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Formulation and Evaluation of Imeglimin Hydrochloride Immediate Release Tablet

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Abstract: ***Imeglimin hydrochloride, an oral drug that oversees type 2 diabetes, brings down blood glucose levels. Among other impacts, it also supports mitochondrial DNA and movement while reducing the production of reactive oxygen species (ROS). Imeglimin [1] tablets with a quick delivery recipe are presently being created and tried frequently. Tests were conducted using super-disintegrants, such as Croscarmellose sodium, and the amount of PVPK-30 was adjusted to reduce the disintegration time further. Microcrystalline. The diluent in the definition preliminaries was cellulose, the folio was polyvinylpyrrolidone (K-30), and the Glidant was colloidal silicon dioxide. Using the USP Device II (Paddle) at a temperature of 37°C ± 0.5°C and a speed of 50 rpm, the in vitro drug release was studied. Hydrochloric acid, 0.1 N, was utilised as the dissolving agent. For preliminaries F1 and F6, the level of the drug administered at different times was determined using UV technology. The review's findings revealed that Preliminary F6 provided the best detailing. Every estimation was within the permitted range specified by the Pharmacopoeial Details. The actual properties of different tablets, including hardness, thickness, weight variation, friability, percentage drug content, and in vitro drug release, were scrutinised.***

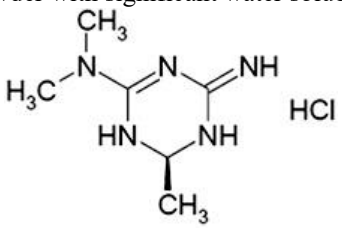
Keywords: Type 2 diabetes, Wet granulation, In vitro dissolution, Disintegration, and Pre-formulation, Imeglimin hydrochloride.

I. INTRODUCTION

A. Introduction on Imeglimin

Imeglimin, a significant ingredient of the primary treatment in this novel class of oral anti-diabetic drugs known as "glimins," contains tetrahydrotriazine. Following a first in vivo phenotypic screen based on rodent anti-hyperglycemic effectiveness, it is produced by chemically changing a lead molecule. Figure 1 illustrates the chemical composition that facilitated identification.

Imeglimin Hydrochloride, a member of the glimins class of drugs, is an original tetrahydrotriazine-containing oral anti-diabetic drug [18]. Its molecular weight is 191.66 g/mol, and its organic name is (4R)-6-N,6-N,4-trimethyl-1,4,5-triazine 2,6-diamine hydrochloride. Imeglimin appears as a white, crystalline powder with significant water solubility.



[Fig.1: Imeglimin Hydrochloride]

Imeglimin employs a distinct mode of action compared to other anti-hyperglycemic drugs, making it a pioneering and first-in-class oral anti-diabetic medicine. It increases mitochondrial function and primarily targets the bioenergetics of mitochondria. Imeglimin regulates the functions of the mitochondrial respiratory chain complex while efficiently reducing the production of reactive oxygen species. By raising the quantity of insulin released in response to glucose and the responsiveness of the pancreatic beta cells, Imeglimin has been shown to normalise glucose tolerance in persons with type 2 diabetes [9]. Additionally, it enhances insulin sensitivity in animal models of diabetes. According to a recent finding, Imeglimin is known to prevent the opening of the mitochondrial permeability transition pore, a known factor contributing to cell death, without affecting mitochondrial respiration. The study's findings

B. Rationale

Imeglimin can treat the three main pathophysiologic elements that cause type 2 diabetes [22]: a slowing of beta-cell senescence, an increase in hepatic gluconeogenesis, and a decrease in muscle glucose uptake. It lowers haemoglobin A1c and fasting plasma glucose just as effectively as metformin and Sitagliptin.

Imeglimin is a therapy option for type 2 diabetes [23] when diet and exercise alone are inadequate. Enhancing insulin activity is one of its odd and varied modes of action. It successfully lowers hepatic glucose production while enhancing insulin signalling in skeletal muscle and the liver. Imeglimin also protects beta-cell mass and increases glucose-stimulated insulin secretion (GSIS). Imeglimin Hydrochloride is an effective diabetes medication because it particularly addresses mitochondrial bioenergetics. Additionally, Imeglimin Hydrochloride carries a low risk of hypoglycemia.

Even though there are other anti-diabetic medications accessible, Imeglimin hydrochloride seems to be a viable treatment for diabetes patients [20] [21]. It offers more safety, more power, and better tolerability than competing options [25] [26].

Imeglimin hydrochloride was shown in clinical tests to dramatically lower

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HbA1c levels when compared to a placebo while maintaining a similar safety profile. Imeglimin showed a respectable level of safety and acceptability when administered as a stand-alone medication [2][3].

