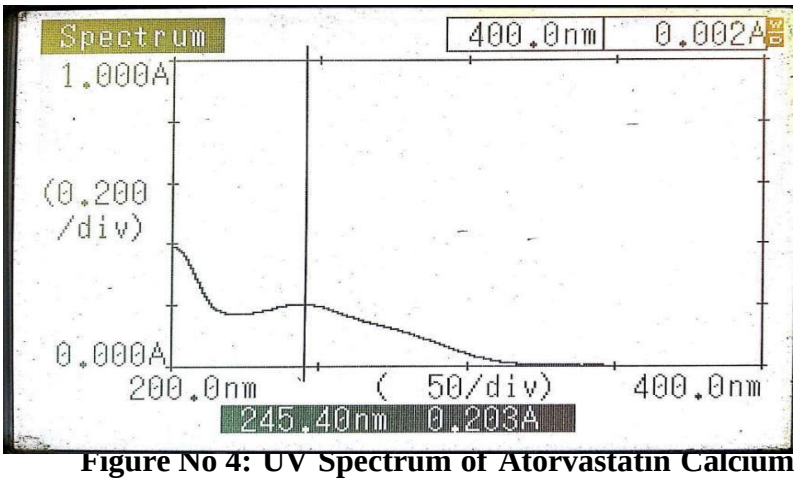


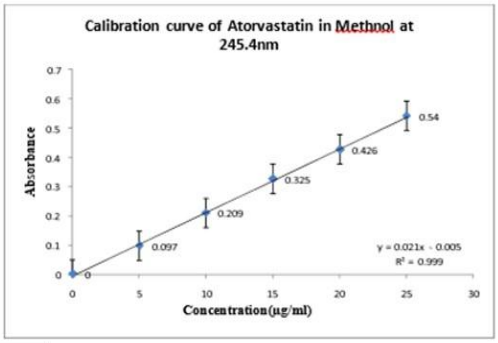
Figure No 4: UV Spectrum of Atorvastatin Calcium

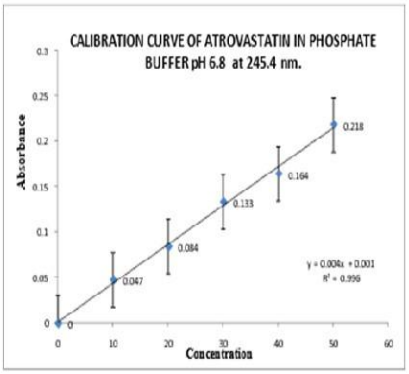
Calibration curve of Atorvastatin Calcium in Methanol

Fig No 5. Absorbance data of Atorvastatin Calcium in Methanol and in phosphate buffer pH 6.8 for preparation of calibration curve, at 245.4nm

S.No.	Concentration(µg/ml)	Absorbance (mean ± standard deviation) (n=3)
1	5	0.097±0.005
2	10	0.209±0.003
3	15	0.325±0.017
4	20	0.426±0.018
5	25	0.54±0.013

S.No.	Concentration (µg/ml)	Absorbance (mean ± standard deviation) (n=3)
1	10	0.047±0.005
2	20	0.084±0.008
3	30	0.133±0.007
4	40	0.164±0.010
5	50	0.218±0.010





Atorvastatin Calcium in Methanol follows the Beer – Lambert's law in theconcentration range of 5-25 µg/ml.Atorvastatin Calcium in phosphate buffer pH 6.8 follows the Beer–Lambert's law inthe concentration range of 10-50 µg/ml.[26]

Calibration curve of Atorvastatin Calcium in pH 1.2 HCl buffer:

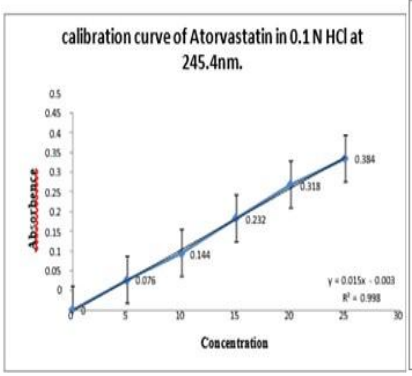
The calibration curves of Atorvastatin Calcium in pH 1.2 HCl buffer were prepared and shown below: Atorvastatin Calcium water follows the Beer – Lambert's law in the concentrationrange of 10-50 µg/ml.

