International Journal of Research in Pharmacy and Life Sciences

Journal Home Page: www.pharmaresearchlibrary.com/ijrpls

Research Article **Open Access**

Design and Evaluation of Effect of Disintegration Agents in Ciprofloxacin Hydrochloride

Pudi Venkata Prasad*[1], Kavitha G[2], Adapa Sivarami Reddy[3]

[1]*Nimra College of Pharmacy, 4-90 Nimra Nagar, Ibrahimpatnam, Vijayawada, Andhra Pradesh, India-521456*
[2]*Department of Pharmaceutics, Seshachala College of Pharmacy, Puttur, Chittoor, Andhra Pradesh, India-517 583*
[3]*Vignan Pharmacy College, Vadlamudi post, Chebrolu Mandal, Guntur, Andhra Pradesh, India-522213*

A B S T R A C T

Drug release from a solid dosage form can be enhanced by addition of suitable disintegrants. In more recent years, increasing attention has been paid to formulating fast dissolving and/or disintegrating tablets that are swallowed, but also orally disintegrating tablets that are intended to dissolve and/or disintegrate rapidly in the mouth. Superdisintegrants are generally used at a low level in the solid dosage form, typically 1-10 % by weight relative to the total weight of the dosage unit. Examples of super disintegrants are croscarmellose sodium, crospovidone, sodium starch glycolate that represent example of cross-linked cellulose, cross-linked polymer and a cross-linked starch respectively. The stronger the binder, the more effective must be the disintegrating agents in order for the tablet to release its medication. Ciprofloxacin hydrochloride, a synthetic fluoroquinolone, it is a bactericidal agent having a mode of action was achieved through inhibition of DNA gyrase, is an essential component of the bacterial DNA replication system. Pre-compressional characteristic of Ciprofloxacin HCl Tablets Using FA as disintegrants for various batches like FA, FB, FC, FD, FE, includes the formulation FA 1 to FA 3 having the angle of repose value 26.56 to 29.47, Bulk Density values 0.3832 to 0.3850, The Tap density values 0.4466 to 0.4566, Compressibility Index values 14.0999 to 15.1992, Hausner ratio values contain 1.1641 to 1.1792. The FB batches disintegrants FB 1 to FB 3 having the angle of repose value 28.19 to 29.31, Bulk Density values 0.3421 to 0.3575, The Tap density values 0.3981 to 0.4041, Compressibility Index values 6.5789 to 15.3427, Hausner ratio values contain 1.0704 to 1.1812. The disintegration and dissolution profile and also perform stability studies for various disintegrants.

Keywords: Disintegration Agents, Ciprofloxacin Hydrochloride, Disintegration, Dissolution, Stability studies.

A R T I C L E I N F O

CONTENTS

Article History: Received 25 January 2016, **Accepted** 29 March 2016, **Available Online** 24 May 2016

***Corresponding Author**
Pudi Venkata Prasad
Nimra College of Pharmacy,
Ibrahimpatnam, Vijayawada,
Andhra Pradesh, India-521456
Manuscript ID: IJRPLS2910

PAPER-QR CODE

Citation: Pudi Venkata Prasad, *et al.* Design and Evaluation of Effect of Disintegration Agents in Ciprofloxacin Hydrochloride. *Int. J. Res. Pharm, L. Sci*., 2016, 4(1): 05-18.

Copyright© 2016 Pudi Venkata Prasad, *et al.* This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

1. Introduction

Despite increasing interest in controlled-release drug delivery systems, the most common tablets are those intended to be swallowed completely and to disintegrate and release their medicaments rapidly in the gastrointestinal tract. The proper choice of disintegrants and its consistency of performance of critical importance to the formulation development of such tablets. Drug release from a solid dosage form can be enhanced by addition of suitable disintegrate. In more recent years, increasing attention has been paid to formulating fast dissolving and/or disintegrating tablets that are swallowed, but also orally disintegrating tablets that are intended to dissolve and/or disintegrate rapidly in the mouth. Disintegrants are substances or mixture of substances added to the drug formulation that facilitate the breakup or disintegration of tablet or capsule content into smaller particles that dissolve more rapidly than in the absence of disintegrants[1].

Superdisintegrants are generally used at a low level in the solid dosage form, typically 1-10 % by weight relative to the total weight of the dosage unit. Examples of super disintegrants are croscarmellose sodium, crospovidone, sodium starch glycolate which represent example of cross-linked cellulose, cross-linked polymer and a cross-linked starch respectively. The emphasis on the availability of drug highlights the importance of the relatively rapid disintegration of a tablet as a criterion for ensuring uninhibited drug dissolution behavior. Number of factors affects the disintegration behavior of tablets. The development of fast dissolving or disintegrating tablets provides an opportunity to take an account of tablet disintegrants. Recently new materials termed as superdisintegrant have been developed to improve the disintegration processes. Selecting appropriate formulation excipients and manufacturing technology can obtain the design feature of fast disintegrating tablet. The disintegrants have the major function to oppose the efficiency of the tablet binder and the physical forces that act under compression to form the tablet. The stronger the binder, the more effective must be the disintegrating agents in order for the tablet to release its medication [2]. Ideally, it should cause the tablet to disrupt, not only into the granules from which it was compressed, but also into powder particles from which the granulation was prepared.

