

## Preparation and Evaluation of Orodispersible Tablets of Carbamazepine using Different Superdisintegrating Agents

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**Abstract:** A direct compression method was used to prepare fast dissolving tablets containing Carbamazepine as a model drug using natural as well as synthetic superdisintegrants such as isolated mucilage of *Plantago ovate*, croscarmellose sodium and sodium starch glycolate respectively. Prepared formulations were evaluated for pre-compression parameters such as micromeritic properties like angle of repose, bulk density, % compressibility and Hausner's ratio. Tablets were also subjected to post-compression evaluation for the parameters such as weight variation, hardness, friability, *in vitro* disintegration time, wetting time, drug content, and *in vitro* dissolution studies. The prepared tablets were characterized by FTIR for drug-excipient compatibility studies. No chemical interaction between drug and excipients was confirmed by FTIR studies. Nature of thermogram is totally changed and the sharp peaks are shifted to lower range and the peaks of pure drug have change to broad peaks with reduction of the height of each peak in DSC studies. These changes indicate that the dehydration of pure drug and change in the particle size giving more amorphous type of the product this may help in increasing the fast release of tablets. The results concluded that amongst all formulations prepared with mucilage of *Plantago ovata* showed better superdisintegrating property than the most widely used synthetic superdisintegrant like croscarmellose sodium and sodium starch glycolate.

**Keywords:** Carbamazepine, *Plantago ovate*, Croscarmellose sodium and Sodium starch glycolate.

### Introduction:

Form the past one decade, there has been an enhanced demand for more patient-friendly and compliant dosage forms. As a result, the demand for developing new technologies has been increasing annually. Since the development cost of a new drug molecule is very high, efforts are now been made by pharmaceutical companies to focus on the development of new drug dosage forms for existing drugs with improved safety and efficacy together with reduced dosing frequency, and the production of more cost effective dosage form<sup>1,2</sup>.

For most therapeutic agents used to produce systemic effects, the oral routes still represents the preferred way of administration, owing to its several advantages and high patient compliance compared to many other routes. Tablets and hard gelatin capsules constitute a major portion of drug delivery systems that are currently available. However, many patients groups such as the elderly, children and patient who are mentally retarded, uncooperative, nauseated, or on reduce liquid-intake/diets have difficulties swallowing these dosage forms<sup>3,4</sup>. And those who are travelling or have little access to water are similarly affected.

To fulfill these medical needs, pharmaceutical technologists have developed a novel oral dosage form known as Fast Dissolving Tablets (FDTs) which disintegrate rapidly in saliva, usually in a matter of seconds, without the need to it with water. Drug dissolution and absorption as well as onset of clinical effect and drug bioavailability may be significantly greater than those observed from the conventional dosage forms<sup>5</sup>.

Oral drug delivery has been known for decades the most widely utilized route for administration among all the route that have been explored for systemic delivery of drugs via various pharmaceutical products of different dosage forms. The reasons that the oral route has achieved such popularity may be in part attributed to its ease of administration as well as the traditional belief that by oral administration the drug is well absorbed as the food stuffs that are ingested daily. In fact, the development of a pharmaceutical product for oral delivery, irrespective of its physical form involves varying extents of optimization of dosage form characteristics within the inherent constraints of GI physiology<sup>6</sup>. Therefore, a fundamental understanding of various disciplines, including GI physiology, pharmacokinetics, pharmacodynamics and formulation design are essential to achieve a systemic approach to successful development of an oral pharmaceutical dosage form. The more sophisticated a delivery system, the greater is the complexity of these various disciplines involved in the design and optimization of the system<sup>7,8</sup>. In any case, the scientific framework required for the successful development of an oral drug delivery system consists of a basic understanding of the following three aspects. Physicochemical, pharmacokinetic, and pharmacodynamic characteristics of the drug, the anatomic and physiologic characteristics of the GIT, and Physicochemical characteristic and the drug delivery of the dosage form to be designed<sup>9</sup>.