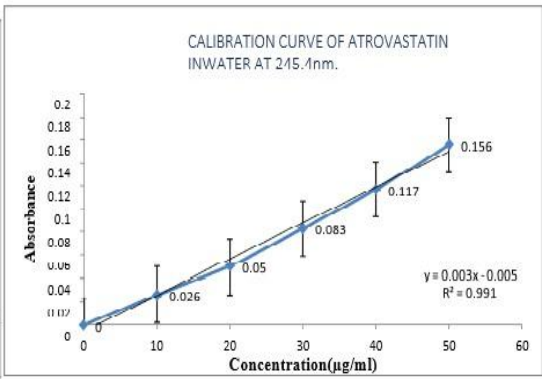
Atorvastatin Calcium in pH 1.2 HCl buffer follows the Beer – Lambert's law in theconcentration range of 5-25 µg/ml

Fig no. 6: - Absorbance data of Atorvastatin Calcium pH 0.1 HCl buffer and in water forpreparation of calibration curve, at 245.4nm

S.no.	Concentration (µg/ml)	Absorbance (mean ± standard deviation) (n=3)
1	5	0.076±0.007
2	10	0.144±0.004
3	15	0.232±0.003
4	20	0.318±0.005
5	25	0.384±0.008

S.no.	Concentration (µg/ml)	Absorbance (mean ± standard deviation) (n=3)
1	**10**	**0.026±0.003**
2	20	0.05±0.005
3	30	0.083±0.007
4	40	0.117±0.012
5	50	0.156±0.030





Determination of solubility of Atorvastatin Calcium in various medium:
The solubility of Atorvastatin Calcium in various mediums was studied and the resultsof study were shown in below table:

Table no. 3: Solubility data of Atorvastatin Calcium in different mediums:

S.NO.	Solvent	Solubility (mg/ml) Mean±SD (n=3)	Inference
1	Methanol	30.106±2.18 6	Sparingly Soluble
2	Phosphate buffer pH 6.8	0.184±0.001	Very Slightly Soluble
3	pH 1.2 HCl buffer	0.108±0.007	Very Slightly Soluble
4.	Water	0.578±0.010	Slightly soluble

Determination of solubility of inclusion complex:
The solubility of inclusion complex in phosphate buffer pH 6.8 was studied and the results of study were shown in below table:

Table no. 4: Solubility data of inclusion complex:

S.No.	Phosphate buffer pH 6.8	Solubility (mg/ml) Mean±SD (n=3)	Inference
1	Pure drug	0.184±0.001	Very Slightly Soluble
2	Drug:β-CD (1:3)	0.471±0.004	Slightly Soluble
3	Drug:β-CD (1:4)	0.694±0.008	Slightly Soluble
4	Drug:β-CD (1:5)	0.840±0.012	Slightly Soluble

Drug-excipient interaction study:
The drug (Atorvastatin) was found to be compatible with various excipients which were selected for formulation of orodispersible tablet. The compatibility was assessedby TLC and the retention factors of all ratios found similar.[25]

Table no. 6: Data of drug-excipient interaction study

S.No.	Drug/ Excipient Ratio (1:1)	Physical appearance (initial)	Present Day (Rf)	Physical appearance after 15 days (final)	After15 Days (Rf)
1.	Drug (Atorvastatin)	White	0.58	White	0.57
2.	Pure Drug + β-cyclodextrin	White	0.68	White	0.66
3.	Pure Drug + Mucilage	Light green	0.66	Light green	0.64
4.	Pure Drug + MCC	White	0.60	White	0.60
5.	Pure Drug + Mannitol	White	0.63	White	0.64

6.	Pure Drug+ Aspartame	White	0.63	White	0.62
7.	Pure Drug + Magnesium stearate	White	0.68	White	0.69
8.	Pure Drug + Talc	White	0.73	White	0.71
9.	Pure drug + Mixture	Whitish green	0.75	Whitish green	0.74

Evaluation of precompression parameters of powder:
Bulk density, **Tapped density**, **Carr's index**, **Hausner's ratio**, **Angle of repose** The bulk density, tapped density, Carr's index, Hausner's ratio and angle of repose of selected formulations were performed and shown in table no.7.9. The results show that the all formulations that possess a good flow property.

