RESEARCH ARTICLE

Osmotic Release Oral Tablet Formulation, Development, and Evaluation of an Anti-epileptic Drug

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ABSTRACT

Efforts were attempted to create a bioequivalent Osmatic release tablet formulation of carbamazepine, with a drug release profile comparable to that of the innovator product. Tablets were formulated using the wet granulation technique based on literature data and the innovative product's characterization. It was discovered that the pioneer tablet had a film coating. After reviewing the existing literature and patents, it was determined to use a non-infringing approach and create a film-coated tablet with an equivalent bioavailability and dissolution profile. Based of justification, the optimized formulation has an F9 value of 90, which is excellent. The intention was to keep the same composition and only increase the size. Trial formulation 9's formula and procedure fulfilled the specified physicochemical properties and dissolution profile, which is equivalent to the reference product in various media, based on the results of several laboratory trials and evaluations. The extended-release was achieved by combining the rate-controlling polymer Natrosol 250L/Natrosol 250 H, a pH-dependent polymer, and Hypromellose. Compared to the innovator sample, the extended-release tablets were found to comply with the USP specification. Stability tests on the optimised batch showed no major deviations, which is a positive result.

Keywords: Osmotic Release Tablets, Wet Granulation, Extended-release tablets, pH-dependent Solubility, bioequivalence, Innovator, rate controlling polymers.

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INTRODUCTION

Seizures in epilepsy are brief episodes of symptoms that manifest themselves as a result of abnormally high or synchronized brain activity. In terms of prevalence, it is second only to stroke. Some novel medications, such as remacemide and lamotrigine and flunarizine and loreclezole and levetiracetam, have been approved for use, while others are still in the research and development phase. There are a number of anti-epileptic medications, including phenytoin and sulfate topiramate (TPM), that have shown clinical efficacy in reducing the frequency and severity of seizures. Half of the patients may have their seizures under control with accessible medicine, and the incidence of seizures may be reduced in another 75% of individuals. Ongoing research in medicinal chemistry aims to find more selective and less toxic anti-epileptic drugs. It is believed that epilepsy begins in the brain. Varied forms of epilepsy have different causes and are not all the result of a single process. Epilepsy develops when a large number of neurons engage in concert during a highly stimulated state to produce enormous discharges that disrupt the brain's normally well-ordered pattern of integrative activity. A number of factors, including fluctuations in blood glucose levels and

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plasma pH, have been linked to the development of epilepsy. Fatigue, emotional stress, nutritional inadequacy, trauma, infection, meningitis, brain tumors, cerebrovascular illness, and metabolic disorders all contribute to an imbalance in the body's total osmotic pressure and electrolytes composition of extracellular fluids. Primary or idiopathic epilepsy refers to epileptic seizures for which no underlying cause can be determined, while secondary or symptomatic epilepsy refers to epileptic attacks for which a cause can be established. For a tiny percentage of patients, medication and brain surgery are now the only viable techniques for treating epilepsy.[1]

It wasn't until 1955 that Australian physiologists Rose and Nelson invented an implanted pump for osmotic medication administration, and since then, a lot of progress has been made. Osmotic medication delivery employs osmogens and osmotic pressure to facilitate the metered administration of medicines (for up to 10–16 hours.). A semipermeable membrane coating is commonly applied to a compressed tablet core to provide an osmotic drug-delivery system that is suited for oral administration. Drugs in solution or suspension are slowly delivered through one or more delivery apertures in the coating. At its heart is a medicated concoction with a water-swellable polymer and an osmotic agent.[2]

Wet granulation is the gold standard for making tablets of any strength, but especially for low-strength medications. High shear development is most appropriate for medication candidates with dosage strengths between 0.5 and 850 mg per tablet. Techniques for granulation, either aqueous or non-aqueous, are involved.[3]