Ciprofloxacin hydrochloride, a synthetic fluoroquinolone, it is a bactericidal agent having a mode of action was achieved through inhibition of DNA gyrase, is an essential component of the bacterial DNA replication system. Inhibition of the alpha subunit of the DNA gyrase blocks the resealing of the nicks on the DNA strands induced by this alpha subunit, leading to the degradation of the DNA by exo-nucleases. This bactericidal activity persists not only during the multiplication phase, but also during the resting phase of the bacterium [3]. It is mainly sued for the treatment of patients with the following infections caused by susceptible strains of the indicated Respiratory Tract Infection, Acute exacerbation of chronic bronchitis caused by H. influenzae, M. catarrhalis, S. pneumoniae. Acute pneumonia caused by: E. cloacae, E. coli, H. influenzae, K. pneumoniae, P. mirabilis, P. aeruginosa, S. aureus, S. pneumonia.

2. Materials and Methods

Ciprofloxacin Hydrochloride is a gift sample of Intex lab Pvt Ltd, Stach (Lab chem. fine chemicals Mumbai), Croscaramellose Sodium (Fischer Ltd, Chennai), Sodium Starch Glycolate (Maral Labs, Chennai), Magnesium stearate (Lab chem labs, Mumbai), Anhydrous lactose (Jain Enterprises Chennai), Aerosil (Lab Chemical Ltd, Chemical), Talc (Lab chem Chennai), Polyvinyl pyrolidine (Fischer Ltd Chennai) and all other chemicals & Solvents used were of analytical grade.

Methodology:

Formulation: Quantity sufficient of Ciprofloxacin hydrochloride for a batch of 50 tablets was separately mixed to ensure complete mixing. A tablet containing 500 mg equivalents to ciprofloxacin was compressed. The tablets were prepared by following the General Methodology as given below, All ingredients were weighed and passed through 40# sieve, blended in a Poly Bag except Magnesium Stearate for 10 minutes. Mix half the part of the disintegrant with the above mixture after passing through the sieve [4]. The resultant mixture was wet massed using suitable binder (qs) for granulation. This wet mass was passed through 20# sieve in order to form granules. These granules were dried and the dried granules were passed through 30# sieve. These dried granules were lubricated with Magnesium stearate, which was previous, passed through 60# Sieve. The lubricated granules were punched to tablets using single punching machine.

Pre-Formulation Studies

Drug-excipients compatibility studies: Compatibility of drug with excipients was determined by FTIR using kBr pellet technique, in the wavelength region of 4000-400cm^{-1}.

Angle of Repose:

The flow property was determined by measuring the Angle of Repose. In order to determine the flow property, the Angle of Repose was determined. It is the maximum angle that can be obtained between the free standing surface of a powder heap and the horizontal plane [5].

$$\Theta = \tan^{-1} (h/r)$$

Where, h = height

r = radius

θ = angle of repose

Compressibility Index: The flow property was determined by measuring the compressibility index (I) (flow ability). A simple indication of the case with which a material can be induced to flow is given by application of a compressibility index (I) given by equation [5].

$$I = [1 – (V/V_0)] \times 100$$

Where 'V' the volume occupied by a sample of the power after being subjected to a standardized tapping procedure (after 500 vibrations) and 'V_0' in the volume before tapping.

Hausner's Ratio: Hausner's ratio was determined as the ratio between the tapped density to that of the bulk density.

Hausner's ratio = Tapped Density / Bulk Density

Evaluation of Post-Compression Characteristics: The following evaluation of tablets was performed.

Drug content:

The estimation of drug content for ciprofloxacin tablets was performed by crushing three tablets and quantity equivalent to 45mg was taken and determined using 0.1M HCl using UV spectrophotometer at about 276nm.

Weight Variation:

The USP weight variation test was run by weighing 20 tablets individually, calculating the average weight, and comparing the individual tablet weights to the average. The tablets met the USP tests that were not more than 2 tablets were outside the percentage limit and no tablets differed by more than 2 times the percentage limit [6].

Hardness:

Hardness of the tablets was determined by breaking it between the second and third fingers with thumb being as a fulcrum. There was a sharp snap the tablet was deemed to have acceptable strength [7]. Stokes Monsanto Hardness Tester determined hardness of the tablets and the hardness should be found within the range of 3.5-5.5 kg/cm².

Friability:

Roche Friablator determined the friability of tablets. 20 tablets were taken and weighed. After weighing the tablets were placed in the Roche Friablator and subjected to the combined effects of abrasion and shock by utilizing a plastic chamber that revolves at 25RPM for minutes dropping the from a distance of six inches with each revolution. After operation the tablets were de-dusted and reweighed [8]. Friability is determined by

F=100(1-Wo/Wt)

Where

Wo= wt. of tablets before friability test, Wt= wt. of tablets after friability test.

Content Uniformity:

In this test, 30 tablets were randomly selected contained for sample, and 10 the tablets Ciprofloxacin Hydrochloride contain not less than 98.0 per cent and not more than 102.0 per cent [9].

Thickness:

The thickness of a tablet was the only dimensional variable related to the process. 10 tablets were measured for their thickness and diameter with a Caliper, Thickness Gauge. Average thickness and diameter were calculated [10].

Disintegration Test:

Disintegration time is considered to be one of the important criteria in selecting the best formulation. For most tablets, the first important step toward solution is break down of tablet into smaller particles or granules, a process known as disintegration. Place one tablet into each tube, suspend the assembly in to the 1000ml beaker containing water maintained at 37 ± 2oC, and operate the apparatus for 30 seconds. Remove the assembly form the liquid. Observe the tablets, if one or two tablets fail to disintegrate completely; repeat the test on 12 additional tablets [11].