Oral route of drug administration have wide acceptance of up to 50-60% of total dosage forms. Solid dosage forms are popular because of ease of administration, accurate dosage, self medication, pain avoidance and most importantly the patient compliance. The most popular solid dosage form are being tablets and capsules and important drawback of these dosage forms for some patients however is the difficulty to swallow<sup>10</sup>.

Drinking water plays an important role in the swallowing of oral dosage forms. Often times people experience inconvenience in swallowing conventional dosage forms such as tablets when water is not available in the case of motion sickness (kinetosis) and sudden episodes of coughing during the common cold, allergic conditions and bronchitis.<sup>11</sup>

'Fast dissolve', 'Quick dissolve', 'Rapid melts', 'Quick disintegrating', 'Mouth dissolving', 'Orally disintegrating', 'Oro-dispersible', 'Melt in mouth' etc are the term that represent the same drug delivery system. Recently fast dissolving tablet technology has been approved by the United State Pharmacopoeia (USP), Centre for Drug Evaluation and Research (CDER). USFDA define fast dissolving tablets as "A solid dosage form containing medicinal substances which disintegrates rapidly usual within a matter of second, when placed upon the tongue". Recently the European pharmacopoeia also adopted the term oro-dispersible tablet as tablet that is to be placed in mouth where it disperses rapidly before swallowing. This dosage forms dissolve or disintegrates in the patient's mouth within 15 sec to 3 min without the need of water or chewing. Despite various terminologies used, Fast dissolving tablet are here to offer unique form of drug delivery with many advantages over the conventional oral solid dosage form<sup>12,13,14</sup>. Fast dissolving/disintegrating tablets are formulated by utilizing several processes, which differ in their methodologies and vary in various properties such as, mechanical strength of tablets, taste and mouth feel, swallowability, drug dissolution in saliva, bioavailability, stability. Various techniques used in formulating FDTs include direct compression, sublimation/ Effervescent, mass extrusion, tablet moulding, spray drying, lyophilisation/ freeze drying, melt granulation, phase transition process, cotton candy process, three-dimensional Printing (3DP) and nanonization<sup>15,16</sup>. Direct compression represents the simplest and most cost effective tablet manufacturing technique. This technique can now be applied to preparation of ODT because of the availability of improved excipients especially superdisintegrants and sugar based excipients<sup>17</sup>.

## Materials and Methods

### Materials:

Carbamazepine as a gift sample from Apex laboratories Pvt. Ltd, sodium starch glycolate, croscarmellose sodium, chitosan, microcrystalline cellulose, DC-mannitol, talc, magnesium stearate, sacharrin sodium, sodium laryl sulphate and methanol are from SD fine chemicals.

### Preformulation Studies with the Drug

Preformulation testing is the first step in the rationale development of dosage forms of a drug substance. It can be defined as an investigation of physical and chemical properties of a drug substance alone and when combined with excipients<sup>18,19</sup>. The overall objective of preformulation testing is to generate

information useful to the formulator in developing stable and bioavailable dosage forms, which can be mass-produced. The preformulation studies with the drug obtained were performed using conventional and reported techniques. The UV-Visible spectrum, solubility, flow properties, drug crystallinity were determined<sup>20,21</sup>.

### Methods:

Different batches of tablets are prepared by direct compression method. The drug/polymer mixture was prepared by homogeneously mixing sodium starch glycolate, cross carmellose, chitosan, microcrystalline cellulose, and mannitol. Tablet each containing 100 mg of carbamazepine were prepared as per composition given in Table 1 (F1 to F12). Required quantity of ingredients was weighed as given in table 1. The drug and excipients were passed through sieve (#80) to ensure the better mixing and co-ground in mortar and pestle. The powder blend was evaluated for flow property and compressibility behaviour. Microcrystalline Cellulose was used as a direct compressible vehicle. Super disintegrants like sodium starch glycolate, crospovidone and croscarmellose sodium were used in different ratios. The powder was compressed by cadmach tablet compression machine equipped with 12 mm round punch by direct compression technique. A minimum of 50 tablets was prepared for each batch. Each tablet weighed 200 mg<sup>22,23,24</sup>.