This research aims to create a formulation for an anti-epileptic medicine that may be taken orally in the form of an osmotic release tablet employing a controlled-release polymer. Carbamazepine, in the dosage of 400 mg, is used as an anticonvulsant. The anti-epileptic medication was shown to prevent electrically and chemically induced seizures in rodents. It seems to work by inhibiting post-tetanic potentiation and decreasing polysynaptic responses. Medications that can be taken once daily with a single tablet offer significant benefits to patients and doctors alike (Figure 1).[4]

This study aims to design, develop, and assess alternative formulations of an osmotic release oral tablet dosage form for an anti-epileptic medicine. The current innovator's formulation serves as a benchmark for comparison.[5]

MATERIALS AND METHODS

The drug gifted by JUBLIANT, Gajaula. HPMC 3 CPS, Natrosol 250 L(HEC), Mannitol (PERITOL 25 C) and Dextrates (EMDEX NON-GMO) were obtained from Shine-Etsu, Ashland, Hyderabad, ROQUETTE, Mumbai, JRS Pharma, Vadodara, respectively.

Preformulation Study

Identification of Drug:(IP. Volume II 2018 Page No. 1482, 1483)

Drug was identified by performing UV-spectroscopy, FTIR and differential scanning colorimetry.

Table 1: Formulation batches F1 to F3

S. No.	*Ingredients*	*Batch Number*		
		F1	*F2*	*F3*
Intragranular		*Quantity per tablet (mg/tablet)*		
1	Carbamazepine	400.00	400.00	400.00
2	HPMC (3 cps)	40.00	40.00	40.00
3	Natrosol (250 L)	10.00	38.00	10.00
4	Natrosol (250 H)	20.00	13.00	20.00
5	Mannitol (25 C)	108.00	108.00	108.00
6	Dextrate	109.00	89.00	109.00
7	SLS	05.00	05.00	05.00
Binder Solution				
8	Purified water	-	-	Q.S.
Extragranular				
9	Magnesium stearate	07.00	07.00	07.00
Target wt. (core)		700.00	700.00	700.00

Table 2: Formulation of batch F4 to F6

S. No.	*Ingredients*	*Batch no.*		
		F4	*F5*	*F6*
Intragranular		*Quantity per tablet (mg/tablet)*		
1	Carbamazepine	400.00	400.00	400.00
2	HPMC 3 (cps)	40.00	40.00	40.00
3	Natrosol (250 L)	38.00	10.00	38.00
4	Natrosol (250 H)	13.00	20.00	20.00
5	Mannitol (25 C)	100.00	100.00	100.00
6	Dextrate	80.00	101.00	80.00
7	SLS	05.00	05.00	05.00
Binder solution				
8	Purified water	Q.S.	Q.S.	Q.S.
Extragranular				
9	Magnesium stearate	09.00	09.00	09.00
Target wt. (core)		700.00	700.00	707.00
Coating				
10	Cellulose acetate 320S	30.00	35.00	30.00
11	Cellulose acetate 398-10	05.00	05.80	05.00
12	HPMC 15 cps	03.50	04.10	03.50
13	PEG 8000	03.50	04.10	03.50
14	Methanol	Q.S.	Q.S.	Q.S.
15	Dichloromethane	Q.S.	Q.S.	Q.S.
Target wt. (coated)		742.00	749.00	742.00

Solubility Study

Using a shaker-incubator with a temperature-controlling system set to 37 ± 0.1°C, we tested the kinetic solubility and solution stability of 50 mg equivalent of CBZ in 200 mL of distilled water for 72 hours. For this experiment, we used a UV-vis spectrophotometer to measure absorbance in the range of 200 to 400 nm (Table 1-3).