***In-Vitro* Drug Release Studies:**

In our case to study the release kinetics of drug we used USP II apparatus (Paddle type, 2) with 900 ml**,** pH 6.8 phosphate buffer as the dissolution medium. The paddle was rotated 50 rpm, 5ml of aliquots were withdrawn at pre-determined time intervals, and an equal amount of thee medium was replaced to maintain sink conditions. The aliquots were diluted suitably and the amount of drug(s) released was determined spectrophotometrically using U.V. at wavelength 271 nm [12].

Stability Studies:

Selected formulation were subjected to stability studies as per ICH guidelines sample were taken and analyzed at time interval of 15 days for 3 months [13].

3. Results and Discussion

FT-IR Spectrums

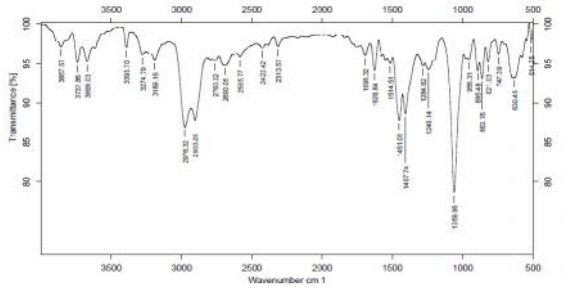

Figure 2: FTIR Spectrum of Pure Ciprofloxacine HCL

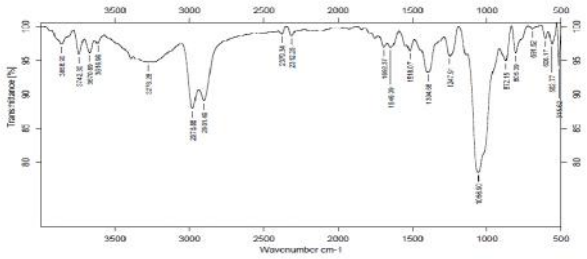

Figure 3: FTIR Spectrum of S odium starch glycolate

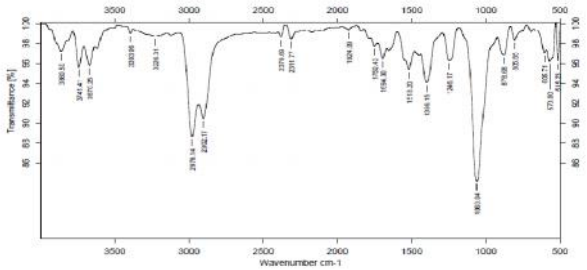

Figure 4: FTIR Spectrum of Crospovidone

Evaluation of blend characteristics:

Ciprofloxacin hydrochloride Tablet was prepared by using wet granulation method. The Formulated Ciprofloxacin tablet were evaluated for Pre-formulation parameters like

angle of repose, bulk density, tapped density, Compressibility index and Hausner's Ratio. The angle of repose of prepared Ciprofloxacin Hcl tablet was in the range of 20°-30°. Normally if the value falls between 20°-30°, it shows good flow property. The bulk density and tapped density were found to be in the range of 0.37 to 0.38 g/cm^3 and 0.44 to 0.45 g/cm^3 respectively. A Hausner ratio was within the range of 1.16 to 1.17, lesser than 1.25 is considered to be an indication of good flow property. The compressibility index was within the range of 5-15 hence falls within the excellent range.

The pre-formulation characteristics results for all the formulation of ciprofloxacin HCl tablets using FB as disintegrating agent found to be within the range, compressibility index for FB1 and FB3 was found to be within good range of 12-16 were as FB2 was in excellent range. The angle of repose of prepared tablet was in the range of 20°-30°. Normally if the value falls between 20°-30°, it shows good flow property. The bulk density and tapped density were found to be in the range of 0.34 to 0.36 g/cm^3 and 0.39 to 0.40 g/cm^3 respectively. A Hausner ratio was within the range of 1.07 to 1.18, lesser than 1.25 is considered an indication of good flow property. The compressibility index was within the range of 5-15 hence falls within the excellent range. The results were tabulated in table 9.

The pre-formulation characteristics results for all the formulation of ciprofloxacin HCl tablets using FC as disintegrating agent found to be within the range, angle of repose and compressibility index was found to be within good range. The angle of repose of prepared ciprofloxacin hydrochloride tablet was in the range of 20°-30°. Normally if the value falls between 20°-30°, it shows good flow property. The bulk density and tapped density were found to be in the range of 0.35 to 0.36 g/cm^3 and 0.39 to 0.41 g/cm^3 respectively. A Hausner ratio was within the range of 1.08 to 1.18, lesser than 1.25 is considered to be an indication of good flow property. The compressibility index was within the range of 5-15 hence falls within the excellent range. The results were tabulated in table 10.

The formulation of ciprofloxacin HCl using 4% B.C disintegrants found to be within the limits for both FD1 and FD2 and falls in good range. The angle of repose of prepared ciprofloxacin tablet was in the range of 20°-30°. Normally if the value falls between 20°-30°, it shows good flow property. The bulk density and tapped density were found to be in the range of 0.36 to 0.38 g/cm^3 and 0.40 to 0.41 g/cm^3 respectively. A Hausner ratio was within the range of 1.07 to 1.16, lesser than 1.25 is considered to be an indication of good flow property. The compressibility index was within the range of 5-15 hence falls within the excellent range. The results were tabulated in table 11.