**Table: 1 Formulations of fast Dissolving tablets of Carbamazepine:**

Ingredient (mg)	Formulation composition (mg)											
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
Carbamazepine	100	100	100	100	100	100	100	100	100	100	100	100
Sodium starch Glycolate	20	15	10	5	-	-	-	-	-	-	-	-
Cross carmellose sodium	-	-	-	-	5	10	15	20	-	-	-	-
Chitosan	-	-	-	-	-	-	-	-	5	10	15	20
Microcrystalline cellulose	40	40	40	40	40	40	40	40	40	40	40	40
DC-mannitol	25	30	35	40	40	35	30	25	40	35	30	25
Sodium saccharin	10	10	10	10	10	10	10	10	10	10	10	10
Talc	3	3	3	3	3	3	3	3	3	3	3	3
Magnesium stearate	2	2	2	2	2	2	2	2	2	2	2	2
<b>Total</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>	<b>200</b>

### Evaluation studies of orodispersible tablets:

#### Pre compression parameters<sup>26,27,28</sup>:

#### Angle of repose:

Angle of repose was determined using funnel method. The blend was poured through funnel that can be raised vertically until a maximum cone height (h) was obtained. The height of the funnel was adjusted in such a way that the tip of the funnel just touched the apex of the powder blend. The powder blend was allowed to flow through the funnel freely on to the surface. The diameter of the powder cone was measured and angle of repose was calculated using the following equation. Radius of the heap (r) was measured and angle of repose was calculated using the formula:

$$\tan \theta = h/r$$

Where,  $\theta$  is the angle of repose, h is height of pile; r is radius of the base of pile.

The angle of repose of powder blend was determined by the funnel method.

**Bulk density:**

Apparent bulk density ( $\rho_b$ ) was determined by pouring the blend into a graduated cylinder.

A quantity of 2 gm of powder blend from each formula, previously shaken to break any agglomerates formed, was introduced in to 10 ml measuring cylinder. After that the initial volume was noted and the cylinder was allowed to fall under its own weight onto a hard surface from the height of 2.5cm at second intervals. The bulk volume ( $V_b$ ) and weight of powder ( $M$ ) was determined. The bulk density was calculated using the formula

$$\text{Bulk density} = \frac{\text{weight of the powder blend}}{\text{Untapped volume of the packing}}$$

The measuring cylinder containing known mass of blend was tapped for a fixed time. Tapping was continued until no further change in volume was noted. The minimum volume ( $V_t$ ) occupied in the cylinder and weight ( $M$ ) of the blend was measured. The tapped density ( $\rho_t$ ) was calculated using the following formula

$$\text{Tapped bulk density} = \frac{\text{weight of the powder blend}}{\text{Tapped volume of the packing}}$$

**Hausner's Ratio:**

It indicates the flow properties of the granules and is measured by the ratio of tapped density to the bulk density. Hausner ratio is an indirect index of ease of powder flow. It is calculated by the following formula: Where is tapped density and is bulk density.

$$\text{Hausner's Ratio} = \frac{\text{Tapped density } (\rho_t)}{\text{Bulk density } (\rho_b)}$$

Lower Hausner ratio (< 1.25) indicates better flow properties than higher ones (>1.25).

**Compressibility index (Carr's Index):**

Compressibility index is an important measure that can be obtained from the bulk and tapped densities. The simplest way of measurement of free flow of powder is compressibility, an indication of the ease with which a material can be induced to flow is given by compressibility. In theory, the less compressible a material is the more flowable it is. A material having values of less than 20% has good flow property. The compressibility index of the granules was determined by Carr's compressibility index, which is calculated by using the following formula

$$C_I = \frac{(\text{Tapped density} - \text{Bulk density})}{\text{Tapped density}} \times 100$$

**Post compression parameters<sup>29,30,31</sup>:**

The tablets were evaluated for in-process and finished product quality control tests i.e. appearance, thickness, hardness, weight variation, friability, drug content uniformity, in-vitro disintegration time and in-vitro drug release.

**Appearance:**

The tablet should be free from cracks, depressions, pinholes etc. The color and the polish of the tablet should be uniform on whole surface. The surface of the tablets should be smooth.

