FORMULATION, EVALUATION AND OPTIMIZATION OF ORALLY DISINTEGRATING TABLET OF CINNARIZINE

Bhupendra G. Prajapati[1,*] and Satish N. Patel[2]

1. S.K. Patel College of Pharmaceutical Education & Research, Ganpat Vidyanagar, e-mail: bhupen_27@yahoo.co.in, bhupen27@gmail.com
2. Ganpat University, Kherva. PIN: 382711 City: Mehsana, State: Gujarat, Country: India.

[*]Corresponding author: Bhupendra G Prajapati, Assistant Professor, S.K. Patel College of Pharmaceutical Education & Research, Ganpat University, Ganpat Vidhyanagar, Kherva - 382711, Mehsana, North Gujarat, India. Contact: bhupen27@gmail.com, Phone: (O) 91-02762-286082

ABSTRACT

Objective of this study was to formulate directly compressible orally disintegrating tablets of Cinnarizine with sufficient mechanical integrity, content uniformity, and acceptable palatability to assist patients of any age group for easy administration. Effect of varying concentrations of different superdisintegrants such as crospovidone, croscarmellose sodium, and sodium starch glycolate on disintegration time was studied. Tablets were evaluated for weight variation, thickness, hardness, friability, taste, drug content, in vitro disintegrating time and in vitro drug release. Other parameters such as wetting time, water absorption ratio ('R'), and drug-excipient compatibility were also evaluated. The disintegration time of the optimized CP5 batch was 25 sec. Good correlation was observed between disintegration time and water absorption ratio (R) for each of three superdisintegrants at concentrations studied. Considering the 'R' values and disintegration time, crospovidone was significantly superior compared to other two superdisintegrants tested. Release of drug was faster from formulations containing 6% crospovidone (CP5) compared to the marketed convetional Cinnarizine tablet. Differential scanning calorimetric studies did not indicate any excipient incompatibility, either during mixing or after compression. Finally concluded that directly compressible orally disintegrating tablets of cinnarizine with lower friability, acceptable taste, and shorter disintegration times were obtained using crospovidone at optimized concentrations.

KEYWORDS: Cinnarizine, orally disintegrating tablet, wetting time, water absorption ratio.

INTRODUCTION

Over a decade, the demand for development of orally disintegrating tablets (ODTs) has enormously increased as it has significant impact on the patient compliance. Orally disintegrating tablets offer an advantage for populations who have difficulty in swallowing. It has been reported that dysphagia [1] (difficulty in swallowing) is common among all age groups and more specific with pediatric, geriatric population along with institutionalized patients and patients with nausea, vomiting, and motion sickness complications.[2] Orally disintegrating tablets with good taste and flavor increase the acceptability of bitter drugs by various groups of

population. Orally disintegrating tablets are also called as orodispersible tablets, quick disintegrating tablets, mouth dissolving tablets, fast disintegrating tablets, fast dissolving tablets, rapid dissolving tablets, porous tablets, and rapimelts. However, of all the above terms, United States pharmacopoeia (USP) approved these dosage forms as orally disintegrating tablets. Recently, European Pharmacopoeia has used the term orodispersible tablet for tablets that disperses readily and within 3 min in mouth before swallowing.[3]United States Food and Drug Administration (FDA) defined orally disintegrating tablet as "A solid dosage form containing medicinal substance or active ingredient which disintegrates rapidly usually within a matter of seconds when placed upon the tongue." The disintegration time for orally disintegrating tablets generally ranges from several seconds to about a minute.

Moreover, drug candidates that undergo pre-gastric absorption when formulated as orally disintegrating tablets may show increased oral bioavailability [4]. From the perspective of the pharmaceutical industry, orally disintegrating tablets may provide new business opportunities in the form of product differentiation, line extension and life cycle management, exclusivity, uniqueness, and patent life extension. At the present time a significant limitation of orally disintegrating tablet formulations is product cost since manufacturing involves use of novel excipients and technologies. In addition, specialized packaging is necessary to withstand handling and transportation mechanics. The key parameters that are to be considered in the process of formulating an orally disintegrating tablet are taste and the disintegration time [5]. Both of these are related either directly or indirectly to the oral cavity.

The mucosa in the oral cavity presents a surface area of about 100 cm^2 and three different types of oral mucosa are recognized: the masticator mucosa, the lining mucosa, and the specialized mucosa. Of the total oral mucosa, 15% of it consists of specialized mucosa, which is present on the dorsum of the tongue. It is mainly involved in identifying the taste of the formulation [6]. The saliva plays an important role in disintegration of orally disintegrating tablets and primarily secreted in the oral cavity by parotid, submandibular (sub maxillary), sublingual glands, and also by numerous minor glands. Saliva is mainly constituted by water (99.5% w/v) and the remaining 0.5% w/v is constituted by dissolved compounds [7]. The principal components of saliva are inorganic electrolytes (0.2% w/v), gases (CO_2, N_2, and O_2), nitrogen products, such as urea and ammonia, vitamin C, creatinine, and mucins. The accepted range of normal salivary flow is comprised from about 0.1 to 0.2 mL/min and reaches 7 mL/min upon stimulation [8].