Table 3: Formulation of batch F7 to F9

S. No.	*Ingredients*	*Batch no.*		
		F7	*F8*	*F9*
Intragranular		*Quantity per tablet (mg/tablet)*		
1	Carbamazepine	400.00	400.00	400.00
2	HPMC (3 cps)	40.00	40.00	40.00
3	Natrosol (250 L)	10.00	38.00	10.00
4	Natrosol (250 H)	20.00	13.00	20.00
5	Mannitol (25 C)	108.00	108.00	108.00
6	Dextrate	109.00	89.00	109.00
7	SLS	05.00	05.00	05.00
Binder Solution				
8	Purified water	Q.S.	Q.S.	Q.S.
Extragranular				
9	Magnesium stearate	09.00	07.00	09.00
Target wt. (core)		700.00	700.00	700.00
Coating				
10	Cellulose acetate (320S)	35.00	30.00	30.00
11	Cellulose acetate (398-10)	05.80	05.00	05.00
12	HPMC (15 cps)	04.10	03.50	03.50
13	PEG (8000)	04.10	03.50	03.50
14	Methanol	Q.S.	Q.S.	Q.S.
15	Dichloromethane	Q.S.	Q.S.	Q.S.
Target wt. (coated)		749.00	742.00	742.00

Drug Excipient Interaction Study

Many excipients were chosen and formulated with the medication individually, following standard tablet-making procedures. Three replicates of each mixture are made, with one set is used for immediate testing and the other is maintained at 40°C/75% RH for a month (Table 4-6). After the sample are checked visually for change of color or its appearance in powder from. To determine whether or not drug excipients interacted, samples are analyzed by high-performance liquid chromatography (HPLC).[6]

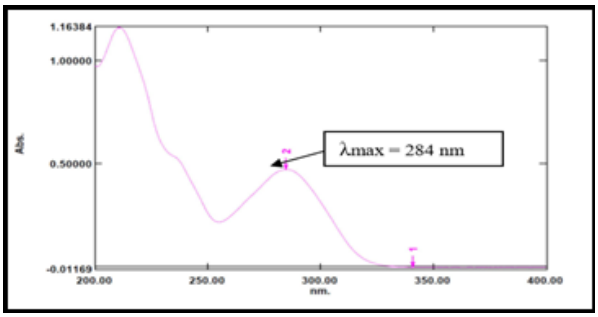

Figure 1: UV-spectrum of the carbamazepine.

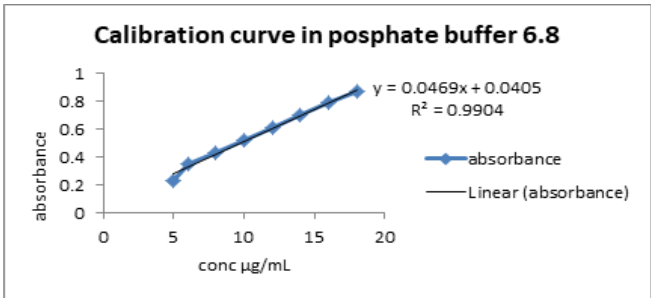

Figure 2: Calibration curve of carbamazepine in buffer 6.8.

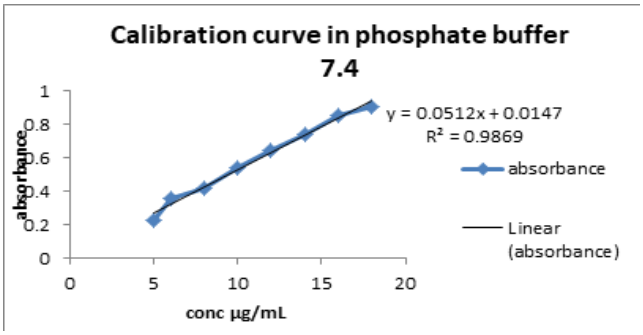

Figure 3: Calibration curve of carbamazepine in buffer 7.4.

Assay of Drug by HPLC

Carbamazepine was assayed using HPLC (Agilent Technologies) at 225 nm.