The angle of repose of prepared ciprofloxacin HCl using FE as disintegrants was in the range of 20°-30°. Normally if the value falls between 20°-30°, it shows good flow property. The bulk density and tapped density were found to be in the range of 0.36 to 0.37 g/cm^3 and 0.340 to 0.41 g/cm^3 respectively. A Hausner ratio was within the range of 1.10 to 1.11, lesser than 1.25 is considered to be an indication of good flow property. The compressibility index was within the range of 5-15 hence falls within the excellent range. The results were tabulated in table 12.

The disintegration time of the entire Formulated batch varies with change in concentration of disintegrating agents from few seconds to several minutes. Formulations FD2 and FE2 disintegrated within 3 min and found to be more effective. The disintegration time of the tablets using different disintegrants decreases in the following order Starch > CCS > SSG > Bharat coats. It is observed that, when BC is used as disintegrant, tablets disintegrate rapidly with in less time compared to other tablets prepared using croscarmellose sodium, starch and sodium starch glycolate disintegrants. Though tablets prepared by intra and extra granulation method found to be more effective in comparison with formulation prepared by only extra granulation. When concentration of Starch, SSG, CCS and BC is increased, the disintegration time was reduced significantly.

In-Vitro drug release studies were conducted for the formulation using USP dissolution apparatus type-II (paddle), at 50 rpm. The percentage of drug release was determined at a time interval of 0, 5, 10, 15, 20, 25, 30 min and at the end of 30 min it was found in the range 80-95% using FC as disintegrants.

In-Vitro drug release studies were conducted for the formulation using USP dissolution apparatus type-II (paddle), at 50 rpm. The percentage of drug release was determined at an time interval of 0, 5, 10, 15, 20, 25, 30 min and at the end of 30 min it was found in the range 81-95% using 4% BC as disintegrants and 78-98% using 8% BC as disintegrants.

Stability Studies:

Drug molecules are of reactive naturally, the additives are considered to be inert substance but this may not be true for all additives in a formulations. Hence, in developing any formulation, when additive are selected the same must be super imposed on to drugs and with other additives present in the formulation, to see how compatible they are with the other formulation ingredients. There is not ready made answer for such situation and all that is possible is to "wait and watch", the method called "Real time study". As per ICH guide line for stability study, which advice the formulation to store their products at 30 ° c and 65 % RH to find out actual shelf life period or to assure the product quality free from unwanted interactions.

Real time study of ICH guidelines involves storage of products at 30°C & 65% RH for the complete proposed shelf life period, and analyzing the product sample every month in the first 3 months, every 3 months from 4th month onwards up to one year, every 6 month in the second year of storage, afterwards once in a year till shelf life is

completed. ICH guidelines also demands for storing samples at 40°C and 75% RH (stress condition or accelerated stability studies) for relatively short period of time (3-6 months) which depends on claimed shelf life period as well as the zone (zone 1/2/3/4 of the world) to which the product is meant to be exported. This later study (with stress conditions) is to mine the alternating climates condition during the shelf life of the product. The stability parameter for all the formulation were evaluated after 15, 30, 45, 60, and 90 days for 40 °C at 75% RH and the values were been tabulated in table given below.

Table 1: Formulation Table for Ciprofloxacin Hcl by Wet Granulation Technique

Formulation	FA1	FA2	FA3	FB1	FB2	FB3	FC1	FC2	FC3	FD1	FD2	FE1	FE2
Ciprofloxacin (mg)	500	500	500	500	500	500	500	500	500	500	500	500	500
Starch (%)	5	10	15	-	-	-	-	-	-	-	-	-	-
SSG (%)	-	-	-	4	5	6	-	-	-	-	-	-	-
CCS (%)	-	-	-	-	-	-	1	2	3	-	-	-	-
CP (%)	-	-	-	-	-	-	-	-	-	4	8	4	8
Aerosil (%)	2	2	2	2	2	2	2	2	2	2	2	2	2
Lactose	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S
PVP (%)	5	5	5	5	5	5	5	5	5	5	5	5	5
Talc(%)	5	5	5	5	5	5	5	5	5	5	5	5	5
Magnesium Sterate (%)	3	3	3	3	3	3	3	3	3	3	3	3	3
TotalWeight (mg)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Table 5: FTIR Interpretations of Ciprofloxacin HCl

Observed peak	Characteristic peak	Bond	Functional Groups
Pure Drug – Ciprofloxacin HCl			
3669.03	3000-3700	O-H stretching	Monomeric alcohols, Phenol
2976-32	2700-3300	C-H Stretching	Hydrogen Bonds
1695.35	1600-1700	C=N Stretching	Aldehyde, Ketone, esters
1514	1500-1700	N-H Bending	Aromatic rings
1451	1300-1500	C-H Bend in plane	Alkenes
1284.82	1200-1500	O-H Bending	Amines
1059.86	1000-1400	C-F Stretch	Alcohol, Ethers
956.31	900-1300	C-O Stretch	Alkanes
895.48	800-1200	C-C Stretch	Alkanes
747.39	600-900	C-H Rocking	Alkanes
630.45	600-900	C-H Rocking	Alkanes
514.25	500-600	C-Br Stretching	Alkanes

Table 6: FTIR Interpretations of Sodium Starch glycolate

3670.89	3000-3700	O-H stretching	Monomeric alcohols & Phenol
2978.88	2700-3300	C-H Stretching	Hydrogen Bonds
1692.37	1500-1700	C=N Stretching	Aldehyde, Ketone, esters
1518	1500-1700	N-H Bending	Aromatic rings

1247.91	1200-1500	O-H Bending	Amines
1056.90	1000-1400	C-F Stretch	Alcohol, Ethers
872.15	600-900	C-H Rocking	Alkanes
515.62	500-600	C-Br Stretching	Alkanes