**Thickness:**

The dimensions of the tablets are thickness and diameter. The tablets should have uniform thickness and diameter. The manufacturer normally states these. Thickness and diameter of a tablet were measured using vernier calipers. These values were checked and used to adjust the initial stages of compression.

**Hardness:**

The resistance of tablets to shipping or breakage under conditions of storage, transportation and handling before usage depends on its hardness. The hardness of each batch of tablet was checked by using

Monsanto hardness tester. The hardness was measured in terms of  $\text{kg/cm}^2$ . Six tablets were chosen randomly and tested for hardness. The average hardness of six determinations was recorded.

#### **Weight Variation:**

Twenty tablets from each formulation were selected at a random and average weight was determined. Then individual tablets were weighed and was compared with average weight. The weight of the tablet being made was routinely determined to ensure that a tablet contains the proper amount of drug. The tablets should meet the I.P specification that not more than 2 tablets are outside the percentage limits and no tablet differs by more than 2 times the percentage limit as in I.P official limits.

#### **Friability:**

Friability determines the resistance of tablets to shipping or breakage under conditions of storage transportation and handling before usage. Friability generally refers to loss in weight of tablets in the containers due to removal of fines from the tablet surface. Friability generally reflects poor cohesion of tablet ingredients. If there is any chipping, capping, cracking or breaking of tablet; then the batch should be rejected. 20 tablets were weighed and the initial weight of these tablets was recorded and placed in Roche friabilator and rotated at the speed of 25 rpm for 100 revolutions. Then tablets were removed from the friabilator, dusted off the fines and again weighed and the weight was recorded.

$$\text{Friability} = \frac{(w_1 - w_2)}{w_1} \times 100$$

Where:  $w_1$  = weight of the tablet before test.

$w_2$  = weight of the tablet after test

#### **Drug content uniformity:**

Ten tablets were weighed and powdered equivalent to 100 mg of CBZ was weighed and dissolved in 1% SLS solution (in water) and filtered the solution through the whatman filter paper. The filtrate was collected and diluted with sufficient amount with 1%w/v SLS solution till the concentration of the drug lies within the standard plot range. The diluted solution was analyzed for the CBZ content by UV spectrophotometer (Merck, Thermo scientific Evolution 201) at 284.4 nm using 1%w/v SLS solution as a blank. Each sample was analyzed in triplicate.

#### **In vitro Disintegration time:**

The disintegration time for all formulations was carried out using tablet disintegration test apparatus. Six tablets were placed individually in each tube of disintegration test apparatus and discs were placed. The water was maintained at a temperature of  $37 \pm 2^\circ\text{C}$  and time taken for the entire tablet to disintegrate completely was noted.

#### **In vitro Dissolution studies:**

In-vitro dissolution study of Carbamazepine was carried using Electro lab TDT-082, Model-ETC 11L USP Type II apparatus (USP XIV Dissolution test apparatus) at 100 rpm and 900ml of phosphate buffer as dissolution media. Temperature of dissolution media was maintained at  $37^\circ\text{C} \pm 5^\circ\text{C}$  upto 15 min. 2ml of sample was withdrawn at every 2 min interval and replaced by the respective buffer solution. Samples withdrawn were analyzed by UV spectrophotometer at 284.4 nm in 1% SLS solution for estimation of amount of drug released using buffer solution as blank.

#### **Compatibility studies<sup>32,33</sup>:**

The objective of drug/excipient compatibility considerations and practical studies is to delineate, as quickly as possible, real and possible interactions between potential formulation excipients and the API. This is an important risk reduction exercise early in formulation development. The drug-excipient incompatibility can alter the stability and/or the bioavailability of drugs, thereby, affecting its safety and/or efficacy.

#### **Fourier transform Infra-red spectrophotometer (FT-IR studies):**

FTIR spectrum of drug, polymer and physical mixture of drug with polymers were obtained on FTIR

instrument. Sample about 5 mg was mixed thoroughly with 100 mg potassium bromide IR powder and compacted under vacuum at a pressure of about 12 Psi for 3 minutes. The resultant disc was mounted in a suitable holder in Perkin Elmer IR spectrophotometer and the spectrum was scanned over the wave number range of 4000-400  $\text{cm}^{-1}$ . IR helps to confirm the identity of the drug and to detect the interaction of the drug with the carriers.