Table 4: Analysis of innovator product

S. No.	*Parameter*	*Observation*
1	Company	Novartis
2	Marketed by	Novartis
3	Batch Number	F-1154
4	Strength	400 mg
5	Dosage Form	Extended release tablet, OROS
6.	Description	The tablet is round, coated in brown, and has a release portal on one side (the other side is embossed with “T” and “400 mg”).
7.	Composition	Mannitol (Peritol 25 C), Dextrates, HPMC 3 CPS, Sodium Lauryl Sulphate, Magnesium Stearate, Cellulose acetate 320S, Cellulose acetate, PEG 8000
8	Thickness (mm)	6.23-6.25 (core),6.28-6.35(coated)
9	Diameter (mm)	11.87–12.05 mm (By Vernier caliper)
10	Average Weight (coated)	720.90–721.00 mg
11	Storage	Store at 25°C

Table 5: Dissolution data of reference product

Time in Hours	*Percent CDR of RLD*
000	0
001	7
003	26
006	48
010	70
012	75
020	81
024	84

Table 6: Absorbance of drug at a different wavelength

S. No.	*Wavelength*	*Abs.*	*S. No.*	*Wavelength*	*Abs.*
1.	357.4	0.001	4.	345	0.000
2.	354.4	0.000	5.	311	0.000
3.	347.o	0.000	6.	284	0.452

Table 7: Calibration curve of Anti-epileptic drug in buffer 6.8

Concentration (µg/mL)	*Absorbance*
005	00.2300
006	00.3450
008	00.4270
010	00.5230
012	00.6140
014	00.7010
016	00.7890
018	00.8670

Table 8: Calibration curve of carbamazepine in buffer 7.4

Concentration	*Absorbance*
05 µg/mL	00.224
06 µg/mL	00.356
08 µg/mL	00.421
10 µg/mL	00.536
12 µg/mL	00.645
14 µg/mL	00.742
16 µg/mL	00.853
18 µg/mL	00.901

Table 9: Solubility study of carbamazepine in different solvents and buffer

Solvent/medium	*Solubility (mg/250ML)*
0.1 N HCL	48.86
pH 4.5 Acetate buffer	62.38
pH 6.8 Phosphate buffer	54.12
pH 7.4Phosphate buffer	47.06
Purified Water	48.17

Table 10: Physical parameters of drug

Parameter	*Observation*
BD, Bulk Density (gm/mL)	0.577 gm/mL
TD, Tapped density (gm/mL)	0.61 gm/mL
Hauser's ratio	1.61
Compressibility Index (%)	22.39%

Table 11: Drug-excipient compatibility: chemical analysis data

S. No.	*Drug + Excipients and ratio*	*Initial*			*40°C/75 %RH–28 Days*		
		Imp A	*UII*	*TI*	*Imp A*	*UII*	*TI*
1	Carbamazepine 1:5	0.08	0.05	0.28	0.09	0.04	0.29
2	Carbamazepine + Natrosol 250 H 1:5	0.08	0.05	0.37	0.19	0.04	0.44
3	Carbamazepine + Natrosol 250 L 1:5	0.15	0.05	0.46	0.17	0.04	0.43
4	Carbamazepine + HPMC 3CPC 1:5	0.17	0.04	0.38	0.23	0.11	0.56
5	Carbamazepine + Mannitol 1:1	0.10	0.06	0.32	0.17	0.04	0.38
6	Carbamazepine + Dextrates 1:0.25	0.10	0.06	0.32	0.17	0.04	0.38
7	Carbamazepine + SLS 1:0.25	0.36	0.04	0.59	0.42	0.05	0.57
8	Carbamazepine + Mg. Stearate 1:0.25	2.28	0.04	2.50	4.00	0.08	4.47
9	Carbamazepine + CA 320 S 1:0.5	0.10	0.03	0.13	0.15	ND	0.19
10	Carbamazepine + CA (398-10) 1:0.5	0.08	0.05	0.28	0.09	0.04	0.29

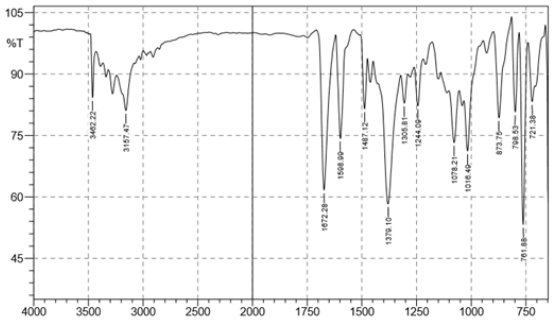

Figure 4: FTIR-spectrum of Carbamazepine.