Table no.7: Evaluation of Precompression Parameters of powder

Formulation	Bulk density (gm/ml) (n=3) Mean±SD	Tapped density (gm/ml) Mean±SD	Carr's index (%) (n=3) Mean±SD	Angle of repose (º) (n=3) Mean±SD	Hausner's ratio (n=3) Mean±SD
F1	0.314±0.004	0.368±0.004	14.635±1.503	25.406±0.374	1.170±0.026
F2	0.299±0.002	0.358±0.003	14.634±1.004	29.333±1.106	1.166±0.015
F3	0.288±0.002	0.345±0.003	16.323±1.047	27.606±0.525	1.186±0.015
F4	0.332±0.003	0.385±0.006	13.907±0.852	26.966±0.450	1.16±0.01
F5	0.307±0.003	0.363±0.002	15.260±1.695	25.59±0.213	1.176±0.020
F6	0.293±0.003	0.355±0.003	17.360±1.663	27.4±0.500	1.206±0.025
F7	0.344±0.003	0.402±0.004	14.414±0.402	26.74±0.767	1.166±0.005
F8	0.326±0.003	0.376±0.003	13.354±1.494	30.6±0.888	1.15±0.02
F9	0.298±0.002	0.330±0.001	9.787±0.459	26.633±0.709	1.103±0.005

Evaluation of post-compression parameters of orodispersible tablet:
The orodispersible tablet of Atorvastatin calcium were evaluated like weight variation, hardness, thickness, friability, disintegration time, drug content, wetting time and water absorption ratio. The results of the studies were shown in below table:

Table no. 8: Weight variation, Hardness, Thickness and Friability of Formulation (F1 F9)

Formulation	Weight variation (mg) (n=3) Mean±SD	Hardness (Kg/cm^2)(n=3) Mean±SD	Thickness(mm) (n=3) Mean±SD	Friability(%) (n=3) Mean±SD
F1	210.16±0.378	2.6±0.264	3.1±0.10	0.460±0.027
F2	211.75±0.312	2.4±0.173	3.1±0.12	0.750±0.047
F3	214±0.938	3.0±0.057	3.2±0.10	0.460±0.045
F4	223±0.301	2.9±0.152	3.3±0.10	0.672±0.045
F5	232±2.13	3.0±0.1	4.06±0.152	0.346±0.043
F6	233±0.28	3.0±0.057	3.4±0.208	0.343±0.043
F7	246.58±0.56	3.0±0.057	3.13±0.057	0.349±0.023
F8	247.83±1.05	3.1±0.1	3.26±0.152	0.361±0.040
F9	251.06±0.17	3.1±0.057	3.73±0.412	0.358±0.040

Table no. 9: Disintegration Time, Drug Content, Wetting time & water absorption Ratio of Formulation F1-F9.

Formulation	Disintegration Time (sec) (n=3) Mean±SD	Drug Content (%) (n=3) Mean±SD	Wetting time (sec) (n=3) Mean±SD	Water absorption Ratio (%) (n=3) Mean±SD
F1	42±1.05	91.833±0.233	32.7±0.590	55.97±3.63
F2	38±1.86	93.36±0.356	31.37±0.580	49.01±3.59
F3	37±1.93	95.84±1.362	30.05±0.040	42.18±3.13
F4	35±1.28	92.19±0.583	32.38±0.540	46.75±1.34

F5	30±1.25	99.25±0.470	29.71±0.546	30.3±1.56
F6	33±1.36	96.85±0.584	31.06±0.015	35.90±0.65
F7	45±1.68	95.76±0.466	33.38±0.580	36.83±0.61
F8	36±1.26	95.60±1.151	34.69±0.534	40.42±0.61
F9	39±1.48	93.73±1.113	35.06±0.015	41.96±0.60

In-vitro drug release study of orodispersible tablet:

Table no 10: Percentage cumulative drug release data of F1 to F9 formulationof orodispersible tablets:

Time (in min)	% Cumulative drug Release (Mean±SD) (n=3)								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
0	0	0	0	0	0	0	0	0	0
5	11.4± 3.20	16.9± 3.16	21.8± 4.35	28.8± 2.11	27.4± 2.41	30.2± 3.27	21.1± 3.21	23.9± 3.21	21.8± 2.44
10	214± 1.19	25.3± 1.60	3 7.2± 2.11	34.2± 2.11	35.1± 2.07	39.9± 3.20	28.8± 2.11	34.4± 4.35	28.1± 3.20
15	34.4± 3.16	40.0± 1.20	46.2± 2.44	44.2± 3.18	46.9± 3.21	44.8± 1.280	41.1± 2.07	43.5± 3.62	33.7± 3.16
20	44.2± 4.37	53.9± 5.52	57.4± 6.41	50.5± 4.81	56.0± 2.07	55.3± 3.22	53.2± 2.45	56.7± 1.95	47± 3.21
25	58.1± 2.07	67.9± 5.25	63.7± 4.34	67.9± 3.20	73.1± 2.14	62.2± 1.96	75.5± 3.21	72.8± 2.07	68.6± 2.11
30	90.9± 3.17	86.0± 1.24	89.5± 3.58	88.1± 3.19	95.8± 2.08	84.6± 3.20	86.7± 1.24	92.3± 4.34	93.7± 2.09

The percentage cumulative drug release from formulations F1 to F9. The formulation F5 was shows the highest release (99.25±0.470) within 30 minutes.