Motion sickness is the uncomfortable dizziness, nausea, and vomiting that people experience when their sense of balance and equilibrium is disturbed by constant motion. Riding in a car, aboard a ship or boat, or riding on a swing all cause stimulation of the vestibular system and visual stimulation that often leads to discomfort. While motion sickness can be bothersome, it is not a serious illness, and can be prevented. [9, 10, 11] cinnarizine is the drug which is used in treatment of vertigo/meniere's disease, nausea and vomiting, motion sickness and also useful for vestibular symptoms of other origins. Cinnarizine inhibits contractions of vascular smooth muscle cells by blocking calcium channels. Cinnarizine increases erythrocyte deformability and decreases blood viscosity. Cinnarizine inhibits stimulation of the vestibular system.

MATERIAL

Cinnarizine was purchased from Rakshit Pharma, Mumbai, Pearlitol® SD 200, a directly compressible vehicle, was obtained from Signet Chemical Corporation (Mumbai, India); Crospovidone (CP), Croscarmellose Sodium (CS), Sodium Starch Glycolate (SSG), Sodium Stearyl Fumarate (SSF), aspartame, and peppermint flavor were gifts from were obtained from (Welable healthcare, Mehsana, India), Avicel PH 102 and colloidal silicon dioxide Aerosil® were purchased from Span Pharma Private Limited (Hyderabad, India) and nigrosine RM 247, a water soluble dye, was purchased from Hi Media Laboratories Private Limited (Mumbai, India). All other chemicals were of analytical grade.

METHOD

Assignment of Formulation Codes Various formulations of cinnarizine orally disintegrating tablets were designed utilizing three superdisintegrants, crospovidone (CP), croscarmellose sodium (CCS), and sodium starch glycolate (SSG) each varied at three different levels (4, 6, and 8%). All of the other ingredients were kept constant. A total of such nine formulations prepared were designated with their codes and will be referred with the same in further sections. The assigned formulation codes were as follows, CCS1, CCS2, CCS3, CP4, CP5, CP6, SSG7, SSG8, and SSG9.

Preparation of Orally Disintegrating Tablets

All of the formulation components other than the lubricant and glidant were accurately weighed passed through a 40# sieve and mixed in a V-blender for 15 min. The obtained blend was lubricated with sodium stearyl fumarate and Aerosil® for another 5 min and the resultant mixture was directly compressed into tablets. The amount of all tablet components other than superdisintegrants and Pearlitol® SD 200 (filler) were kept constant. Round biconvex tablets of 100 mg in weight and 6 mm in diameter were prepared by RIMEK Rotary Machine (Karnavati eng. Ahmedabad).

EVALUATION

Weight Variation

Twenty tablets from were randomly selected from each formulation and weighed using a Shimadzu digital balance. The mean SD values were calculated. [12]

Thickness Variation

Ten tablets from each formulation were taken randomly and their thickness was measured with a digital screw gauge micrometer (Digimaticmicrometer, Mitutoyo, Japan). The mean SD values were calculated. [12]

Hardness and Friability

Hardness or crushing strength of the tested orally disintegrating tablet formulations was measured using the dial hardness tester (Model no 1101, Shivani Scientific India). The friability of a sample of 20 orally disintegrating tablets was measured utilizing a USP-type Roche friabilator (Camp-bell Electronics, Mumbai). Pre-weighed tablets were placed in a plastic chambered friabilator attached to a motor revolving at a speed of 25 rpm for 4 min. The tablets were then de-dusted, reweighed, and percentage weight loss (friability) was calculated. [13]

$$\%Friability = \frac{W_0 - W}{W_0} \times 100 \quad (1)$$

W○= initial weight of 20 tablets
W= weight of 20 tablets after 100 revolutions

Water Absorption Ratio (R)

The weight of the tablet prior to placement in the Petri dish was noted (Wb) utilizing a Shimadzu digital balance. The wetted tablet was removed and reweighed (Wa). Water absorption ratio, R, was then determined according to the following equation. Where Wb and Wa were tablet weights before and after water absorption, respectively. [14]

$$R = \frac{(Wb - Wa)}{Wa} X\ 100 \quad (2)$$

Wetting Time

Five circular tissue papers were placed in a Petri dish of 10 cm diameter. Ten milliliters of water containing 0.5% nigrosine, a water-soluble dye, was added to the petri dish. The dye solution was used to identify complete wetting of the tablet surface. A tablet was carefully placed on the surface of the tissue paper in the petri dish at 25°C. The time required for water to reach the upper surface of the tablets and to completely wet them was noted as the wetting time. These measurements were carried out in replicate of six. Wetting time was recorded using a stopwatch. [14]