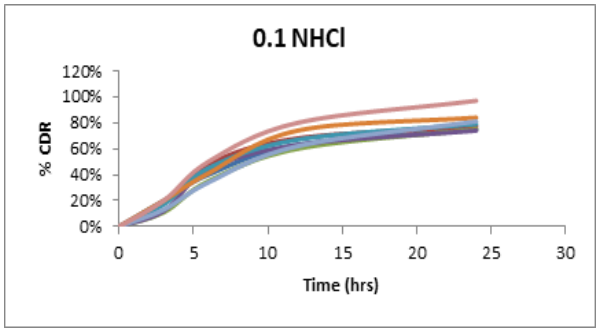

Figure 5: Dissolution in: 0.1N HCL, 900 mL, basket, 100 rpm.

Table 12: Drug - Excipient Compatibility Data- Physical observations

S. No.	*Composition Details*	*Description*	
		Initial	*40°C/75 % RH- 1 Month*
1	Carbamazepine	White – Almost White	White – Almost White
2	Carbamazepine + Natrosol 250 H	White – Almost White	White – Almost White
3	Carbamazepine + Natrosol 250 L	White – Off White	White – Off White
4	Carbamazepine + HPMC 3CPC	White – Off White	White – Off White
5	Carbamazepine + Mannitol	White – Almost White	White – Almost White
6	Carbamazepine + Dextrates	White – Almost White	White – Almost White
7	Carbamazepine + SLS	White – Almost White	White – Almost White
8	Carbamazepine + Mg. Sterate	White – Almost White	White – Almost White
9	Carbamazepine + CA 320 S	White – Almost White	White – Almost White
10	Carbamazepine + CA (398-10)	White – Off White	White – Off White

Table 13: Pre-Compression parameters of all batches

Batch No.	*Bulk Density (gm/mL)*	*Tapped density (gm/mL)*	*Carr's Index (%)*	*Hauser's ratio*	*Angle of repose (degrees)*
F1	00.568	00.732	22.40	01.29	42.04
F2	00.541	00.703	23.04	01.30	43.32
F3	00.532	00.680	21.76	01.28	41.89
F4	00.548	00.723	24.20	01.32	44.20
F5	00.571	00.679	15.97	01.19	34.12
F6	00.550	00.687	20.01	01.25	37.00
F7	00.550	00.687	20.01	01.25	37.00
F8	00.583	00.625	13.79	01.16	32.43
F9	00.570	00.650	12.30	01.14	32.26

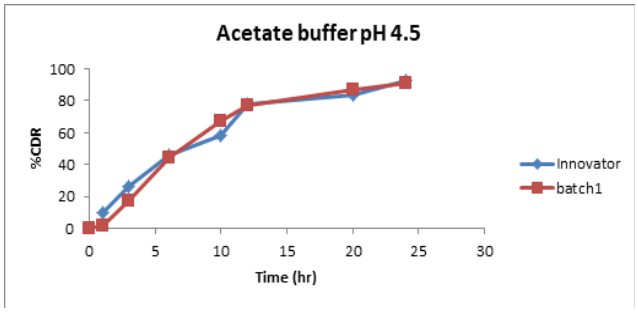

Figure 6: Comparison %drug release of tablets in acetate buffer pH 4.5 at 100 rpm.

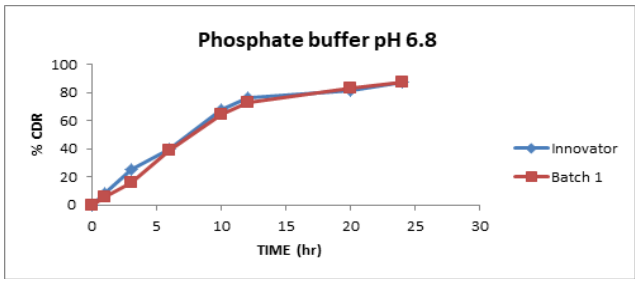

Figure 7: %Drug release comparison of Tablets in pH 6.8 Phosphate Buffer at 100 rpm.