Table 7: FTIR Interpretations of Crospovidone

3670.25	3000-3700	O-H stretching	Monomeric alcohols & Phenol
2979.14	2700-3300	C-H Stretching	Hydrogen Bonds
1694.30	1500-1700	N-H Bending	Alkenes
1518.20	1500-1700	N-H Bending	Alkenes
1451	1300-1500	C-H Bend in plane	Alkenes
1246.17	1200-1500	Bending Plan	Amines
1060.04	1000-1400	C-F Bend in plane	Alcohol, Ethers
866.85	800-1200	C-H Rocking	Alkanes
606.71	600-900	C-H Rocking	Alkanes
515.25	500-600	C-Br Stretching	Alkanes

Table 8: Pre-compression characteristic of Ciprofloxacin Hcl Tablets Using FA as disintegrants

S.No	Formulation	Angle of repose	Bulk Density (gm/cm^3)	Tap Density (gm/cm^3)	Compressibility Index (%)	Hauser's ratio
1.	FA1	29.47	0.3872	0.4566	15.1992	1.1792
2.	FA2	28.44	0.3832	0.4461	14.0999	1.1641
3.	FA3	26.56	0.3850	0.4528	14.9734	1.1761

Table 9: Pre-compressional characteristic of Ciprofloxacin Hcl Tablets using FB as disintegrant

S.No	Formulation	Angle of repose	Bulk Density (gm/cm^3)	Tap Density (gm/cm^3)	Compressibility Index (%)	Hausner's ratio
1.	FB1	29º 31'	0.3421	0.4041	15.3427	1.1812
2.	FB2	28 º54'	0.3692	0.3952	6.5789	1.0704
3.	FB3	28 º 19'	0.3575	0.3981	10.1984	1.1135

Table 10: Pre-compression characteristic of Ciprofloxacin Hcl Tablets Using FC as disintegrate

S.No	Formulation	Angle of repose	Bulk Density (gm/cm^3)	Tap Density (gm/cm^3)	Compressibility Index (%)	Hausner's ratio
1.	FC1	27 ˚26'	0.3547	0.4189	15.3258	1.1809
2.	FC2	28 ˚78'	0.3689	0.4012	8.0508	1.0875
3.	FC3	27 ˚43'	0.3541	0.3964	10.6710	1.1194

Table 11: Pre compression characteristic of Ciprofloxacin Hcl Tablets using 4% and 8% FD1 and FD2 as disintegrant by intra and extra granulation method

S.No	Formulation	Angle of repose	Bulk Density (gm/cm^3)	Tap Density (gm/cm^3)	Compressibility Index (%)	Hausner's ratio
1.	FD1	27 º 37'	0.3618	0.4183	13.5070	1.1561
2.	FD2	28 º 11'	0.3856	0.4155	7.1961	1.0775

Table 12: Pre-compression characteristic of Ciprofloxacin HCL Tablets using 4% and 8% BC FE1 and FE2 as disintegrant by extra granulation method

S.No	Formulation	Angle of repose	Bulk Density (gm/cm^3)	Tap Density (gm/cm^3)	Compressibility Index (%)	Hausner's ratio
1.	FE1	28 º62'	0.3718	0.4128	9.9321	1.1102
2.	FE2	28 º41'	0.3684	0.4072	9.5284	1.1053

Table 13: Post-compressional characteristic of Ciprofloxacin Hcl Tablets Using FA as disintegrant

S.No	Formulation	Weight variation (mg)	Thickness (mm)	Diameter (mm)	Hardness (Kg/cm^2)	Friability (%)	Assay (%)
1.	FA1	Compiles	7.194	18.99	3.5-5.5	0.291	91.8263
2.	FA2	Compiles	7.29	19.06	3.5-5.5	0.386	93.1792
3.	FA3	Compiles	7.39	18.97	3.5-5.5	0.254	103.9458

Table 14: Post-compressional characteristic of Ciprofloxacin Hcl Tablets Using FB as disintegrant

S.No	Formulation	Weight variation (mg)	Thickness (mm)	Diameter (mm)	Hardness (Kg/cm^2)	Friability (%)	Assay (%)
1.	FB1	Compiles	7.194	18.99	3.5-5.5	0.291	91.8263
2.	FB2	Compiles	7.29	19.06	3.5-5.5	0.386	93.1792
3.	FB3	Compiles	7.39	18.97	3.5-5.5	0.254	103.9458

Table 15: Post-compressional characteristic of Ciprofloxacin Hcl Tablets Using FC as disintegrant

S.No	Formulation	Weight variation(mg)	Thickness (mm)	Diameter (mm)	Hardness (Kg/cm^2)	Friability (%)	Assay (%)
1.	FC1	Compiles	7.251	17.96	3.5-5.5	0.314	98.6604
2.	FC2	Compiles	7.564	18.42	3.5-5.5	0.389	99.8846
3.	FC3	Compiles	7.387	18.55	3.5-5.5	0.296	98.8863

Table 16: Post-compressional characteristic of Ciprofloxacin Hcl Tablets Using 4% and 8% FD as disintegrant by intra and extra granulation method

S.No	Formulation	Weight variation (mg)	Thickness (mm)	Diameter (mm)	Hardness (Kg/cm^2)	Friability (%)	Assay (%)
1.	FD1	Compiles	7.27	19.11	3.5-5.5	0.214	98.4771
2.	FD2	Compiles	7.39	19.27	3.5-5.5	0.296	99.2737

Table 17: Post-compressional characteristic of Ciprofloxacin Hcl Tablets using 4% and 8% FE as disintegrant by extra granulation method