***In Vitro* Disintegration Time**

In vitro disintegration time (DT) of the orally disintegrating tablets was determined following the procedure described by Gohel at al (2004). 10 mL of water at 25°C was placed in a petri dish of 10 cm diameter. The tablet was then carefully positioned in the center of the petri dish and the time required for the tablet to completely disintegrate into fine particles was noted. Measurements were carried out in replicates of six tablet (n=6) and mean SD values were recorded. [15]

***In Vitro* Release Studies**

In Vitro release studies of Cinnarizine from different formulations were performed according to USP XVIII apparatus II, paddle method (Dissolution test apparatus-TDT-06T, Electrolab, Mumbai, India). Paddle speed was maintained at 50 rpm and 900 mL of 0.1N HCl was used as the dissolution medium. Samples (10 mL) were collected at predetermined time intervals (1, 2, 3, 5, 10 and 15, min) and replaced with equal volume of fresh medium, filtered through a 0.45 µm filter and analyzed with a UV—Visible spectrophotometer (Shimadzu, Japan) at λ= 254 nm. Drug concentration was calculated from a standard calibration plot and expressed as cumulative % drug dissolved. The release studies were performed in replicates of six. [16]

Assay

Orally disintegrating tablet formulations were assayed for drug content. Ten tablets were randomly selected from each formulation and pulverized to a fine powder. Weighed aliquots containing an amount of powder equivalent to a single dose were taken in triplicate and assayed for the drug content utilizing a UV-VIS spectrophotometer (Model Systronics 2201 UV/Visible double beam Spectrophotometer, Shimadzu, Japan) at a wavelength of 254 nm. [17]

Comparison of Dissolution Profiles

The similarity factor (f2) given by SUPAC guidelines for modified release dosage form was used as a basis to compare dissolution profile. The dissolution profiles of products were compared using a similarity factor (f2). This similarity factor is calculated by following formula,

$$f_2 = 50\mathrm{X}\log\left\{\left[1+\left(\frac{1}{n}\right)\sum_{t=1}^{n} w_t\left(R_t - T_t\right)^2\right]^{-0.5} \mathrm{X}100\right\} \quad (2)$$

Where, **n** is the number of dissolution time points

$\mathbf{R_t}$ – The reference profile at the time point t

$\mathbf{T_t}$ - The test profile at the same point.

Differential Scanning Calorimetric (DSC)

DSC was used to characterize the thermal properties of the drug, bulking agent, physical mixture, and the compressed orally disintegrating tablet formulation. The DSC thermo grams were recorded using a differential scanning calorimeter (DSC- Shimadzu 60, Japan). Ultrahigh pure nitrogen was used at a flow rate of 20 mL/min. Samples were analyzed in crimped aluminum pan and heated from 50–300°C at a linear heating rate of 10°C min^{-1}.

Stability Study

Accelerated stability study carried out at 40 ± 2^0c in a humidity chamber having 75%RH for 1 month.

RESULTS AND DISCUSSION

Formulation Rationale

An objective of a directly compressible orally disintegrating tablet is that it disintegrates or disperses in the saliva within a matter of seconds. To achieve such a formulation most of the excipients selected are inherently required to be water-soluble. Pearlitol® SD 200 utilized in the formulation is a directly compressible grade of mannitol with good flow properties and provides a refreshing or cooling mouth feel due to its negative heat of solution. Pearlitol SD 200 was thus used as a bulking agent to achieve the desired tablet weight. Avicel PH 102 was included in the formulation as a disintegrate and a diluents. This grade of microcrystalline cellulose is granular in nature and thus displays excellent flow properties. To impart pleasant taste and improve mouth feel, aspartame and peppermint were included as sweetening and flavoring agents, respectively. Sodium stearyl fumarate was employed as a lubricant instead of magnesium stearate not only because of the metallic taste of the latter, but also due to its water solubility and directly compressible features. Colloidal silicon dioxide (Aerosil), which acts both as a glidant and lubricant, also helps in appreciably decreasing tablet friability. This may be due to Aerosil helping in restoring the bonding properties of the excipients. In this study, effectiveness of CP, CCS, and SSG in the Cinnarizine orally disintegrating tablet formulations was evaluated at three different concentrations. Other formulation components were kept constant. CP is dens cross-linked homopolymers of Nvinyl 2-pyrrolidones. Their porous particle morphology enables them to rapidly absorb liquids into the tablet by capillary action and to generate rapid volume expansion and hydrostatic pressures that result in tablet

disintegration. CCS swells rapidly up to 4–8 times its original volume on contact with water. Similar to CP, it is also used as a dissolution aid. SSG, a sodium salt of carboxymethyl ether of starch, is usually employed at concentrations between 2–8% w/w and a concentration of 4% may be optimum in most cases.

Quality Control Tests

In all the formulation weight variations was within ±2%, hardness is within ±0.5%.all the formulation passes the drug content assay. Uniformity of drug contents was within 99.0% ±2%.

Friability data represent that as the concentration is increases %friability of the formulation is also increases. Except CCS3, CP6, SSG9 batches all the formulation passed %friability limit.