Formulation of Osmatic Release Tablet

Osmatic release tablets containing 400 mg of carbamazepine were developed and standardised through trial batches to achieve a dissolving profile comparable to that of innovative drug products.[7]

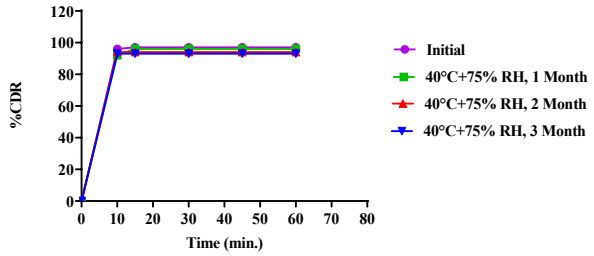

Figure 8: Comparative stability dissolution profile of batch F11 in 0.1 N HCL.

Table 14: Post-compression (Coated Tablet) parameter of different batches

S. No.	*Average wt. (mg)*	*Thickness (mm)*	*Hardness (N)*
Specification	*743–753 (targeted wt. 749 mg)*	*6.45–6.55mm*	*19–23 kp*
F-4	744	06.50	19.20
F-5	743	06.55	20.60
F-6	744	06.48	19.60
F-7	749	06.53	22.90
F-8	749	06.48	22.10
F-9	750	06.50	21.50

Table15: Dissolution in: 0.1N HCl, 900 mL, basket, 100 rpm

0.1 N HCL							
Time (hrs.)	*Innovator (%)*	*F4 (%)*	*F5 (%)*	*F6 (%)*	*F7 (%)*	*F8 (%)*	*F9 (%)*
3(10-35%)	18	9	18	20	21	21	21
6(35-65%)	43	34	36	39	41	48	46
12(65-90%)	71	64	66	72	76	82	74
24(NLT75%)	83	74	78	79	86	94	87

Table 16: Drug release of batch F9 in comparison with innovator product

Time (hrs.)	*Innovator (%)*	*F9 (%)*
3(10-35%)	26	19
6(35-65%)	46	41
12(65-90%)	78	68
24(NLT 75%)	93	91
F2	NA	58

Table 17: Drug release of batch F9 in comparison with the innovator product

Time (hrs.)	*Innovator (%)*	*F9 (%)*
3(10-35%)	25	16
6(35-65%)	40	39
12(65-90%)	76	73
24(NLT 75%)	87	87
F2	NA	58

Table 18: Stability observation of batch F9

Condition	*Assay (%)*	*Dissolution in 0.1 N HCl (%) time point (hours)*					*Related substances*		
		3	*6*	*10*	*20*	*24*	*ImpA*	*Any other unknown individual impurity*	*Total impurity*
Release Specifications	NLT 95 & NMT 105% of label claim	NLT 80 %(Q) of the labeled amount is dissolved in 15 mins					NMT 0.5%	NMT 0.2%	NMT 1.0%
Stability Specifications	NLT 95& NMT 105% of label claim	NLT 80 % (Q) of the labeled amount is dissolved in 15 mins					NMT 1.0%	NMT 0.2%	NMT 1.5%
Initial	102.1	96	97	97	97	97	0.20	0.05	0.39
40°C+75% RH, 1M	100.8	92	96	96	96	96	0.60	0.05	0.85
40°C+75% RH, 2M	100.2	94	95	95	96	96	0.65	0.054	0.88
40°C+75% RH, 3M	101.5	93	96	96	97	97	0.68	0.06	0.90

Evaluation of Pre-compression Parameters of Drug

Formulas were used from tables to make the granules. The primary manufacturing step is granulation. All parameters of granules from various formulations were all found to be within acceptable ranges, indicating that the granules had satisfactory flow qualities. Low values of the compressibility index corroborated this.[8]

Post-compression Parameters of Tablet

Tablets were tested for thickness, hardness, friability, weight fluctuation, drug content, and *in-vitro* release to determine the best formulations.