C. Introduction on Immediate Release Tablet [14]:

Conventional oral medication administration procedures, which have been utilised for an indefinite period to treat acute and chronic illnesses, employ a wide range of dosage forms, including tablets, capsules, powders, liquids, suspensions, and aerosol sprays. These conventional definitions keep on being vital to the drug business [5]. The circulatory system focus, then again, bit by bit ascends to a remedial level when a medication is taken as recommended, stays there for some time, and afterwards at last tumbles to a sub-restorative level, delivering the solution pharmacologically inert [4].

D. Advantage of the tablet dosage form [7]

- They feature a unit dosage form, variable lease content, and good dose accuracy.
- Oral dosage forms have the lowest cost [16].
- The least expensive and simplest items to package and strip; smaller, lighter, and easier to swallow.
- The coating process helps mask pungent odours and sharp tastes.
- Suitable for mass production.

E. Advantages of Immediate Release Drug Delivery System [6][8][13][24]

- Increased adherence
- Improved stability and bioavailability
- Fit for controlled-release substances.
- Be able to offer liquid medicinal advantages in the form of a solid mixture; • Permit substantial medication loading; • Be able to be adapted to be compatible with current processing and packaging equipment.
- More affordable
- Enhanced solubility of medicinal formulations

II. MATERIAL AND METHODS

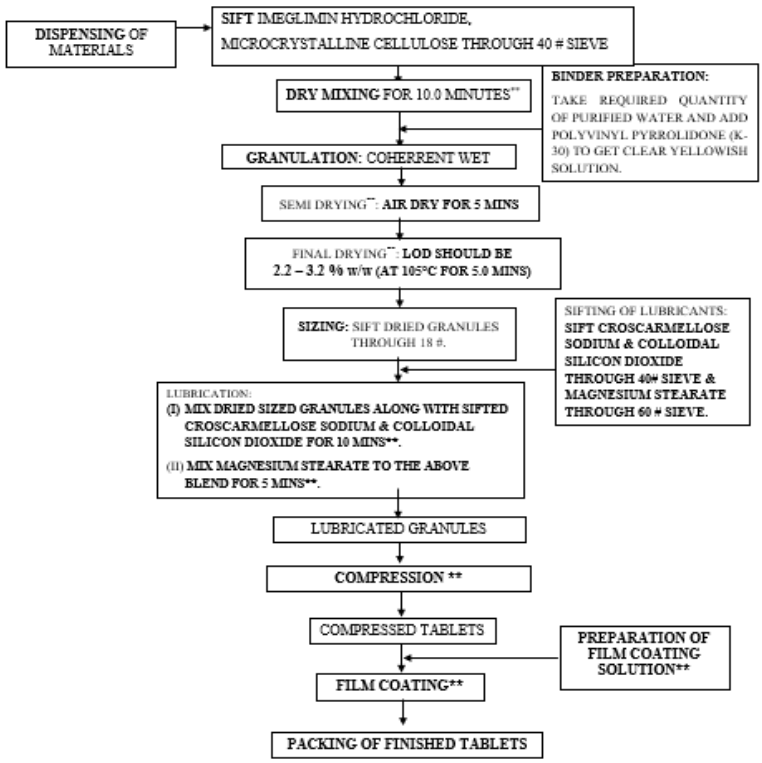
Table 1: List Of Materials

S. No.	Ingredients	Company Name (from where material received)
1.	Imeglimin Hydrochloride	Windlas Biotech Ltd.
2.	Microcrystalline Cellulose	Windlas Biotech Ltd.
3.	Polyvinyl Pyrrolidone (K-30)	Windlas Biotech Ltd.
4.	Croscarmellose Sodium	Windlas Biotech Ltd.
5.	Colloidal Silicon Dioxide	Windlas Biotech Ltd.
6.	Magnesium Stearate	Windlas Biotech Ltd.
7.	H.P.M.C.	Windlas Biotech Ltd.
8.	PEG - 400	Windlas Biotech Ltd.
9.	Titanium Dioxide	Windlas Biotech Ltd.
10.	Purified Talc	Windlas Biotech Ltd.

Table 2: List of Equipment

Sr. No.	Machinery / Equipment
1.	Platform weighing balance (Digital)
2.	Multi Mill
3.	Vibro Sifter
4.	Double Cone Blender
5.	Compression Machine
6.	Hardness tester
7.	Weighing Balance
8.	Vernier Callipers Digital
9.	Disintegration Apparatus
10.	Friability Testing Apparatus
11.	Halogen Moisture Analyser
12.	Rapid Mixer Granulator
13.	Tray Dryer
14.	Stirrer

F. Manufacturing Process Flow Chart



A. Manufacturing Process

Aim: To take a trial batch of Imeglimin Hydrochloride Tablets by wet granulation method.