S.No	Formulation	Weight variation (mg)	Thickness (mm)	Diameter (mm)	Hardness (Kg/cm^2)	Friability (%)	Assay (%)
1.	FE1	Compiles	6.94	18.72	3.5-5.5	0.184	99.2401
2.	FE2	Compiles	7.05	18.92	3.5-5.5	0.213	98.1880

Table 18: Disintegration profile of Ciprofloxacin Hcl tablets Using FA as disintegrant

S.No	Formulation	With Disk			Without Disk		
		I	II	III	I	II	III
1.	FA1	11min 43 sec	10 min 30 sec	10min 52sec	14min 32 sec	15min 11sec	15min 48 sec
2.	FA2	8min 2sec	9min 33 sec	8min 18 sec	11min 14sec	12min 31 sec	11min 56 sec
3.	FA3	4min 41 sec	5min 8 sec	4min 55sec	9min 23sec	9min 51 sec	8min 50sec

Table 19: Disintegration profile of Ciprofloxacin Hcl tablets Using FB as disintegrant

S.No	Formulation	With Disk			Without Disk		
		I	II	III	I	II	III
1.	FB1	11min 41 sec	10min 21 sec	10min 54 sec	14min 11sec	14min 56sec	13min 34sec
2.	FB2	8min 43sec	9min 21sec	9min 5sec	12min 37sec	14min 12sec	12min 44sec
3.	FB3	4min 21sec	5min 32 sec	4min 13sec	7min 23sec	7min 47 sec	6min 43sec

Table 20: Disintegration profile of Ciprofloxacin Hcl tablets Using FC sodium as disintegrant

S.No	Formulation	With Disk			Without Disk		
		I	II	III	I	II	III
1.	FC1	9min 21sec	8min 55 sec	10min 12 sec	11min 15 sec	11min 24 sec	10min 55min
2.	FC2	7min 43sec	8min 11 sec	8 min 5sec	9min 22 sec	9min 17 sec	10 min 31 sec
3.	FC3	5min 22 sec	5min 42sec	6min 31sec	6 min 4 sec	7min 41sec	7min 18sec

Table 21: Disintegration profile of Ciprofloxacin Hcl tablets Using 4% and 8% FD

S.no	Formulation	With Disk			Without Disk		
		I	II	III	I	II	III
1.	FD1	4min 45 sec	4min 52 sec	3min 21sec	7min 19 sec	7min 47 sec	6min 14 sec
2.	FD2	2 min 51 sec	2min 11 sec	1min 33sec	3min 46sec	4min 23 sec	4min 11sec

Table 22: Disintegration Profile of Ciprofloxacin Hcl Tablets Using 4% and 8% FE

S.no	Formulation	With Disk			Without Disk		
		I	II	III	I	II	III
1.	FE1	4min 31sec	5min 55sec	4min 14sec	9min 50sec	8min 14sec	8min 19sec
2.	FE2	3min 11 sec	2 min 47 sec	3min 17sec	5min 11sec	6min 42sec	5min 4 sec

Table 23: Dissolution profile of Ciprofloxacin Hcl tablets Using FA and FB as disintegrant

S.no	Time in minutes	FA			FB		
		FA1	FA2	FA3	FB1	FB2	FB3
1.	5	3.663	4.8583	3.2654	2.070	4.38048	6.8495
2.	10	6.8698	31.1685	25.9826	11.2415	7.6508	19.6706
3.	15	15.2504	42.0668	47.2150	26.8233	29.9889	39.2152
4.	20	25.6508	52.0822	53.3057	44.0336	43.2548	46.0933
5.	25	38.0535	61.2968	63.2946	53.6862	54.8747	62.8566
6.	30	48.0778	70.5070	73.7039	67.6774	68.8787	77.5911

Table 24: Dissolution profile of Ciprofloxacin Hcl tablets Using FC as disintegrant

S.no	Time in minutes	FC		
		FC1	FC2	FC3
1.	5	11.23	26.7610	38.7079
2.	10	29.6109	41.7260	44.8964
3.	15	42.057	52.08	70.0181
4.	20	45.7106	67.2703	80.1132
5.	25	71.2172	77.310	87.3367
6.	30	80.9163	87.7194	94.9429

Table 25: Dissolution profile of Ciprofloxacin Hcl tablets using FD and FE as disintegrant

S.no	Time in minutes	FD		FE	
		FD1	FD2	FE1	FE2
1.	5	3.2652	9.278	5.6548	14.57
2.	10	26.7787	29.9188	19.2260	37.24

3.	15	38.0584	45.60	40.0092	51.6597
4.	20	53.6526	71.8938	52.0712	64.6663
5.	25	71.2601	86.25	61.695	81.8765
6.	30	81.7110	95.95	78.8724	97.8986

Table 26: Stability studies of Ciprofloxacin Hcl using FB3 as disintegrant

S.No	Characteristics	$40^0C \pm 2^0C$, 75% ± 5%RH					
		Initial	**15days**	**30days**	**45days**	**60days**	**90days**
1	Description	White	compiles	compiles	compiles	compiles	compiles
2	Weight variation (mg)	compiles	compiles	compiles	compiles	compiles	compiles
3	Thickness (mm)	6.29	6.31	6.33	6.27	6.27	6.28
4	Diameter (mm)	19.12	18.57	19.03	18.97	18.74	18.77
5	Hardness (kg/cm^2)	3	3	3	3	3	3
6	Friability (%)	0.296	0.21	0.29	0.11	0.174	0.112
7	Assay (%)	97.14	97.11	97.12	98.84	99.14	98.58
8	Disintegration (With disk)	4min 38 sec	4min 19 sec	4 min 21 sec	4min 44sec	3min 53sec	4min 12 sec
9	Disintegration (Without disk)	7min 5sec	7min 15sec	6min 55sec	6min 32 sec	6min 11sec	6min 18sec
10	Dissolution (% drug released)	77.01	78.92	79.01	76.64	78.12	79.32