Stability Study (ICH Q1A)

The optimised batch (F11) was stored in an environmental stability chamber at 40°C and 75 ± 5% relative humidity, 25°C temperature 60 ± 5%, and for a period of 1 month to test the impact of environmental conditions or storage conditions on the formulation, as recommended by the International Council for Harmonization's (ICH) guidelines for accelerated stability conditions.

RESULTS AND DISCUSSION

Analysis of Innovator Product

The Reference Product's Dose-response Relationship to the Drug

OGD-recommended dissolution technique was used to investigate *in-vitro* drug release characteristics using US FDA database information.

- **Medium:** Deaerated water
- **Apparatus:** USP Type I (Basket)
- **Speed (RPM):** 100
- **Volume (mL):** 1800
- **Timepoint:** 1, 3, 6, 10, 12, 20, 24 hours

Preformulation Study

Confirmation of drug confirmation or identification of drug was carried out by following methods.

UV-spectrophotometer (λ_{max})

The UV-visible spectrophotometer was used to take a reading of the anti-epileptic drug's UV spectrum between 200 and

Table 19: Stability dissolution profile of batch F9 in 0.1 N HCL

Time (hrs.)	*Initial*	*40°C+75% RH, 1M*	*40°C+75% RH, 2M*	*40°C+75% RH, 3M*
0	0	0	0	0
3	96	92	94	93
6	97	96	94	93
10	97	96	94	93
20	97	96	94	93
24	97	96	94	93

400 nm (Figure 1). Similar to the reported value, the sample shows a maximum at 284 nm. The drug's ultraviolet (UV) spectrum is depicted here (Table 6):

Calibration Curve of Anti-epileptic Drug in Phosphate Buffer 6.8

Figure 2 shows the typical API calibration curve in phosphate buffer 6.8. Table 7 displays the results of absorbance measurements.

Calibration Curve of Carbamazepine in Buffer 7.4

Figure 3 shows a typical calibration curve for carbamazepine in phosphate buffer 7.4. Absorbance values were displayed in Table 8. The below equation represents the equation of the regressed line for the given data.

Fourier Transmission Infrared (FTIR) Spectroscopy

Since distinctive peaks of the drug were found, it follows that the substance's IR spectrum agrees with its chemical structure. Figure 4 shows the spectrum with the distinctive peaks superimposed.

Solubility Study

Table 9 displays the results of an investigation on carbamazepine's solubility in a variety of solvents and buffers.

Powder Flow Characterization

The drugs were characterized for their physical properties. Results are shown in Table 10.

Drug-Excipient Compatibility Studies

Compatibility Studies by HPLC.

Physical Evaluation Parameter of Tablets

Both the angle of repose (25–30) and the compressibility index (12–14) were within the expected ranges. Both bulk density and tapped density results were in the range of 0.500–0.580 and 0.730, respectively. Table 13 displays the results of the bulk density and the tapped density. Bulk density ranged from 0.5 to 0.590 and tapped density from 0.580 to 0.730 across all formulations.

Compared to other formulations, the flow characteristics of batches F1, F2, F3, and F4 are poor since they were produced using dry, direct granulation. Wet granulation technology powder blend batches display superior powder flow. Therefore, the wet granulation method was used to advance the formulation. The results are compared to the gold standard established by the existing literature (Figure 5-8, Table 14).

The compression parameters and drug dissolving profiles of Formulation batch F9, which uses an optimized quantity of excipients, are identical to those of the innovator product.

