Develop and Evaluate Compression Coating Technology

DNYANESHA N. SOMNATHE[1], DR. BHUSHAN S. BHOYAR[2]
[1, 2] P. R. Pote Patil College of Pharmacy, Amravati

Abstract- ***Tablets are indeed the most popular solid dosage form for oral administration. One category of tablet formulations that has gained remarkable importance in drug therapeutics owing to various benefits it offers is controlled or modified release formulations. Although less popular, compression coating technology gained increased interest in the recent years for creating modified released products. It involves the compaction of granular materials around a preformed tablet core using specially designed tableting equipment. Compression coating is a dry process. This type of tablet (compression coated tablet) has two parts, internal core and surrounding coat. The core is small porous tablet and prepared on one turret. After tablet core manufacture it is transferred (centrally positioned) to another slightly larger die that is partially filled with coating powder. More coating powder is filled on the top of the core and compressed again resulting in tablet with in tablet. Mechanically, it is a complex process, as the tablet may be tilted when transferred to the second die cavity. Mostly, the coat is water soluble and disintegrates easily after swallowing, in order to achieve immediate release product.***

Index Terms: Tablet, Compression, Immediate release, convenient

I. INTRODUCTION

Most conventional oral drug products, such as tablets and capsules, are formulated to release the active drug immediately after oral administration, to acquire quick and entire systemic drug absorption. Such immediate release products result in comparatively rapid drug absorption and onset of associated pharmacodynamic effects. Although, after absorption of the drug from the dosage form is whole, plasma drug concentrations refuse according to the drug's PK profile. Tablet is considered as one of the popular pharmaceutical dosage forms. It is easily acceptable both to end customer patient and pharmaceutical industries. Tablet as a dosage form can be with or without an active pharmaceutical ingredient (API). This popular solid dosage form contains API and other excipients. Excipients are in various forms like diluent, granulating agent or binders, glidants, lubricant (help in tableting process), disintegrants (help the tablet break-up in the digestive system), flavors, sweeteners, colors (to give visual appearance). A tablet may be coated or un-coated. Coating may improve appearance, a make swallowing easier or control the release rate of the API[1].

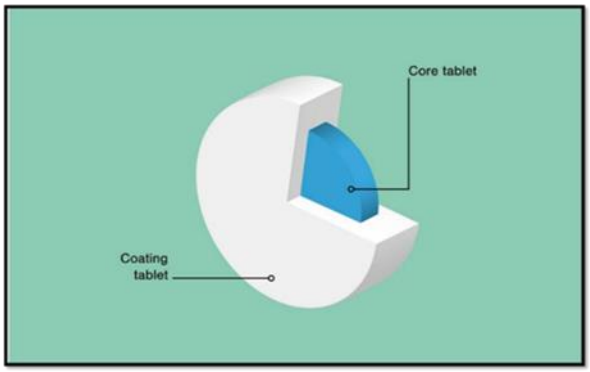


Fig 1. Compressed Coated tablet

Tablet in Tablet or compression coating introduces as alternating coating technique. Itis also recognized as a dry coating or press coating and was one of the first solvent free-coating techniques. In general, a Tablet in Tablet or compression-coated tablet consists of two parts; one is an internal drug core, and another is an outside coating shell. The outer layer surrounds the inner core, and it mainly controls the strength of the film coating, the release of the drug, and the stability[2].

Advantages of compression coating technology

- Elimination of the bitter taste and unpleasant smell of the active pharmaceuticalingredient (API).
- Elimination of water or other solvent in the coating procedure and thereby decreasing the possible degradation of the API.
- Easier and more economical manufacturing process.
- Stability of moisture sensitive drugs can be improved by this technique.
- Improves patient compliance by decreasing dosing frequency.

- Separation of incompatible material can be achieved in the core and outer shell.
- It will use to develop a modified release product (e.g., delayed release product)[3].