Name of Product	:	Imeglimin Hydrochloride Tablets 500 mg
Description	:	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.
Composition	:	Each film-coated tablet contains: Imeglimin Hydrochloride…….500 mg Colour: Titanium Dioxide IP
Batch size	:	100 Tablets

***Formula*:**

Table no. 10 Working Formula F1

Bill Of Raw Materials

Sr. No.	Ingredients	Grade	Rationale for use	Qty. / Tabs. [mg.]
1.	Imeglimin Hydrochloride	IH	API	500.00
2.	Microcrystalline Cellulose	IP	Diluent	85.50
3.	Polyvinyl Pyrrolidone (K-30)	IP	Binder	17.50
4.	Purified Water	IP	Binder vehicle	q.s.@
5.	Croscarmellose Sodium	IP	Disintegrant	12.50
6.	Colloidal Silicon Dioxide	IP	Glidant	5.00
7.	Magnesium Stearate	IP	Lubricant	9.50
Total Weight				**630.00 mg**

@ Not to be found in original product.

Bill Of Film Coating Materials

Sr. No.	Ingredients	Grade	Rationale for use	Qty. / Tabs. [mg.]
1.	H.P.M.C (E-5)	IP	Film Forming material	9.02*
2.	P.E.G - 400	IP	Plasticizer	2.15*
3.	Titanium Dioxide	IP	Opacifier	2.86*
4.	Purified Talc	IP	Film Smoothening Agent	0.28*
5.	Purified Water	IP	Coating Solvent	q.s.@

@Not to be found in original product.

*Include 10.0 % extra to compensate for film coating process loss.

Steps involved in the Working Formula (F1*) by Wet Granulation Method:

Sr. No.	Operation
1.0	**SIFTING:**
1.1	Check the intactness of sieve before & after use.
1.2	Sift Imeglimin Hydrochloride** and Microcrystalline Cellulose** through 40# sieve using a mechanical sifter. Collect it properly.
2.0	**BINDER PREPARATION:**
2.1	Dissolve Polyvinyl Pyrrolidone (K-30) in Purified water with continuous stirring for 5.0 minutes or until a clear solution is obtained.
3.0	**GRANULATION:**
3.1	**DRY MIXING:** Transfer the sifted materials of step 1.2 to the RMG [Imeglimin Hydrochloride, Microcrystalline Cellulose]. Cover the mixer & run it for 10 minutes at slow impeller speed [for blend homogeneity] with chopper off.
3.2	**Addition of Binder Solution: Add the binder solution from step 2.1 steadily to the RMG containing the** dry mix material. Rinse the binder vessel with Purified water**. Mix at slow impeller speed for 2 minutes. Then switch off the mixer & turn the mass manually with the help of scoops. Mix for an additional 2 minutes at a slow impeller speed with the chopper on (slow speed).
4.0	**SEMI DRYING:**
4.1	Transfer the wet granules of step no. 3.2 in Try dryer. Air-dry for 5 minutes.
4.2	**SIZING:** Pass the semi-dried mass of step no.4.1 through multi-mill using 6.0 mm perforated S.S. screen, knives in forward direction at medium speed.
4.3	**FINAL DRYING:** Transfer the semi-dried sized granules from step 4.2 to the tray dryer. Then dry the granules at 50 ± 5 °C.
4.4	**LOD DETERMINATION:** Check the Loss on Drying (LOD) of granules at 105°C for 5 minutes. The LOD should be between 2.2% and 3.2%. LOD should be checked using a Halogen Moisture Analyser.

4.5	Check the granules for proper drying & dry further if required. Note & record the Total time taken for drying when drying is complete.	
4.6	Check the intactness of sieve before & after use.	
4.7	Pass the dried granules of step no. 4.5 through 18 # S.S. sieve sifted on a sifter.	
4.8	If required, pass the above 18 # oversized granule through the multi-mill using 1.5mm SS screen knives in the forward direction.	
4.9	Re-dry if required & sift through 18 #.	
4.10	Note down the weight of the dried granules and store them in a polyethene bag.	
5.0	**LUBRICATION:**	
5.1	Check the intactness of sieve before use.	
5.2	Sift Croscarmellose Sodium** & Colloidal Silicon Dioxide** through 40 # sieve using a mechanical sifter.	
5.3	Sift Magnesium Stearate** through 60 # sieve using a mechanical sifter.	
5.4	Transfer the dried granules to the next size. 4.10 & sifted material of step no. 5.2 to a blender. Mix for 10.0 minutes.	
5.5	Add sifted magnesium stearate from step no. 5.3 to blend with step no. 5.4 in Blender and mix further for 5.0 minutes.	
5.6	Collect the lubricated blend in polyethene bags & keep them tightly closed with proper labelling until they are taken for compression—record wt. of the batch.	
6.0	**COMPRESSION OF TABLET**	
6.1	Type of punch: 'D' Tooling, _____ station.	
	Punch Description	**16.0 mm X 8.0 mm**, capsule shape, standard concave
	Upper Punch	Break-line
	Lower Punch	Plain
6.2	Check the complete rotation of the turret by turning the wheel by hand, followed by electric operation. Feed the granules and set the machine according to the following specifications. Check tablet from one complete rotation.	
6.3	Set RPM of Machine.	

*Ensure that each die and punch set is clean and free from any defect.