### Differential Scanning Calorimetry (DSC):

Differential Scanning calorimetry is used to determine drug excipient compatibility studies, investigate and predict any physiochemical interactions between components in a formulation and, therefore, can be applied to the selection of suitable chemically compatible excipients. It is also used to observe more phase changes such as glass transition, crystallization, amorphous forms of drugs and polymers. Differential scanning calorimeter has been proposed as a rapid method for evaluating the drug-excipient interaction. The physical state of drugs and polymer was analyzed by Differential Scanning calorimeter (Schimadzu). Approximately 10 mg of sample was analyzed in an open aluminum pan, and heated at scanning rate of 10°C/min between 0°C and 400°C. Magnesia was used as the standard reference material. DSC of Carbamazepine (drug) alone and binary mixture of drug and excipients (CHITOSAN, SSG, CCS, DC Mannitol, Talc, magnesium stearate) was performed by increasing the temperature from 40°C to 200°C at 5°C/min.

### Result and Discussion:

The values of pre-compression parameters evaluated were found within prescribed limits and indicated good free flowing property. The data obtained from post-compression parameters such as weight variation, hardness, friability, wetting time, drug content and *in vitro* disintegration time for FDTs were shown in table 2 and 3. In all the formulations, hardness test indicated good mechanical strength, as the hardness of the FDTs was found in the range of 3.14 to 3.5  $\text{kg/cm}^2$ . Friability was observed less than 1%, indicated that FDTs had a good mechanical resistance. Drug content was found to be high ( $\geq 99.22\%$ ) and uniform in all the FDTs. The FDTs were subjected for evaluation of *in vitro* disintegration time. The *in vitro* disintegration time for all the formulations varies from  $09.13 \pm 0.6$  to  $53.20 \pm 2.2$  seconds. It was observed that when *Chitosan* used as superdisintegrant (F9 to F12), the FDTs disintegrates rapidly within short time. *Chitosan* containing FDTs disintegrates rapidly as compared to other FDTs prepared using croscarmellose sodium and sodium starch glycolate. It was observed that the *in vitro* disintegration time of the FDTs decreased with increase in the level of croscarmellose sodium and mucilage of *Chitosan*. However, *in vitro* disintegration time increased with increase in the level of sodium starch glycolate in the FDT. It indicates that increase in the level of sodium starch glycolate had a negative effect on the *in vitro* disintegration of the FDTs. At higher levels, formation of a viscous gel layer by sodium starch glycolate, might have formed a thick barrier to the further penetration of the disintegration medium and hindered the disintegration or leakage of tablet contents. Thus, FDT disintegration was retarded to some extent with tablets containing sodium starch glycolate. Results were showed in table 2 and 3. Since the *in vitro* dissolution process of a FDT depends upon the wetting time followed by *in vitro* disintegration of the tablet. The measurement of wetting time may be used as another confirmative test for the evaluation of FDTs. In wetting time study, the wetting time was rapid in FDTs of *Chitosan* followed by croscarmellose sodium and sodium starch glycolate. It was observed that as concentration of croscarmellose sodium and *chitosan* increased in the formulations, the time taken for wetting was reduced. However as in case of FDTs of sodium starch glycolate, as concentration was increased the time taken for wetting was also increased. The *in-vitro* dissolution studies of different formulations are shown in figure 1, with F12 as increased dissolution profile with *chitosan*- natural as super disintegrating agent compared to synthetic super disintegrating agents. FTIR spectra of CBZ and formulation F12 are shown in figure 2. Pure drug showed characteristic absorption bands at 3467 (NH Stretching of NH<sub>2</sub>), 3080 (Aromatic CH stretching), 1678 (C=O stretching of CO NH<sub>2</sub>), 1605, 1489 (C = C ring stretching) and the F12 showed characteristic absorption band at 3465 (NH Stretching of NH<sub>2</sub>), 3080 (Aromatic CH stretching), 1681 (C=O stretching of CO NH<sub>2</sub>), 1605, 1489 (C = C ring stretching). The FTIR spectra of pure CBZ and F12 revealed that there was no appreciable change in the position of absorption band. This revealed that there was no chemical interaction between CBZ and the excipients. Nature of thermo gram is totally changed and the sharp peaks are shifted to lower range around 167.61°C and the peaks of pure drug have change to broad peaks with reduction of the height of each peak in figure 3. These changes indicate that the dehydration of pure drug and change in the partial size giving more amorphous type of the product this may help in increasing the fast release of tablets.