Challenges related to compression coating technology

- The cross-contamination possibility between the layers.
- Face challenges for long-term retaining physical and chemical integrity of device during its storage.
- Between the adjacent layers, the elastic modulus is a mismatch. There are an inadequate layer attachment and relatively low interfacial strength because ofthe high elastic modulus ratio between neighboring layers[4].

Preparation Granules of Core Tablet Wet granulation:

Wet granulation is famous, complex but reliable method of granulation. Most drugs granulated by this method. It entails using a solvent to create a wet mass of drug and excipients, followed by drying and lubrication: excipients and drug are mixed together in a geometric progression pattern, and combination is then wet massed with the adding of solvent[5]. This wet mass is subsequently passed through the proper mesh size to get granules, which are then assessed and compressed to produce tablet

Preparation of Binder

Weigh accurately 5 grams of starch. The ratio of starch to water depend on the concentration of the binder needed for the tablet formulation.

1. Placed the measured amount 20 ml of distilled water into a mixing container. Gradually add the starch to the water while stirring continuously.
2. Ensure that the starch is added slowly to prevent clumping.
3. Heated the mixture while stirring until the starch is fully dissolved.

Compositions of Three different formulations of core tablet of pantoprazole sodium tablets were prepared. All materials were sieved with Sieve Number 30, then weighed and well blended (except magnesium stearate). Wet granulation was used to form the tablets.

1. Weighed and passed pantoprazole sodium and excipients through 30# sieve[6].
2. All materials were sieved with Sieve Number 30, then weighed and well blended (except magnesium stearate).
3. Prepared 5 % starch paste in boiling water and stir until it becomes translucent.
4. Added starch paste dropwise in mortar to get cohesive mass. Record quantity of starch paste used for granulation.
5. Screen prepared cohesive mass through 10# granulating sieve and collected it on granulating tray. Dry granules in tray at 45^0 c for 15 min. Passed dried granules through 30# sieve to get uniform particle size.
6. And lubricated with magnesium stearate[7].

Composition of Core Tablets of Pantoprazole Sodium

Sr.No	Ingredients	Ingredients Per Tablets (mg)			Functions
		F1	F2	F3	
1.	Pantoprazole Sodium	40.00	40.00	40.00	API
2.	Mannitol	11.50	12.50	11.00	Diluent
3.	Sodium Starch Glycolate	00.96	01.20	01.80	Superdisintegrant
4.	Microcrystalline Cellulose	01.50	01.10	01.50	Diluent
5.	Starch	00.75	00.77	00.78	Binder
6.	Magnesium Stearate	00.19	00.23	00.20	Lubricant
	Total	55.00	55.00	55.00	

Preparation of Outer coat

Sr. No	Ingredients	Ingredients Per Tablet(mg)		Function
		F1	F2	
1.	Microcrystalline Cellulose	57.00	11.00	Diluent
2.	Ethyl Cellulose	117.00	174.00	Coating Agent
3.	HPMC	09.50	-	Pore Forming Agent
4.	Magnesium Stearate	05.70	05.70	Lubricant
5.	Ferric Oxide Red	00.10	00.10	Coloring Agent

	Total	190	190	

Manufacturing Steps of Tablet in Tablet

1. 55 mg of granules of core tablet was measured using calibrated weighingbalance.
2. The compression machine was set with lower punch and upper punch.
3. Then firstly compressed the core tablet[8].
4. In the first cycle of tablet in tablet compression half portion of granules of outer core was placed in the die and machine was rotated halfly in such a way that the sack was formed due to the exertion of upper punch.
5. The machine was manually rotated back to the original position and core tablet was placed with the help of forcep precised into sack formed.
6. Precisely weighed remaining portion of granules of outer coat was loaded into the die consisting of core tablet[9].
7. The machine is then allowed to complete one cycle of compression and result in ejection of a tablet consisting of core tablet inside.
8. The same steps were repeated to produce 50 such tablets.