Table 27: Stability studies of Ciprofloxacin Hcl using FC3 as disintegrant

S.No	Characteristics	$40^0C \pm 2^0C$, 75% ± 5%RH					
		Initial	**15days**	**30days**	**45days**	**60days**	**90days**
1	Description	White complies	compiles	Compiles	compiles	compiles	compiles
2	Weight variation (mg)	Compiles	compiles	Compiles	compiles	compiles	compiles
3	Thickness (mm)	6.28	6.24	6.21	6.27	6.26	6.27
4	Diameter (mm)	19.01	18.97	19.07	19.07	18.97	18.87
5	Hardness (kg/cm^2)	3	3	3	3	3	3
6	Friability (%)	0.29	0.17	0.13	0.09	0.01	0.01

7	Assay (%)	91.17	91.03	90.76	90.51	91.27	90.74
8	Disintegration (With disk)	5min 46 sec	5 min 30 sec	5min 57 sec	5min 17 sec	5min 14 sec	5min 4sec
9	Disintegration (Without disk)	8 min 11 sec	8 min 7sec	7min 54sec	7min 49sec	7min 11 sec	7min 12 sec
10	Dissolution (% drug released)	92.14	94.18	95.98	95.14	96.57	97.89

Table 28: Stability studies of Ciprofloxacin Hcl using FD1 as disintegrant

S. No	Characteristics	$40^0C \pm 2^0C$, 75% ± 5%RH						
		Initial	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**	**90 days**
1.	Description	White	compiles	compiles	compiles	compiles	Compiles	compiles
2.	Weight variation (mg)	compiles	compiles	compiles	compiles	compiles	Compiles	compiles
3.	Thickness (mm)	6.28	6.17	6.21	6.22	6.24	6.27	6.21
4.	Diameter (mm)	19.07	19.03	18.97	18.843	18.78	18.99	19.01
5.	Hardness (kg/cm^2)	3	3	3	3	3	3	3
6.	Friability (%)	0.29	0.22	0.18	0.15	0.17	0.1	0.05
7.	Assay (%)	98.97	98.32	99.18	99.57	99.04	99.78	98.56
8.	Disintegration (With disk)	2min 57 sec	3min 1 sec	2min 11 sec	2min 32 sec	2min 5 sec	2min 19sec	2min 02 sec
9.	Disintegration (Without disk)	4min 41 sec	4 min 11sec	3min 19 sec	3min 17 sec	3min 14 sec	4min 11 sec	3min 34sec
10	Dissolution (% drug released)	98.74	99.41	97.16	93.76	97.45	98.75	96.35

Table 29: Stability studies of Ciprofloxacin Hcl using FD2 as disintegrant

S. No	Characteristics	$40^0C \pm 2^0C$, 75% ± 5%RH						
		Initial	**15days**	**30days**	**45days**	**60days**	**75days**	**90days**
11	Description	White	compiles	compiles	compiles	compiles	compiles	compiles
12	Weight variation (mg)	compiles	compiles	compiles	compiles	compiles	compiles	compiles
13	Thickness (mm)	6.24	6.29	6.32	6.31	6.30	6.27	6.24
14	Diameter (mm)	19.17	19.38	19.03	18.97	18.88	18.91	18.94

15	Hardness (kg/cm^2)	3	3	3	3	3	3	3
16	Friability (%)	0.27	0.21	0.13	0.09	0.01	0.001	0.001
17	Assay (%)	97.43	97.56	97.97	96.54	97.14	96.87	96.32
18	Disintegration (With disk)	4min 14 sec	4min 35sec	3min 57 sec	3min 17sec	3min 04 sec	3min 2 sec	3min 14 sec
19	Disintegration (Without disk)	6min 21 sec	7min 57sec	6min 5 sec	5 min 17 sec	6min 2 sec	7 min 34sec	5min 11 sec
20	Dissolution (% drug released)	84.13	80.48	81.84	83.23	85.13	87.94	86.12

Table 30: Stability studies of Ciprofloxacin Hcl using FE1 as disintegrant

S. No	**Characteristics**	**$40^0C \pm 2^0C$, 75% ± 5%RH**						
		Initial	**15days**	**30days**	**45days**	**60days**	**75days**	**90days**
1	Description	White	compiles	compiles	compiles	compiles	Compiles	compiles
2	Weight variation (mg)	compiles	compiles	compiles	compiles	compiles	Compiles	compiles
3	Thickness (mm)	6.21	6.23	6.21	6.28	6.24	6.21	6.24
4	Diameter (mm)	18.74	19.03	18.97	18.95	18.87	18.86	19.01
5	Hardness (kg/cm^2)	3	3	3	3	3	3	3
6	Friability (%)	0.18	0.13	0.14	0.04	0.001	0.001	0.001
7	Assay (%)	99.19	98.74	98.47	98.25	97.54	98.24	97.41
8	Disintegration (With disk)	5min 14 sec	4min 54sec	4min 17sec	5min 2 sec	4min 32sec	4min 47sec	4min 11sec
9	Disintegration (Without disk)	9 min 13 sec	9min 36sec	8min 33sec	8min 53sec	8min 21sec	8min 47sec	7min 38sec
10	Dissolution (% drug released)	81.56	78.97	79.58	81.23	80.07	82.33	79.25