****The amount of API and excipients should be taken as per Formula F1.**

Table. 3 in Process Compression Parameters

SR. NO.	PARAMETERS OBSERVED	LIMITS	FREQUENCY OF OBSERVATION
1.	Description	White to off-white coloured, elongated, biconvex, uncoated tablet, scored on one side & Plain on the other side.	At the beginning of the compression process and throughout.
2.	Average Weight of tablets	630.00 mg ± 3.0%	Every 30 Minutes
3.	Group weight of 20 Tablets	12.600 gm ± 3.0%	Every 30 Minutes
4.	Uniformity of Tablet Weight	630.0 mg ± 5.0%	Every 2 Hrs.
5.	Thickness	5.60 mm ± 0.30 mm	Every 30 Minutes
6.	Hardness	NLT 8.0 Kgf	Every 30 Minutes
7.	Disintegration Time:	NMT 15.0 minutes	Every 2 Hrs.
8.	Friability	NMT 1% w/w	Every 2 Hrs.
9.	Length	16.0 mm ± 0.20 mm	Every 2 Hrs.
	Width	8.0 mm ± 0.20 mm	

7.0 Record the yield & store the tablets in a container (s) with lined polyethene bags.

8.0 Before taking tablets for film coating, de-dust & Inspect the tablets for chipped, broken, or spotted appearance. Segregate the rejection as reusable and to be destroyed separately, and note down the weights accordingly. Store the tablets in a polyethene bag.

Table 8: Process Sheet (Film Coating of Tablet)

SR. NO.	OPERATION
10.0	**PREPARATION OF FILM COATING SUSPENSION:**
10.1	Disperse H.P.M.C (E-5)** by sprinkling in Purified Water**, under constant mechanical stirring for 10.0 minutes, to get a whitish colored solution.
10.2	Add P.E.G 400** to step no. 10.1, under constant mechanical stirring.
10.3	Sift Titanium Dioxide and Purified Talc through a 100-mesh screen.
10.4	Prepare slurry of step no. 10.3 with Purified Water**.
10.5	Pass the final prepared coating suspension (step no. 10.4) through Colloidal mill by '0' Adjustment gap for 10.0 minutes and add to the above coating suspension. 10.1.
10.6	Stir for 40-45 minutes to achieve homogeneous suspension.
10.7	Filter the coating suspension through a 200-mesh sieve and record the weight of the filtrate.

10.8	**FILM COATING:**
10.9	Load the de-dusted & inspected uncoated tablets into a clean, dry coating pan and dry for 10 minutes at 0.5 rpm at 40°C-50 °C [Bed Temperature].
10.10	**Check the below-mentioned film coating parameters:** **Auto-coater** Batch size is 100 Tablets. (As per formula F1) a) Pan Rpm: Initially 1 rpm and gradually increase up to 5 rpm. b) Pump rpm: 30 - 45 rpm c) Tablet bed to gun distance: 16 cm d) Inlet Air temperature: 50 °C to 55 °C. e) Bed temperature: 30°C to 40°C f) Outlet Air temperature: 35°C to 40°C g) Atom air gauze: 2.0 kg/ cm^2 h) Fan air gauze: 2.0 kgs/cm^2 i) No. of guns: 1 Nos. j) Spray Gun Aperture size: 1.5 mm k) Coating Silicon Tube: 5mm ID/8mm OD l) Spray rate (gm/min): 45 to 70 gm/min m) Average weight of uncoated tablets: 630.00 mg (To be calculated based on average weight of the uncoated 500 tablets) n) Target Average weight of film-coated tablets: 643.00 mg [11] (To be calculated based on average weight of the film coated 500 tablets)
10.11	Switch on exhaust & apply the film coating suspension to the tablets using a clean spray gun assembly. (Ensure elegance) Continue stirring the coating suspension throughout the tablet coating process.
10.12	Dry the film-coated tablets thoroughly once the proper weight is achieved. (Approx.2.06%) Target average weight of film-coated tablets = 643.00 mg.

****The amount of API and excipients should be taken as per Formula F1.**

Table 4: Film Coated Tablets Parameters

SR. NO.	Parameters Observed	Limits
1.	Description	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.
2.	Average Weight of tablets	643.0 mg ± 3.0 %
3.	Group weight of 20 Tablets	12.86 gm ± 3.0 %
4.	Uniformity of Tablet Weight	643.0 mg ± 5.0 %
5.	Thickness	5.70 mm ± 0.30 mm
6.	Disintegration Time	NMT 30.0 Minutes
7.	Length	16.10 mm ± 0.20 mm
8.	Width	8.10 mm ± 0.20 mm

Formulation [19] design for Wet Granulation/Trial 1 to Trial 5

Trial 1 Aim: Take a trial batch comparable to F1 with increasing concentration of CCS. [F2$]

Trial 2 Aim: Take a trial batch comparable to F1 by adding more MCC and Magnesium Stearate as extra granular portion. [F3$]

Trial 3 Aim: Take a trial batch comparable to F2 by adding more Purified Water. [F4$]