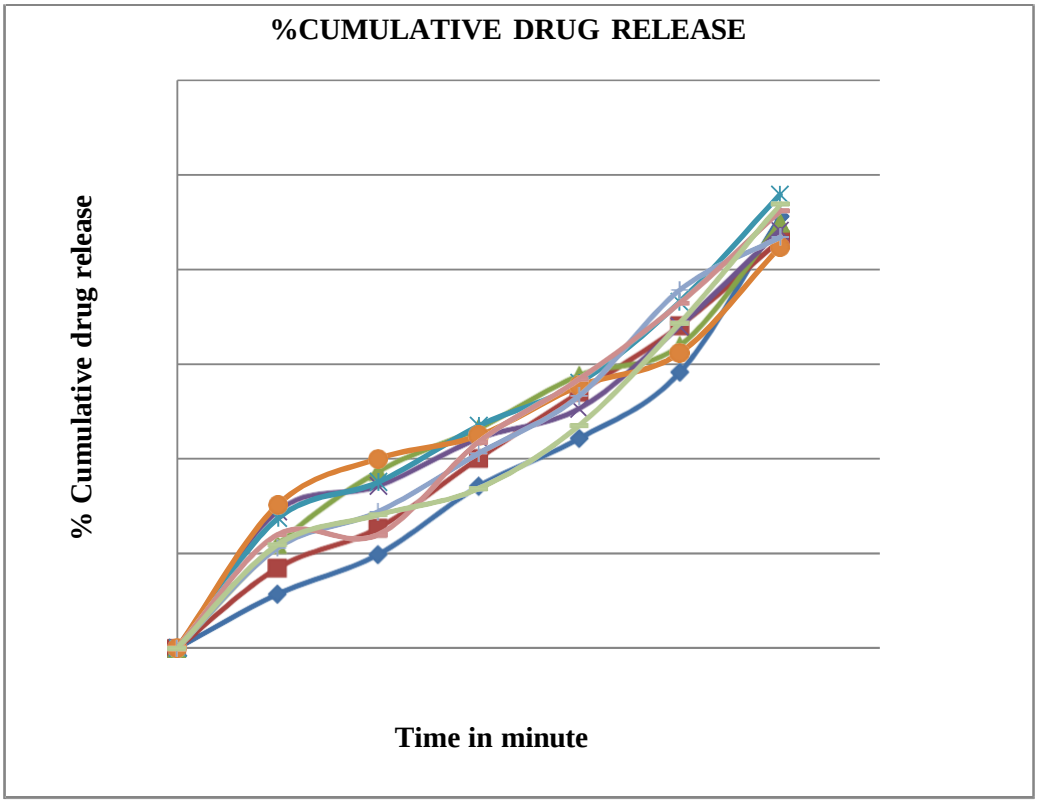


Figure 9: Percentage cumulative drug release graph from formulation F1-F9

Stability study:

Stability studies for one month were performed at different storage condition for optimized orodispersible tablet (F5). The optimized orodispersible tablet were found to be stable with no change in physical appearance and TLC values (Rf) were found similar at different storage condition at different time interval.

Table no.7.13: Stability data of optimized formulation (F5):

S. No.	Time	Physical appearance	Result	Storage condition	Rf value
1	Initial Day	Light brown	No change in appearance	40°C±2°C/ 75%RH±5%RH	0.71
		Light brown	No change in appearance	Room temperature	0.70
2	After one month	Light brown	No change in appearance	40°C±2°C/ 75%RH±5%RH	0.73
		Light brown	No change in appearance	Room temperature	0.72

4. Conclusion

As a result of the effective extraction and characterization of Hibiscus Rosa-Sinensis mucilage powder, the study's solubility profile and promising qualities were demonstrated. The thorough preformulation investigation yielded important insights that were essential for formulation development. These insights included wavelength determination by UV spectroscopy and the creation of calibration curves for Atorvastatin Calcium in various mediums. Additionally, the in-vitro drug release research and the assessment of orodispersible tablet characteristics produced crucial information in favor of the possible medicinal use of these formulations. The improved formulation's resilience and promise were further substantiated by the stability analysis. These results emphasize the need for comprehensive preformulation and formulation research in the medication development process and the potential for breakthroughs in pharmaceutical formulations utilizing calcium atorvastatin. This study makes a significant contribution to the field of pharmaceutical sciences by utilizing the special qualities of natural excipients, such as Hibiscus Rosa-Sinensis mucilage, to improve medication distribution and effectiveness.

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