Wetting time was determined for all of the formulations. Wetting time of all the formulation were more than 45 sec, except CP5 (6%w/w) having the wetting time 35sec was less compared to all formulations due to its rapid water absorbing nature involving both capillary and swelling mechanisms of crospovidone.

Disintegration time is an important criterion for selecting an optimum orally disintegrating tablet formulation. It was observed that increasing the superdisintegrant concentration from 4 to 8% resulted in a decrease in DT as depicted. CCS3, CP6 and SSG9 batches having the lower disintegrating time as compared to other formulation but these batches did corss the friability limit, so while considering friability and disintegrating time CP5 batch having 6% concentration was optimized batch with 25 sec disintegrating time and 0.94% friability.

Water absorption ratio, 'R,' of formulations containing SSG and CCS were greater than that of CP containing formulations and SSG demonstrated greater 'R' values compared to CCS. Water absorption ratio 'R' increased with an increase in superdisintegrants' concentrations from 4-8 % .A linear relationship was observed for each of the superdisintegrant types. The increase in 'R' was most likely due to increased water uptake capacity of the superdisintegrants at higher concentrations.

***In Vitro* Release Studies**

Dissolution methods for orally disintegrating tablets are similar to approaches taken for conventional tablets, unless taste masking is required. All of the orally disintegrating tablet formulations released more than 90.0% of the drug within 15 min. CP5 (6%) batch having 6% released 99.45% drug within 15 min whereas the marketed cinnarizine formulation released 75.2% in the same period. In Vitro Disintegration Time Considering wetting time, 'R' value, in vitro DT, %friability and cumulative % drug released, formulations containing CP5 (6%) was considered to be better than those containing CCS and SSG. CP5 (6%) was considered as the optimal orally disintegrating tablet formulation among all of the 9 formulations tested in this study.

Differential Scanning Calorimetric (DSC)

Drug-excipients compatibility was evaluated using a differential scanning calorimeter. Samples were collected prior to mixing, during mixing and after compression. The endotherms of pure drug and excipients were recorded separately, as a physical mixture and in the compressed form. No shifts in the melting endotherms were noted. These results indicate that the drug is compatible with the excipients used and does not undergo any change during processing.

Stability study

Short term stability study orally disintegrating tablet of cinnarizine was carried out for 1 month at specified condition. All the data are mentioned in the Table 3. Stability study revealed that no any major changes taken place throught the stability study for three months so we can say that the formulation having the good stability**.**

CONCLUSION

In Vitro Disintegration Time Considering wetting time, 'R' value, in vitro DT, %friability and cumulative % drug released, formulations containing CP5 (6%) was considered to be better than those containing CCS and SSG. CP5 (6%) was considered as the optimal orally disintegrating tablet formulation among all.

REFERENCES

1. Lindgren S, Janzon L. (1993) Dysphagia: Prevalence of swallowing complaints and clinical finding. *Med Clin North Am*, **77**:3-5.

2. Sastry SV, Nyshadham JR, Fix JA. (2000) Recent technological advances in oral drug delivery: A review. *Pharm Sci Technol Today*, **3**:138-45.

3. Fu Y, Yang S, Jeong SH, Kimura S, Park K. (2004) Orally fast disintegrating tablets: Developments, technologies, taste-masking and clinical studies. *Crit Rev Ther Drug Carrier Sys*, **21**:433-76.

4. Virely, P., & Yarwood, R. (1990, February). Zydis—a novel, fast dissolving dosage forms. Maniac., *Chem*. 36–37.

5. S.K.Battu, Michael A. Repka, Madhusudan Rao Y Formulation and Evaluation of Rapidly Disintegrating Fenoverine Tablets (2007) Effect of Superdisintegrants, *Drug Development and Industrial Pharmacy*, **33**:1225–1232.

6. Song, Y., Wang, Y., Thakur, R., Meidan, V. M., & Michniak, B. (2004) Mucosal drug delivery: Membranes, methodologies, and applications. *Crit. Rev. Ther. Drug Carrier Syst,* **21(3)**, 195–256.

7. Saracco G, C. E. (1993). In Dobrosielski-Vergogna (Ed.), Biology of the salivary glands (pp. 11–14). Boca Raton: CRC Press.

8. Rossi, S., Sandri, G., & Caramella, C. (2005). Buccal drug delivery: A challenge already won? *Drug Discovery Today: Technologies* **2(1)**, 59–65.
9. Lack, F. O. (May 2002) "Maternal Susceptibility to Nausea and Vomiting of Pregnancy: Is the Vestibular System Involved?" *American Journal of Obstetrics and Gynecology 185,* **Supplement 5**: S204-S209.
10. os, J. E., W. Bles, and B. de Graaf. (May 2002) "Eye Movements to Yaw, Pitch, and Roll About Vertical and Horizontal Axes: Adaptation and Motion Sickness." *Aviation, Space, and Environmental Medicine* **73,** 434-444.
11. Hamid, Mohamed, (2002) MD, PhD, and Nicholas Lorenzo, MD. "Dizziness, Vertigo, and Imbalance." *eMedicine* September 17,
12. Indian Pharmacopoeia, (1996) 4th edition, Ministry of Health and Family