Table 31: Stability studies of Ciprofloxacin Hcl using FE2 as disintegrant

S. No	**Characteristics**	**$40^0C \pm 2^0C$, 75% ± 5%RH**						
		Initial	**15days**	**30days**	**45days**	**60days**	**75days**	**90days**
1	Description	White	compiles	compiles	compiles	compiles	Compiles	compiles
2	Weight	compiles	compiles	compiles	compiles	compiles	Compiles	compiles

	variation (mg)							
3	Thickness (mm)	6.22	6.28	6.27	6.24	6.21	6.28	6.23
4	Diameter (mm)	19.01	19.07	18.96	18.84	18.96	18.87	19.03
5	Hardness (kg/cm^2)	3	3	3	3	3	3	3
6	Friability (%)	0.96	0.11	0.15	0.08	0.09	0.12	0.05
7	Assay (%)	98.14	99.71	98.17	99.52	96.29	98.56	98.74
8	Disintegration (With disk)	3min 15 sec	4min 57 sec	3min 11 sec	3min 44 sec	3min 5sec	3min 47sec	3min 21sec
9	Disintegration (Without disk)	5min 55 sec	5min 14 sec	5min 14 sec	5min 55sec	5min 34sec	5min 21sec	5min 12sec
10	Dissolution (% drug released)	99.17	98.58	98.75	97.41	96.56	98.44	99.18

4. Conclusion

Selecting appropriate formulation excipients and manufacturing technology can obtain the design feature of fast disintegrating tablet. The disintegrants have the major function to oppose the efficiency of the tablet binder and the physical forces that act under compression to form the tablet. The stronger the binder, the more effective must be the disintegrating agents in order for the tablet to release its medication. Ideally, it should cause the tablet to disrupt, not only into the granules from which it was compressed, but also into powder particles from which the granulation was prepared. From this study, it is concluded that the disintegrants such as Starch, SSG, CCS was compared with crospovidone disintegrants and in this study crosprovidone disintegrants prepared by intra and extra granulation method was found to be the most effective as they disintegrate rapidly when compared to other disintegrants, and the percentage drug release shows a higher dissolution profile.

5. Acknowledgements

I would like thank my Principal Vignan Pharmacy College, Vadlamudi, Chebrolu Mandal, Guntur. Andhra Pradesh, India-522213. For his encouragement and kind suggestions to carry out my review, work successfully.

6. References

[1] Antony P J., Sanghavi NM. **1997**. 'A New Binder for Pharmaceutical Dosage Forms'. Drug. Dev. Ind. Pharm., 23(4):413-415.

[2] Bi Y., Sunada H., Yonezawa Y., **1996**. 'Preparation and evaluation of a compressed tablet rapidly disintegrating in the oral cavity'. Chem. Pharm. Bull., 44:2121-2127.

[3] Medwick T., Bailey LC. **1998**. 'A procedures for conducting open dish stability studies'. Pharm Forum., 24(6): 315-16.

[4] Alekha K., Charles Gayser., Hector Fausett., **2000**. 'Evaluation of Quick Disintegrating Calcium Carbonate Tablets'. AAPS Pharm.Sci.Tech., 1(3):20.

[5] Chaudhary K P R., Sujata Rao.,**1992**. 'Formulation and Evaluation of Dispersible tablets of poorly soluble drugs'. Indian J. Pharm. Sci., (2):31-32.

[6] Cohen Y., Lach JL., **1963**. 'Factors affecting the Effect of Disintegrating Agent'. J. Pharm. Sci., (52):122.

[7] E Sallam., Ibrahim H., R Abu Dahab., M. Shubair., Enam Khalil., **1998**. Drug.Dev and Industrial Pharmacy, Vol. 24, 6: 501–507.

[8] Garnpimol C., Ritthidej., Parichat Chomto., Sunibhond Pummangura., Piamsak Menasveta., **1994**. 'Chitin and Chitosan as Disintegrants in Paracetamol Tablets'. Drug Dev. Ind. Pharm., 20(13): 2109-2134.

[9] Hector Fausett., Charles Gayser., Alekha K., **2000**. 'Evaluation of Quick Disintegrating Calcium Carbonate Tablets'. AAPS PharmSciTech., 1(3):20.

[10] Lopez-Solıs., L Villafuerte-Robles., **2001**. 'Effect of disintegrants with different hygroscopicity on dissolution of Norfloxacin:Pharmatose DCL 11 tablets'. Int. J. Pharma 216:127–135.

[11] Malladi S P Sastry., N V Satyanarayana, P V Diwan., D R. Krishna., **1993**. 'Formulation, Pharmacokinetic and Pharmacodynamic Evaluation of Fast Releasing Compressed

Propranolol HCL Suppositories'. Drug. Dev. Ind. Pharm., 19(9):1089–1096.

[12] Mohan Bau G., V.M. Prasad., Ramanna Murthy K V., **2000**. 'Nimesulide-Modified Gum Karaya Solid Mixtures: Preparation, Characterization, and Formulation Development'.Int. J. Pharm. Excipients., 4:185-191.

[13] Noor Fitrah Abu Bakar., Ajit Mujumdar., Shun Urabe., Katsura Takano., Ito A., Sugihara M., **1996**. Improvement of sticking tendency of granules during tabletting process by pressure swing granulation, Chem. Pharm. Bull., 44(11): 2132 -2136.