Primary batch of Carbamazepine Extended-release tablet was formulated using the direct compression method. However, the result of pre-compression showed poor flow of blend and the desired hardness could not be be achieved by this method. Therefore, the roller compaction process used for next batch. Batch F2 was formulated by the roller compaction process but could not solve the problem of poor blend flow and weight variation, so wet granulation was used for further batches. Therefore, in batch F3 flow of the lubricated granules was satisfactory from the hopper and on the turret. Weight variation for the individual tablets was not observed. DT of the core tablets was 30 minutes. Some sticking tendency of the tablets was observed. Hence, to overcome the problem of sticking next trial, SLS in batch F4 was designed as a lubricant to reduce the sticking problem associated in the above batch and optimize diluent level in the formulation. But dissolution profile is not comparable with the innovator's product, so further batches optimized the quantity of intragranular disintegrants, lubricants and film coating. In batch F9 uses an optimized quantity of excipients they show a similar DT and dissolution profile of drug as compared to innovator product.

Comparative Dissolution Profile of Different Trial Batches in 0.1 N HCL

Table 15 displays the results of a comparison of the dissolution profiles of batches F4 through F9 with the original formulation.
Stage: coated tablets, 400 mg strength

Drug Release Profile of Batch F9 in 4.5 Acetate Buffer

Stage: Coated Tablet 400 mg (Table 16).

Drug Release Profile of Batch F9 in 6.8 Phosphate Buffer

Stage: Coated tablet, 400 mg (Table 17).

The optimized batch F9 and the Innovator batch are compared using various mediums. The media consist of water, 0.1 N HCl, pH 4.5 buffer, and pH 6.8 buffer (Figure 5-8).

The formulation lot F9 yields superior results. In order to match the USP release profile of the medicine, trial F9 was created with 7% and 6% weight growth, and the release of drug at the third hour was determined to be 21, Table 18 which is within the USP specification limits. The drug's release depends not only on the proportion of weight growth by coating, but also on the concentration of the drug polymer. The medication release was prolonged as the proportion of polymer reduced from 38 to 10. The extended release tablets were examined

per the USP specification, and it was determined that they met the USP specification compared to the innovator. Various disintegration media were used to assess the extended release tablet. It was dissolved in distilled water, an acidic buffer, an acetate buffer, and a phosphate buffer.

Stability Study of Optimized batch F9

Missing text Stability Dissolution Result of batch F9 in 0.1 N HCL Table (Table 19)

The stability analysis of Optimized batch F9 was conducted under stability conditions of 40°C/75% RH for three months, during which time the color and appearance of the tablets did not change. In addition, stability studies revealed that there was no significant change in the drug release and lag time of pharmaceuticals in pH 6.8 phosphate 0.1 N HCl, and that the impurity level in tablets was within the stipulated limit, as shown in the table, while stored at 40°C, 75% RH for 3 months. Therefore, it is possible to conclude that optimized batch F9 tablets are reliable.[9-11]

SUMMARY AND CONCLUSION

The drug was confirmed as carbamazepine as per identification test, such as melting point, test of UV visible spectroscopy, infra-red test and comparison to innovator product. The tablets were found to be mechanically stable and adhere to applicable pharmacopeia specifications, a comparable innovator product in the dissolution test, and several other physicochemical criteria.[10]

As a whole, F9 is the most successful batch of the formulation. Trial F9 was created with 7% and 6% weight growth, and the drug's release at 3 hours was found to be 21 and 21, respectively, both of which are within the ranges specified by the USP[11].

The optimized batch had a 99% dissolving rate in 0.1 N HCL after 2 hours and a 100% dissolution rate in 6.8 phosphate buffer after 1-hour. with respect to the preceding market standard. Researchers found no evidence of any negative interactions between the medicine and the excipients utilized in the final formulation. All of the excipients tested were API-safe.

After extensive testing, it was determined that the drug's dissolution profile was identical to the innovator and that the process parameters for wet granulation, compression, and coating were all within acceptable ranges. All parameters (assay, drug release pattern) remained constant throughout stability testing of the final batch at 25 C/60%RH, 40°C/75%RH, indicating that the product is stable. At the end of the day, it's determined that the process and excipients used in production result in a product that has all the desired qualities and conforms to all the required specifications.

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