Welfare, Govt. of India. The controller of publications, New Delhi.: A-54.
13. Lachman.L, Lieberman.A, Kinig.J.L. (1991) The Theory and Practice of Industrial Pharmacy, 4th edition, Varghese Publishing House, Bombay. 67-68.
14. Battu SK, Repka MA, Majumdar S, Rao MY. (2007) Formulation and evaluation of rapidly disintegrating tablet Fenoverine tablets: Effect of superdisintegrants. *Drug Dev Ind Pharm*, **33**:1225–1232.
15. Gohel, M., Patel, M., Amin, A., Agrawal, R., Dave, R., & Bariya, N. (2004). Formulation design and optimization of mouth dissolve tablets of nimesulide using vacuum drying technique. *AAPS Pharm. Sci. Tech.,* **5(3)**, e36.
16. British pharmacopoeia (2005), the stationary office of the medicine and healthcare products regulatory agency, Great Briton, **Volume-1**:695-697
17. Bi, Y., Sunada, H., Yonezawa, Y., Danjo, K., Otsuka, A., & Iida, K. (1996). Preparation and evaluation of a compressed tablet rapidly disintegrating in the oral cavity. *Chem. Pharmaceut. Bull. (Tokyo),* **44(11)**, 2121–2127.
18. Adel M, Aly M, Semreen A, Mazen K. (2005) "Superdisintegrants for solid dispersion toproduce rapidly disintegrating tenoxicam tablets via camphor sublimation", *Pharm Tech*.,**4**:23-25.
19. Klancke J. Dissolution testing of orally disintegrating tablets. (2003) *Dissolution Technol,* **10(2)**: 6-8.
20. Mishra DN, Bindal M and Singh SK. (2004) "Rapidly disintegrating oral tablet of valdecoxib", *Indiandrug*, 41**(9)**: 554...
21. Chaudhari PD, Chaudhari SP, Lanke SD, Patel N. (2007) "Formulation and *in vitro* evaluation of taste masked orodispersible dosage form of Levocetirizine", *Indian J Pharm Educ Res*., **41**:319-28.
22. Seager H. (1998) "Drug delivery products and the zydis fast dissolving dosage forms", *J Pharm Phamacol*., **50(4)**: 375-382.
23. Chang, R.-K., Guo, X., Burnside, B. A., & Couch, R. A. (2000). Fast-dissolving tablets. *Pharm. Technol*., **24(6)**, 52–59.

Table: 1 Quantitative Composition of Cinnarizine Orally Disintegrating Tablets (Mg/Tablet)

FORMULATION CODE	CCS 1	CCS 2	CCS 3	CP 4	CP 5	CP 6	SSG 7	SSG 8	SSG 9
Drug	25	25	25	25	25	25	25	25	25
Avicel PH 102	15	15	15	15	15	15	15	15	15
Cross carmellose sodium	4	6	8	-	-	-	-	-	-
Crospovidone	-	-	-	4	6	8	-	-	-
Sodium starch glycolate	-	-	-	-	-	-	4	6	8
Aspartame	1	1	1	1	1	1	1	1	1
Flavour (pipermint oil)	1	1	1	1	1	1	1	1	1
Aerosil	1	1	1	1	1	1	1	1	1
Sodium stearyl fumarate	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Pearlitol SD 200	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Total Weight (100 mg.)	100	100	100	100	100	100	100	100	100