**Table: 2 Pre-compression parameters of orodispersible tablets of Carbamazepine:**

Batch	Angle of repose( $\theta$ )	Bulk density ( $\text{gm}/\text{cm}^3$ )	Tapped density ( $\text{gm}/\text{cm}^3$ )	Hausner's ratio	Compressability (%)
F1	$26.15 \pm 0.12$	$0.42 \pm 0.03$	$0.66 \pm 0.03$	$1.13 \pm 0.04$	$12.22 \pm 0.11$
F2	$27.10 \pm 0.16$	$0.38 \pm 0.02$	$0.52 \pm 0.02$	$1.14 \pm 0.08$	$12.82 \pm 0.20$
F3	$21.70 \pm 0.15$	$0.43 \pm 0.03$	$0.71 \pm 0.04$	$1.17 \pm 0.06$	$14.69 \pm 0.25$
F4	$27.25 \pm 0.14$	$0.36 \pm 0.02$	$0.62 \pm 0.01$	$1.15 \pm 0.08$	$13.38 \pm 0.14$
F5	$24.39 \pm 0.16$	$0.41 \pm 0.02$	$0.59 \pm 0.02$	$1.19 \pm 0.06$	$16.60 \pm 0.16$
F6	$22.17 \pm 0.21$	$0.42 \pm 0.03$	$0.64 \pm 0.04$	$1.16 \pm 0.09$	$14.52 \pm 0.18$
F7	$20.25 \pm 0.24$	$0.36 \pm 0.04$	$0.59 \pm 0.02$	$1.17 \pm 0.10$	$15.41 \pm 0.14$
F8	$26.49 \pm 0.14$	$0.4 \pm 0.02$	$0.62 \pm 0.02$	$1.15 \pm 0.11$	$13.61 \pm 0.16$
F9	$27.75 \pm 0.16$	$0.39 \pm 0.04$	$0.71 \pm 0.03$	$1.17 \pm 0.08$	$14.97 \pm 0.15$
F10	$18.45 \pm 0.18$	$0.4 \pm 0.03$	$0.68 \pm 0.04$	$1.17 \pm 0.04$	$14.75 \pm 0.19$
F11	$23.05 \pm 0.11$	$0.4 \pm 0.01$	$0.70 \pm 0.01$	$1.14 \pm 0.10$	$12.76 \pm 0.15$
F12	$19.17 \pm 0.14$	$0.4 \pm 0.04$	$0.74 \pm 0.03$	$1.13 \pm 0.10$	$12.79 \pm 0.11$