Trial 4 Aim: Take a trial batch comparable to F1 with increasing concentration of H.P.M.C (E-5) in coating stage. [F5$]

Trial 5 Aim: Take a trial batch comparable to F1 with decreasing concentration of PVP K-30. [F6$]

Table 5: Formulation of Immediate Release Tablet / Formulation Design for Wet Granulation [15]

Sr. No.	Ingredients	Grade	Qty. /Tabs [mg] F2$	Qty. /Tabs [mg] F3$	Qty. /Tabs [mg] F4$	Qty. /Tabs [mg] F5$	Qty. /Tabs [mg] F6$
1.	Imeglimin Hydrochloride	IH	500.00	500.00	500.00	500.00	500.00
2.	Microcrystalline Cellulose	IP	85.50	86.50	85.50	85.50	85.50
3.	Polyvinyl Pyrrolidone (K-30)	IP	17.50	15.50	17.00	17.50	15.00
4.	Purified Water	IP	q.s.@	q.s.@	q.s.@	q.s.@	q.s.@
5.	Croscarmellose Sodium	IP	13.50	12.50	13.00	12.50	13.00
6.	Colloidal Silicon Dioxide	IP	4.00	5.00	5.00	5.00	6.00
7.	Magnesium Stearate	IP	9.50	10.50	9.50	9.50	10.50
8.	H.P.M.C (E-5)	IP	9.02*	9.02*	9.02*	10.05*	9.02*
9.	P.E.G - 400	IP	2.15*	2.15*	2.15*	1.10*	2.15*
10.	Titanium Dioxide	IP	2.86*	2.86*	2.86*	2.86*	2.86*
11.	Purified Talc	IP	0.28*	0.28*	0.28*	0.28*	0.28*
12.	Purified Water	IP	q.s.@	q.s.@	q.s.@	q.s.@	q.s.@

@Not to be found in original product.

*Include 10.0 % extra to compensate for film coating process loss.

$Detailed Manufacturing Procedure followed and performed for all formulas

given in above table by Working Formula (F1).

"Finally, the Working Formula F1 is considered as Final Formula because it fully fulfils the complete requirements. And the final tablet manufactured by that formula is found satisfactory". Images of Tablets After Final Compression and Coating:

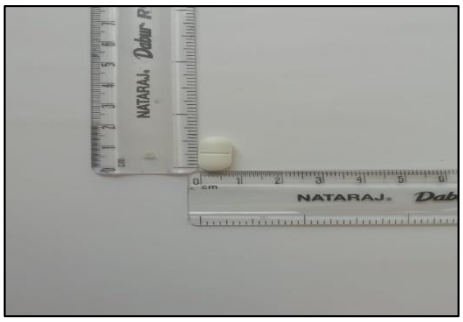


Figure 2 Y-Axis of Coated Tablet

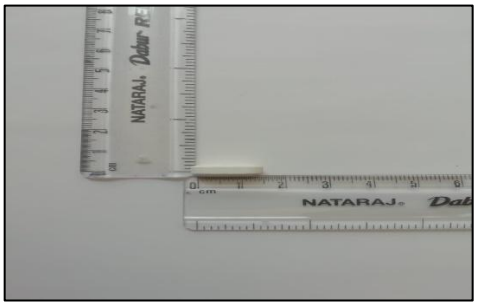


Figure 3 X-Axis of Coated Tablet

III. RESULTS

Final results of formulation are concluded in this section. Results of observation parameters for film-coated tablet are enclosed in this section.

The following Parameters are Evaluated for Film-Coated Tablet:

- Description
- Length
- Width
- Thickness
- Disintegration time
- Average weight
- Uniformity of weight
- Weight variation
- Hardness
- Friability
- Dissolution Studies
- Stability Studies

Table 6: Final Evaluation Parameters of Film Coated Tablets [17]

Sr. No.	Tests	Limits	F1 Results	F2 Results	F3 Results	F4 Results	F5 Results	F6 Results
1.	Description	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.
2.	Average Weight of tablets	643.0 mg ± 3.0 %	643.81	643.99	642.88	645.08	644.78	642.20
3.	Uniformity of Tablet Weight	643.0 mg ± 5.0 %	636.74-648.35	636.84-648.16	636.47-648.06	636.22-648.47	636.01-648.98	636.44-648.46
4.	Thickness	5.70 mm ± 0.30 mm	5.71-5.80	5.74-5.78	5.71-5.73	5.69-5.74	5.72-5.76	5.72-5.78
5.	Disintegration Time	NMT 30.0 Minutes	12-13 min	11-13 min	12-14 min	11-14 min	12-14 min	12-13 min
6.	Length	16.10 mm ± 0.20 mm	16.14-16.19	16.16-16.22	16.11-16.15	16.12-16.18	16.16-16.21	16.18-16.21
7.	Width	8.10 mm ± 0.20 mm	8.16-8.22	8.13-8.17	8.12-8.21	8.11-8.18	8.13-8.21	8.15-8.18
8.	Dissolution	Not less than 75 %	Min: 97 % Max: 102 % Avg.: 100 %	Min: 99% Max: 103 % Avg.: 101%	Min: 99 % Max: 102 % Avg.: 100 %	Min: 97 % Max: 101 % Avg.: 100 %	Min: 98 % Max: 103 % Avg.: 100 %	Min: 98 % Max: 101 % Avg.: 100 %
9.	% Drug content	90.0 % to 110.0 %	100.2 %	100.5 %	99.4 %	199.9 %	99.8 %	99.8%