Table 2: Evaluation Parameters of Orally Disintegrating Tablets of Cinnarizine

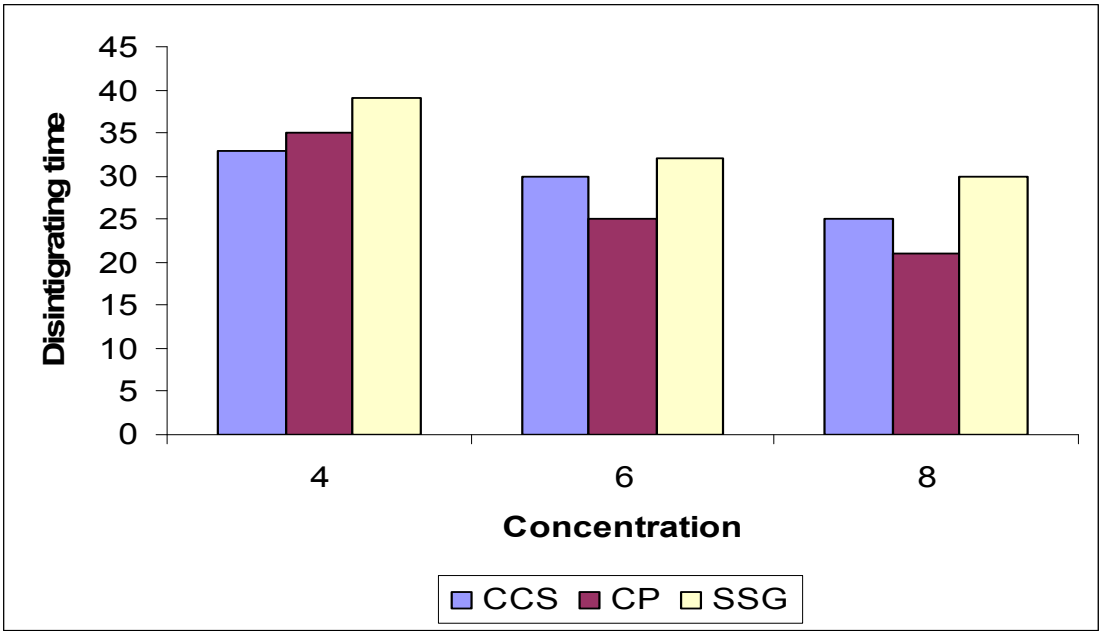
Batch No.	Weight Variation (mg) (N=20)	Thickness Variation (mm) (N=20)	Hardness variation Kg/cm2 (N=10)	Diameter variation (mm) (N=10)	Drug content (N=20)
CCS1	100.25±0.01	3.1±0.1	3.0±0.5	6.1	99.34±0.5
CCS2	99.85±0.02	3.0±0.1	3.0±0.5	6.1	97.15±0.3
CCS3	100.02±0.03	3.2±0.1	3.0±0.5	6.1	99.52±0.21
CP4	100.56±0.02	3.1±0.1	3.0±0.5	6.1	98.76±0.11
CP5	**100.35±0.03**	**3.1±0.1**	**3.0±0.5**	**6.1**	**99.45±0.25**
CP6	99.89±0.02	3.1±0.1	3.0±0.5	6.1	97.85±0.56
SSG7	99.76±0.01	3.2±0.1	3.0±0.5	6.1	98.25±0.32
SSG8	100.21±0.02	3.3±0.1	3.0±0.5	6.1	96.03±0.48
SSG9	100.10±0.02	3.2±0.1	3.0±0.5	6.1	97.56±0.12

Table 3: Evaluation Parameters of Orally Disintegrating Tablets of Cinnarizine

Batch No.	Friability (%) N=20	Disintegrating Time (sec) N=6	Wetting time (sec) (N=6)	Water absorption ratio	Q_{15}
CCS1	0.62±0.1	33±1	47±2	140	91.95±0.21
CCS2	0.91±0.0.5	30±1	48±4	152	95.14±0.60
CCS3	1.60±0.1	25±2	57±1	160	96.08±0.84
CP4	0.65±0.02	35±1	46±3	91	92.86±2.35
CP5	**0.94±0.01**	**25±2**	**35±2**	**105**	**95.60±0.81**
CP6	1.62±0.05	21±1	55±3	110	96.63±0.67
SSG7	0.53±0.04	39±1	49±1	149	91.82±0.45
SSG8	0.82±0.05	32±1	54±2	191	94.36±0.63
SSG9	1.40±0.1	30±1	44±2	202	95.29±0.12

Table 4: Stability Parameter Orally Disintegrating Tablets of Cinnarizine

Parameters	Initial	1 week	2 week	3 week	4 week
Hardness	3.0±0.5	3.0±0.5	3.0±0.5	3.0±0.5	3.0±0.5
Disintegrating time(sec)	25	27	30	31	35
Wetting time(sec)	35	40	42	49	51
Dissolution(%CPR)	95.60	92.30	91.10	85.32	82.1
F2 value		71.45	56.43	59.44	51.93