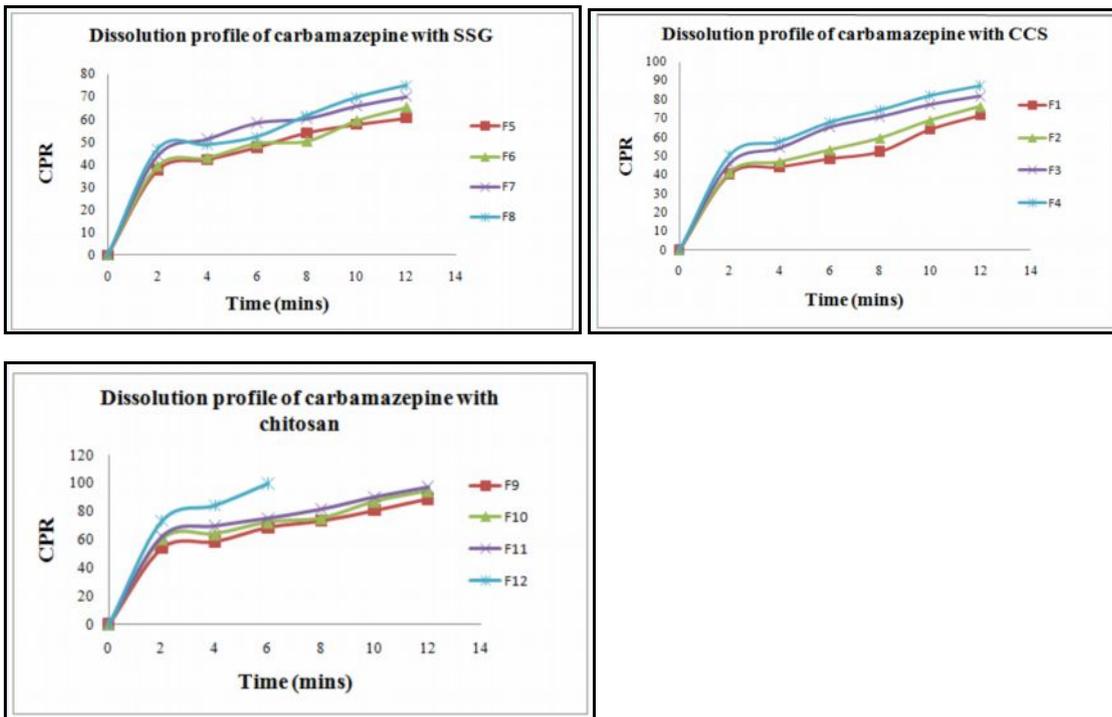
\*Angle of repose, n=3

**Table: 3 Post- Compression parameters of orodispersible tablets of Carbamazepine:**

Formulation code	Thickness (mm)	Hardness $\text{Kg}/\text{cm}^2$	Friability (%)	Drug content uniformity	Invitro Disintegration time(sec)	Wetting time(sec)	Weight variation(mg)
F1	$1.71 \pm 0.12$	$3.2 \pm 0.13$	$0.66 \pm 0.8$	$99.86 \pm 0.4$	$21.18 \pm 1.2$	$32.14 \pm 1.6$	$201.58 \pm 1.7$
F2	$1.70 \pm 0.13$	$3.2 \pm 0.12$	$0.64 \pm 0.4$	$99.49 \pm 0.9$	$42.39 \pm 0.5$	$74.04 \pm 1.1$	$200.45 \pm 0.8$
F3	$1.71 \pm 0.11$	$3.3 \pm 0.13$	$0.57 \pm 0.5$	$99.51 \pm 0.7$	$53.20 \pm 2.2$	$88.11 \pm 1.8$	$199.68 \pm 0.4$
F4	$1.73 \pm 0.12$	$3.3 \pm 0.14$	$0.61 \pm 0.2$	$99.22 \pm 10$	$14.22 \pm 0.8$	$51.16 \pm 1.4$	$200.48 \pm 1.5$
F5	$1.71 \pm 0.12$	$3.5 \pm 0.11$	$0.65 \pm 1.4$	$99.92 \pm 0.8$	$13.21 \pm 0.6$	$48.21 \pm 1.2$	$201.64 \pm 1.9$
F6	$1.73 \pm 0.14$	$3.2 \pm 0.14$	$0.62 \pm 0.9$	$99.52 \pm 0.4$	$12.80 \pm 0.9$	$41.23 \pm 1.6$	$200.55 \pm 2.1$
F7	$1.72 \pm 0.11$	$3.2 \pm 0.14$	$0.59 \pm 0.6$	$99.34 \pm 1.1$	$12.50 \pm 0.8$	$38.31 \pm 1.2$	$201.48 \pm 1.1$
F8	$1.70 \pm 0.12$	$3.1 \pm 0.15$	$0.63 \pm 0.4$	$99.64 \pm 0.9$	$14.18 \pm 0.9$	$22.11 \pm 1.1$	$200.64 \pm 1.1$
F9	$1.73 \pm 0.11$	$3.4 \pm 0.14$	$0.61 \pm 1.6$	$99.41 \pm 0.6$	$10.30 \pm 0.7$	$18.10 \pm 1.8$	$202.51 \pm 1.8$
F10	$1.71 \pm 0.13$	$3.2 \pm 0.11$	$0.59 \pm 0.6$	$99.28 \pm 0.4$	$11.30 \pm 0.7$	$14.10 \pm 1.3$	$200.66 \pm 1.2$
F11	$1.72 \pm 0.13$	$3.2 \pm 0.14$	$0.59 \pm 0.3$	$99.64 \pm 0.9$	$9.32 \pm 0.5$	$16.14 \pm 1.6$	$201.45 \pm 1.8$
F12	$1.71 \pm 0.12$	$3.1 \pm 0.11$	$0.55 \pm 1.1$	$99.44 \pm 1.1$	$9.13 \pm 0.6$	$12.18 \pm 1.4$	$200.68 \pm 0.9$