IV. IN-VITRO DISSOLUTION STUDY:

Dissolution Condition:

Dissolution in 0.1 N HCI (Official Media)

Dissolution Media	0.1 N hydrochloric acid
Apparatus	Paddle (USP-II)
Volume	900 ml
Temperature	Temperature 37°C ± 0.5°C
Rotation Speed	50 rpm
Time Point	10, 15, 20, 30, 45, 60 and 90 minutes
Units	12 Tablets

Dissolution in pH 4.5 Acetate Buffer:

Dissolution Media	pH 4.5 Acetate Buffer
Apparatus	Paddle (USP-II)
Volume	900 ml
Temperature	37°C ± 0.5°C
Rotation Speed	50 rpm
Time Point	10, 15, 20, 30, 45, 60 and 90 minutes
Units	12 Tablets

Dissolution in pH 6.8 Phosphate (Potassium Dihydrogen Phosphate) Buffer:

Dissolution Media	pH 6.8 Phosphate (Potassium Dihydrogen Phosphate) Buffer
Apparatus	Paddle (USP-II)
Volume	900 ml
Temperature	37°C ± 0.5°C
Rotation Speed	50 rpm
Time Point	10, 15, 20, 30, 45, 60 and 90 minutes
Units	12 Tablets

Table Results of F6 In Different Dissolution Medium

i) Release Result in 0.1N HCI

Product Name: Imeglimin Hydrochloride Tablets 500 mg							
Batch: F6							
No. of Tablets	**10 Minutes**	**15 Minutes**	**20 Minutes**	**30 Minutes**	**45 Minutes**	**60 Minutes**	**90 Minutes**
1	107.09	106.71	107.10	106.31	105.89	106.63	106.96
2	103.18	105.89	106.27	105.47	102.31	107.3	105 .69
3	102.40	106.66	106.66	106.65	100.37	108.47	106.36
4	103.18	104.72	105.87	107.41	111.30	107.40	104.23
5	100.83	103:91	100.36	106.53	103.77	106.44	113.03
6	102.4	104.71	99.21	100.29	110.75	100.59	114.16
7	102.01	105.09	99.99	99.52	107.62	111.11	111.89
8	105.13	104.35	100.80	100.33	107.66	107.64	108.44
9	105.13	108.65	109.84	109.08	109.08	106.72	108.23
10	98.10	107.79	107.41	110.53	108.59	111.70	111.32
11	105.91	107.48	106.32	105.91	109.00	111.33	112.90
12	103.57	108.24	107.47	104.73	108.98	110.53	112.87
Mean	103.24	106.18	104.77	105.23	107.11	107.98	109.45
Minimum	98.10	103.91	99.21	99.52	100.37	100.59	103.36
Maximum	107.09	108.65	109.84	110.53	111.30	111.70	114.16
% RSD	2.418	1.629	3.615	3.494	3.379	3.058	3.749