Figures 1 : Comparative profile of disintegrating time of ODT of Cinnarazine

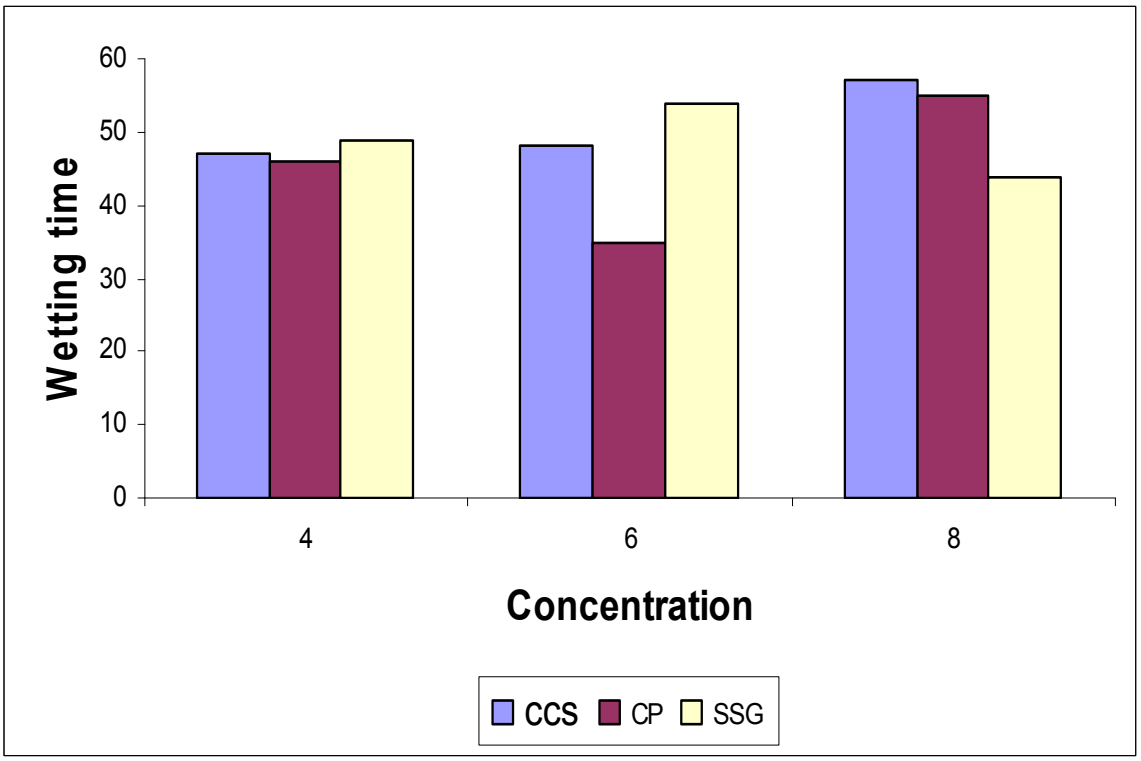


Figure 2: Comparative profile of wetting time of ODT of Cinnarazine

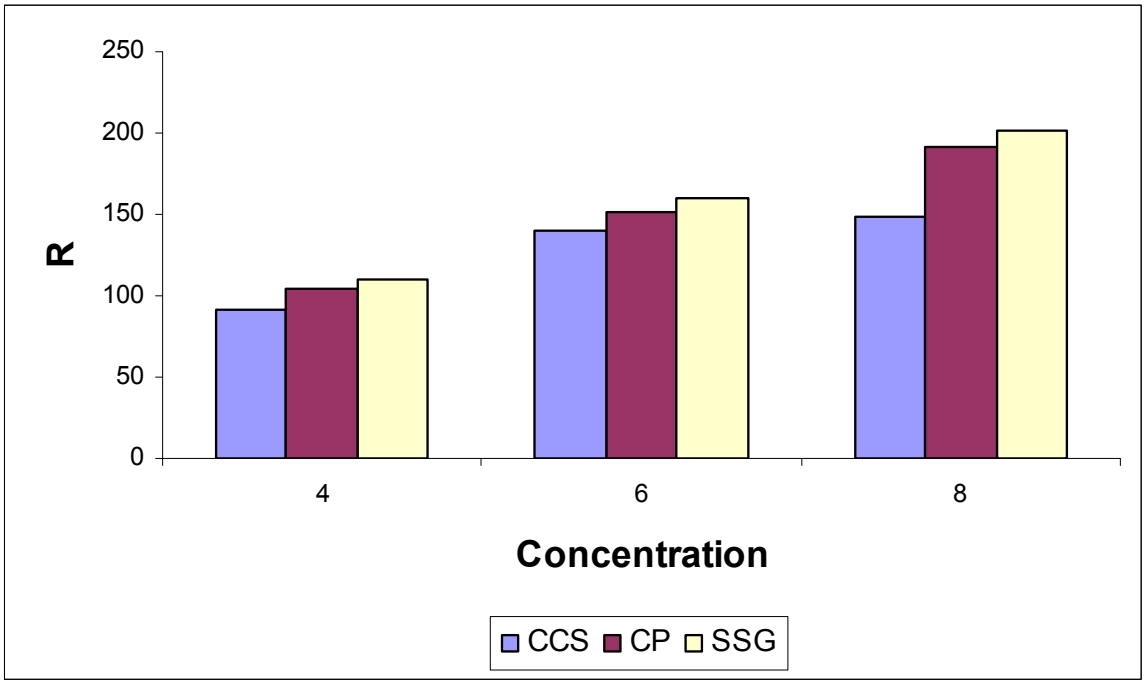


Figure 3: Comparative profile of water absorption ratio of ODT of Cinnarazine