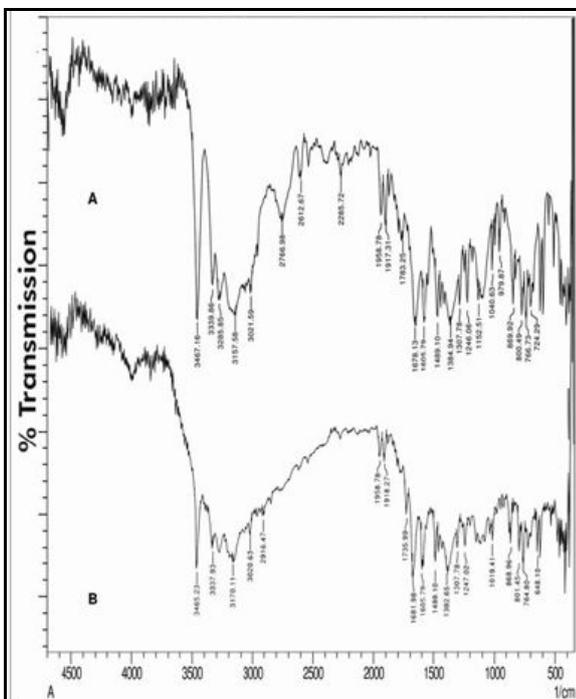
\*Angle of repose, n=3

**In-vitro drug release studies of fast dissolving tablets:**



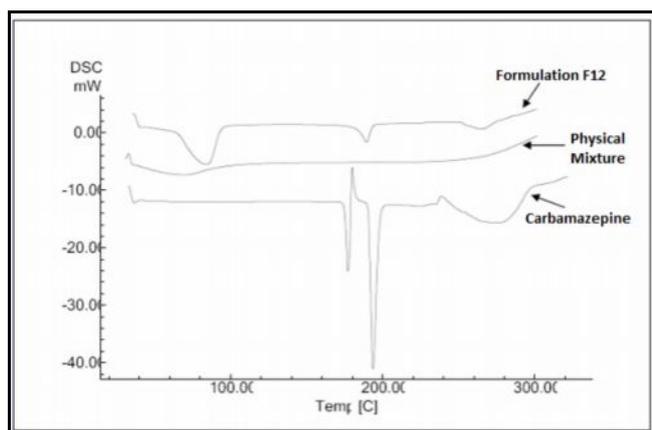
**Fig: 1. In-vitro drug release studies of fast dissolving tablets with different disintegrating agents**

**FTIR Studies:**



**Fig: 2. FTIR spectrum of A) CBZ, B) IR spectrum of Formulation F12.**

**DSC Studies:**



**Fig. 3. DSC Thermogram of Carbamazepine, Physical mixture, Formulation F12.**

### Conclusion:

From the present study it can be concluded that natural superdisintegrant like mucilage of *Chitosan* showed better disintegration property and better in vitro dissolution profile than the most widely used synthetic super disintegrant like Croscarmellose sodium and Sodium starch glycolate in the formulations of FDTs. Among all formulation F12 prepared with mucilage of *Chitosan* showed 99.47% drug release in 6 min.

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