Evaluation

Result of Organoleptic Properties of Drug

Physical State	Crystalline
Color	White to off white
Taste	Bitter
Odor	Odorless

Evaluation of Core tablet granules

Bulk density of prepared formulation blend was found in the range of 0.598 g/cm3 and tapped density between 0.664 g/cm3. Using these two densities data compressibility index and Hausner's ratio was calculated. Values of compressibility index were less than 9.93. Hausner ratio was between 1.11. Angle of repose was less than 20 °. Because of all these factors can persuade the observed compressibility index, the compressibility index has been projected as an indirect measure of bulk density, size and shape, surface area, moisture content, and cohesiveness of materials. The outcomes of these parameters suggested good flow properties and blends were suitable for direct compression10. The powder mixture of all formulations had compressibility index 9.93 which indicating excellent flowability of powder blend. Hausner's ratio for formulation 1.11, indicated excellent flowability. The compressibility flowability correlation data revealed that all powder mixes had great flowability; the blend's good flowability was also demonstrated by the angle of repose, which was <20°.

Fig 2. Core Tablet of Pantoprazole Sodium

EVALUATION OF CORE TABLETS

Physical evaluation of core tablet formulations

Formulation	Average Weight (mg) N=10	ameter (mm) N=10	ickness (mm) N=10	rdness (kg) N=5	ability (%) N=5
F1	53	3.65	3.31-3.33	6.6-7.5	0.5
F2	52	3.66	3.29-3.31	7.5-8.5	0.6
F3	52	3.64	3.33-3.35	6.5-6.8	0.5

Disintegration Time:

All of batches disintegration times were between 2 min , with exception of F3, which took not more than 03 minutes. Formulation F3 had complete disintegration duration of 2 min 15 seconds. According to the IP test, all tablets dissolved quickly, especially when administered at their optimum quantities as found in the literature.

Sr. No	Formulation N=6	Disintegration Time (Min)
1.	F1	3.30-4.00
2.	F2	2.50-3.00
3.	F3	2.00-2.15

Dissolution Study

The % drug release was observed to be between 80.10-81.12 percent, which was inside permissible limits. Using the USP paddle equipment Type-II, in vitro dissolution investigations of the manufactured fast dispersible core tablets containing Pantoprazole were done in 0.1 N HCL.

Dissolution Absorbance of core tablet

Sr. No	Time (min)	Absorbance	% CDR
1.	00	0.000	00.00
2.	10	0.580	46.77
3.	20	0.723	58.30
4.	30	0.782	63.06
5.	60	0.882	71.12
6.	90	0.915	73.79
7.	120	0.950	76.61
8.	150	0.980	79.03
9.	180	0.986	79.51
10.	210	1.006	81.12

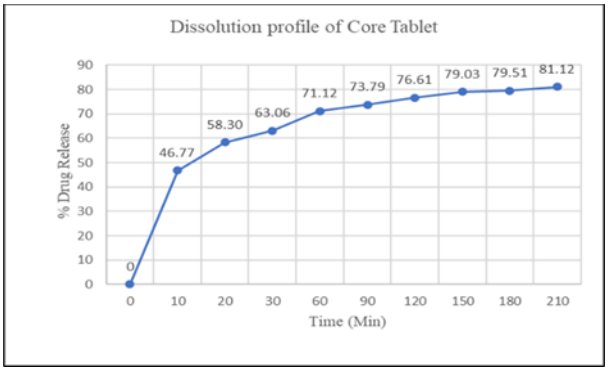


Fig 3. Dissolution profile of Core Tablet

Evaluation of Compressed Coated Tablet

Physical appearance: Compressed Coated tablets were orange with gloss.

Tablet thickness: Coated tablet formulations F1 to F2 showed thickness from 4.75

Tablet hardness:

The hardness of the formed tablets ranged from 10-11 kg of Compressed Coated Tablet, with considerable differences between different formulations. The hardness of all of the formulations implies that they show strong mechanical strength and can sustain physical and mechanical stress while being handled12.