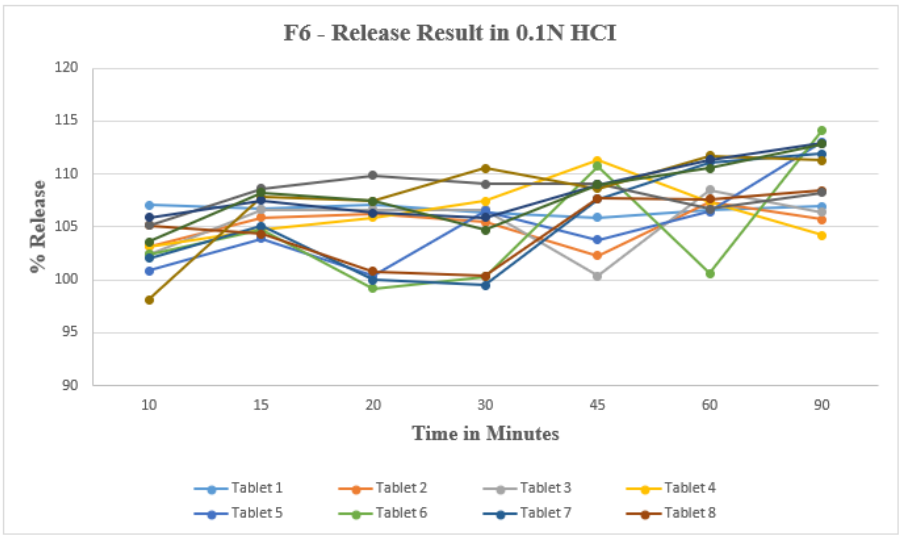


FIGURE 4: F6 - Release Result in 0.1N HCI

ii) Release Result in 4.5 Acetate Buffer

Product Name: Imeglimin Hydrochloride Tablets 500 mg							
Batch: F6							
No. of Tablets	**10 Minutes**	**15 Minutes**	**20 Minutes**	**30 Minutes**	**45 Minutes**	**60 Minutes**	**90 Minutes**
1	34.26	39.21	44.59	49.64	54.75	61.43	71.22
2	36.54	39.23	46.52	50.07	56.32	30.35	70.89
3	34.26	40.35	40.79	52.28	50.94	63.67	74.25
4	28.93	36.86	41.08	52.19	53.13	64.36	74.19
5	26.69	37.25	41.47	46.87	54.99	67 .39	73.44
6	29.69	38.40	42.24	47.27	53.12	63.20	72.64
7	30.83	37.65	43.39	45.01	53.87	64.35	72.27
8	30.83	38.41	44.16	51.12	53.95	66.34	70.47
9	32.74	32.72	42.22	48.44	55.04	66.64	69.26
10	30.83	33.08	40.68	49.11	55.36	65.09	68.45
11	30.83	35.36	41.08	50.29	56.16	65.52	71.55
12	31.97	36.52	43.39	46.53	53.89	68.17	70.81
Mean	31.78	37.08	42.63	49.09	54.29	64.70	71.62
Minimum	28.93	32.72	40.68	45.01	50.94	63.35	68.45
Maximum	36.54	40.35	46.52	52.28	56.32	68.17	74.25
% RSD	7.12	6.4	1.812	2.299	1.488	2.33	1.823

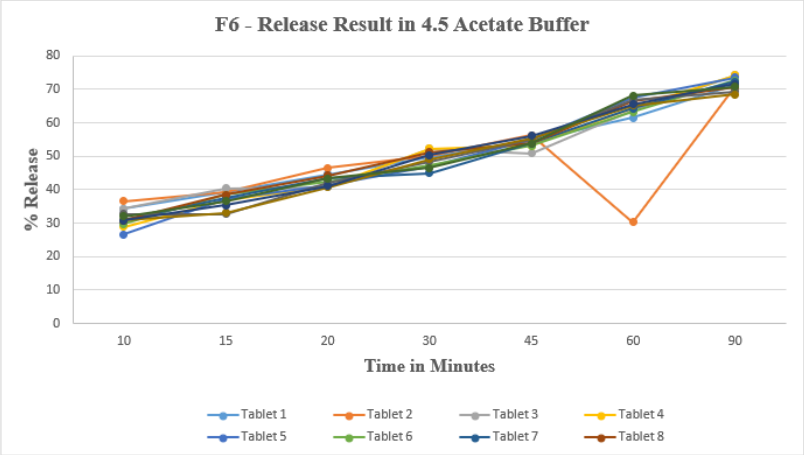


Figure 5: F6 - Release Result in 4.5 Acetate Buffer

iii) Release Result in pH 6.8 Phosphate Buffer

Product Name: Imeglimin Hydrochloride Tablets 500 mg							
Batch: F6							
No. of Tablets	**10 Minutes**	**15 Minutes**	**20 Minutes**	**30 Minutes**	**45 Minutes**	**60 Minutes**	**90 Minutes**
1	2.57	5.82	4.60	7.87	10.54	13.87	22.40
2	2.57	5.82	8.47	7.92	14.45	17.18	19.95
3	5.80	4.57	6.55	9.85	14.47	17.20	14. 17
4	5.15	4.56	5.26	8.54	15.08	19.75	14.81
5	5.15	1.99	5.23	8.51	13.76	17.13	17.96
6	4.51	1.33	3.93	9.77	13.74	19.05	19.26
7	4.51	4.56	10.41	11.17	17.09	17.92	18.76
8	3.86	7.13	7.85	13.74	16.47	19.22	19.43
9	3.22	5.83	5.25	13.04	17.70	14.67	18.05
10	6.44	5.87	5.29	15 .66	17.76	14.73	19.40
11	5.8	2.64	5.89	13.69	18.35	17.91	14.23
12	5.15	2.63	7.82	13.70	16.43	17.25	18.08
Mean	4.56	4.39	6.37	11.12	15.48	17.15	18.04
Minimum	2.57	1.33	3.93	7.87	10.54	13.87	14.17
Maximum	6.44	7.13	10.41	15.66	18.35	19.75	22.40
% RSD	27.93	41.89	29.67	24.56	14.50	10.92	2.49