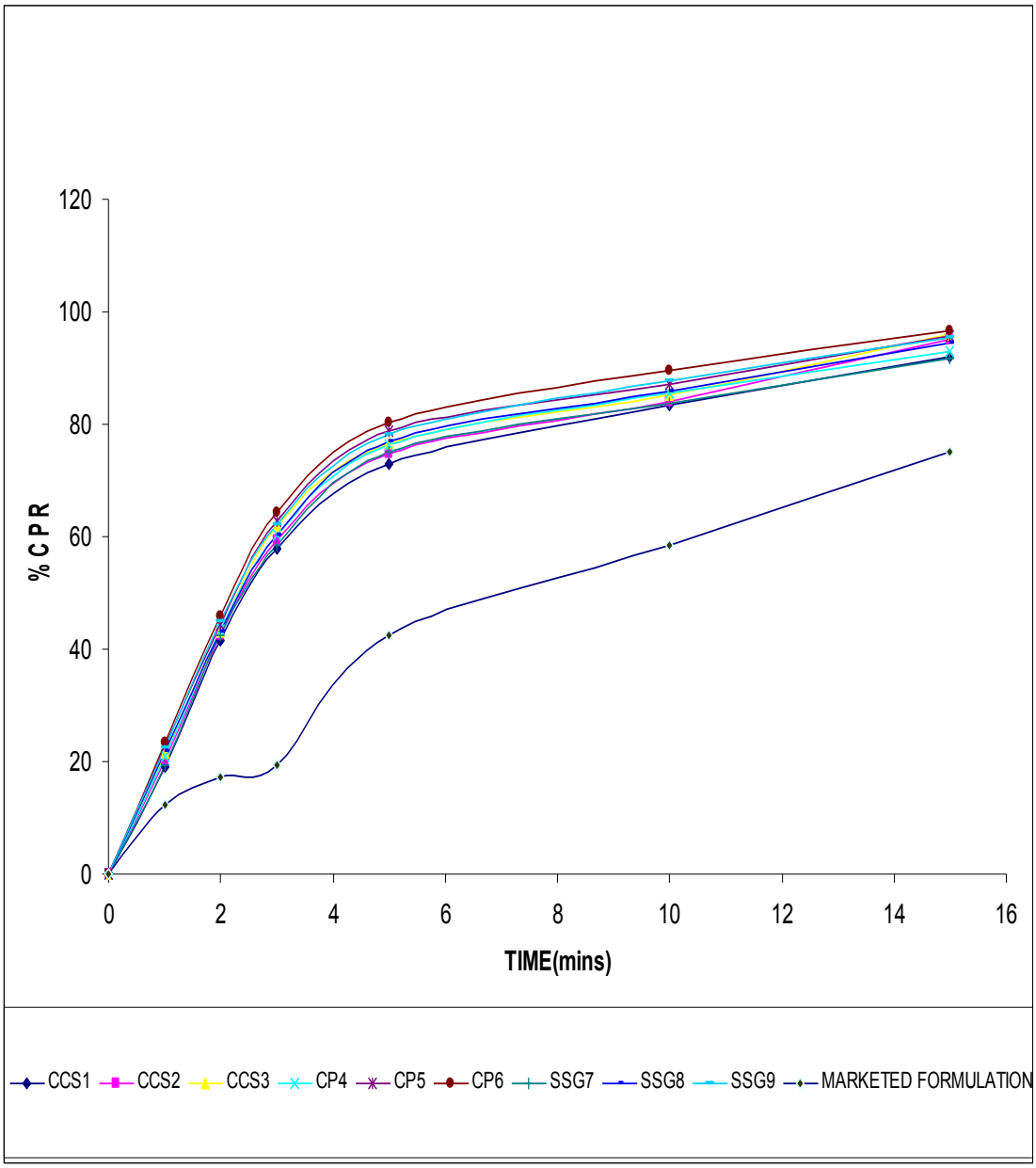


Figure 4: Comparative profile of dissolution study of ODT of Cinnarazine with marketed formulation (Conventional)

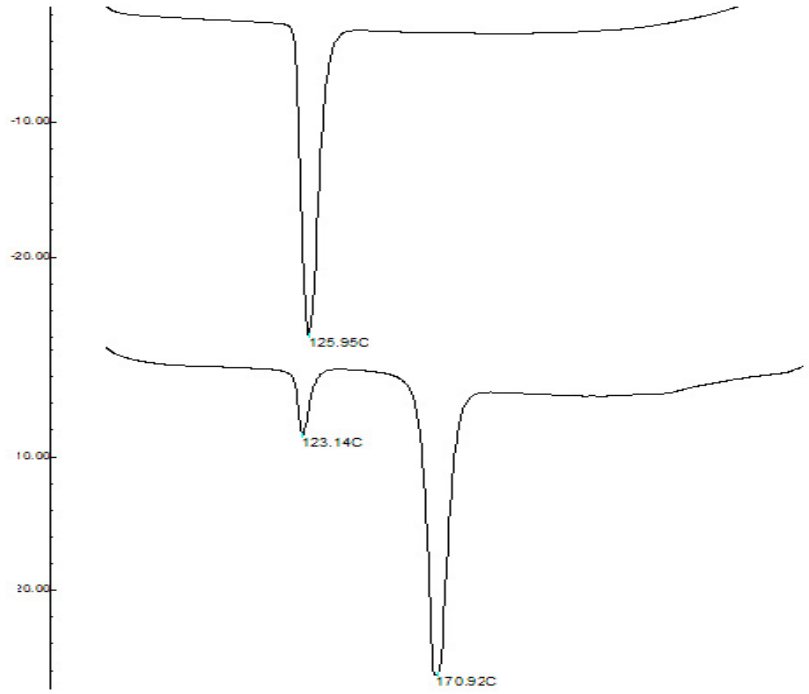


Figure 5 DSC study of ODT formulation