Weight variation: The weight range was 239.30 - 241.65 mg for all tablets. This meets with the Indian Pharmacopoeia's weight variation requirements, showing consistency in tablet manufacturing and minimum batch to batch fluctuation.

Fig 4. Tablet in Tablet

Evaluation of Compressed Coated Tablet

Formulation	Average Weight (mg)	ameter (mm)	icknes s(mm)	rdness (kg)	ability (%)	egrati-on Time (min)
F1	239	7.12	4.75	9.5	0.5	90
F2	240	7.13	4.73	11	0.6	150

Dissolution study of compressed coated tablet:

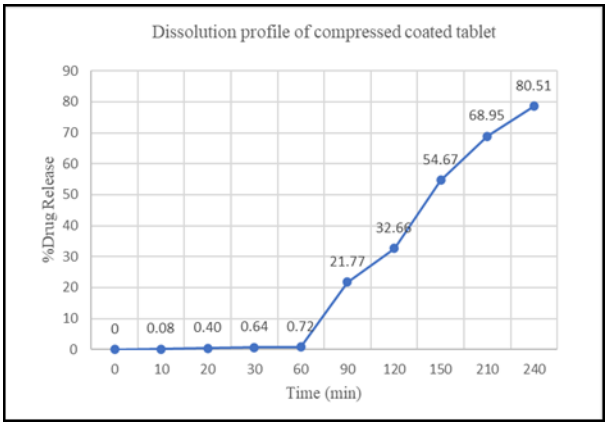
The goal of current compress coating was to get a lag time of 3 hours, during which tablet should not release drug or release fewer than 10% of drug in an acidic medium, and to show maximum release in little period of time as soon as external coat erodes and drug absorbs from the intestine

Dissolution Absorbance of Compressed Coated Tablet

Sr.No	Time (min)	Absorbance	% CDR
1.	0	0.000	0
2.	10	0.001	0.08
3	20	0.005	0.40
4.	30	0.008	0.64
5.	60	0.009	0.72
6.	90	0.270	21.77
7.	120	0.405	32.66
8.	150	0.678	54.67
9.	210	0.855	68.95
10.	240	0.990	80.51

SUMMARY AND CONCLUSION

The tablets prepared combination were found to have desired limits of hardness and thickness and complies to weight variation and within the official limits of friability. The drug release for formulation was found to be 81.34%. The prepared tablets were evaluated for Weight variation, Hardness, Friability, Disintegration time, Drug content and The prepared tablets evaluated for, weight variation, thickness and Disintegration time were found to be within the official limits. The in vitro disintegration studies were performed for all the IT and OT formulations. The in vitro dissolution tests. The results were clearly shown. the results were found satisfactory. This research work proven formulation tablet in tablet F2 of shows good stability compared with other.



CONCLUSION

The aim of present research work is to formulate tablet in tablet by using compression coating technology to control the release rate of drug from the tablet outer layer must be retain for specific period of time. The selection of water insoluble polymer such as ethyl cellulose in specific concentration to control the rate of drug release. To increase the patient compliances, reduce the dosing frequency and to avoid the late night dose by patient. There are three formulation were prepared whose superdisintegrant concentration are 1.80 mg per tablet respectively. The requirement to disintegrate the core tablet in minimum 3 min so the optimized concentration of super disintegrant. After the outer tablet contains two formulations contains ethyl cellulose respectively. To controlled the release of the drug the outer layer must be retained for required time. The selection of the that EC are insoluble in acidic media that concentration is useful to control the release of drug. The optimized formulation contains the amount of EC is help to retard the release of drug. The dissolution of the optimized formulation showing the result that help to concluded that the optimized tablet in tablet formulation shows the release of drug is controlled by the outer tablet layer and the core tablet is disintegrate immediately to release the drug after the outer tablet is dissolved. That suggesting the optimized formulation help to increase the patient compliances, reduce the dosing frequency and to avoid the late night dose by patient14.

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