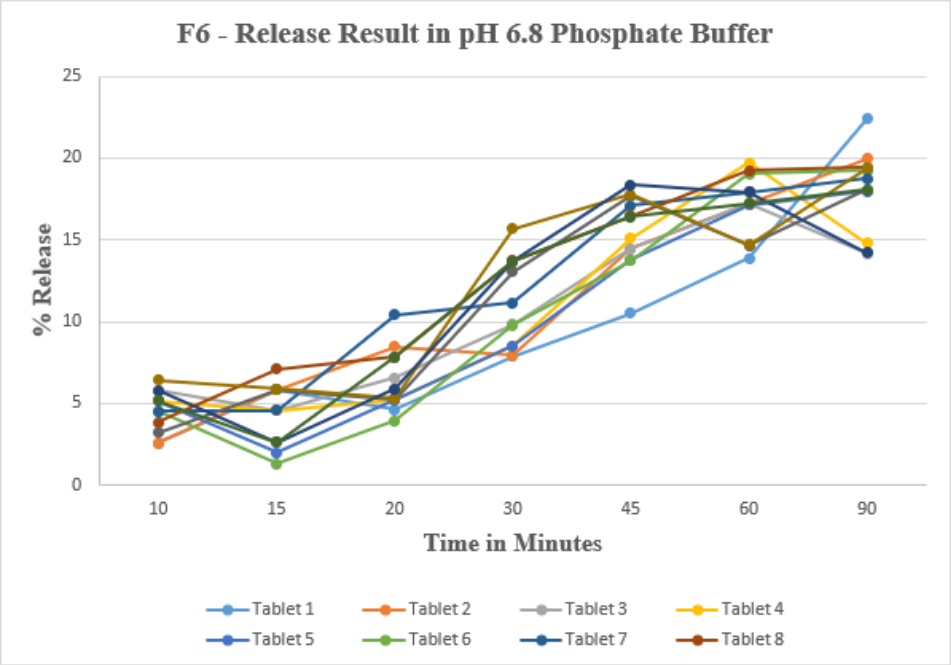


FIGURE 06: F6 - Release Result in pH 6.8 Phosphate Buffer

Table 7: Stability Data

SR. NO.	TESTS	LIMITS	1 month	2 month	3 month
1.	Description	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.	White, elongated, biconvex, film-coated tablet, scored on one side & Plain on the other side.
2.	Hardness	NLT 8.0 Kgf	8.6	8.2	9.1
3.	Friability	NMT 1% w/w	0.01	0.03	0.01
4.	Disintegration Time	NMT 30.0 Minutes	12-13 min	11-12 min	12-14 min
5.	Dissolution	Not less than 75 %	Min: 99 % Max: 101 % Avg.: 100 %	Min: 98% Max: 103 % Ave: 101%	Min: 99 % Max: 101 % Ava: 100 %
6.	% Drug content	90.0 % to 110.0 %	99.1 %	100.2 %	99.8 %

For three months, the formulation was kept at 40°C and 75% RH as a part of an experiment into the short-term stability of the film-coated tablets. The stability research results showed no significant changes in any of the physical characteristics, drug content, or in vitro drug release rate.

V. DISCUSSIONS & CONCLUSION

In the continuous audit, Imeglimin hydrochloride second-release pills were manufactured and evaluated. Considering the dissolution profile examination of various plans, the best formulation, F6, was prepared freely and used to produce the final tablet.

The objective of the ongoing study was to develop a stable Imeglimin hydrochloride prompt-release tablet that can maintain consistent therapeutic [10] levels of the medication. Wet granulation was utilised to produce the fast-disintegrating tablet, which was formulated with super-disintegrants such as Croscarmellose sodium and polymers like H.P.M.C (E-5) and PEG-400.

By including super-disintegrants like Croscarmellose sodium and adjusting the amount of PVP K-30, I had the option to reduce the time it took for our definition to disintegrate in a couple of assessments. The arrangement focuses on using Microcrystalline Cellulose, Polyvinyl Pyrrolidone (K-30), and colloidal silicon dioxide as diluents, clasp, and Glidant.

The prescription release rate was insufficient when the robust medication fixing (Programming connection point) was added directly to the definition, which led to the development of movie-coated rapid-release tablets [12].

Imeglimin hydrochloride pills can be isolated using 0.1 N hydrochloric acid. The results showed that 0.1 N HCl is a preferable solvent for Imeglimin hydrochloride compared to various other solvents. When a 0.1N hydrochloric acid solution was used, the absorbance of Imeglimin hydrochloride reached its maximum at 245 nm.

By including super-disintegrants like Croscarmellose sodium and adjusting the amount of PVP K-30, we had the option to reduce the time it took for our formulation to separate in a couple of preliminary tests. The arrangement focuses on using Microcrystalline Cellulose, Polyvinyl Pyrrolidone (K-30), and colloidal silicon dioxide as diluents, clasp, and Glidant.

The prescription release rate was inadequate when

the unique medication formulation (Programming connection point) was added directly to the specification, prompting the development of movie-coated quick-release tablets.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded by any organizations or agencies. This independence ensures that the research is conducted with objectivity and without any external influence.
- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed equally to all participating individuals.

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