International Journal of Scientific Research and Engineering Development-– Volume 6 Issue 2, Mar-Apr 2023
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

A REVIEW ON QUALITY CONTROL TEST OF TABLETS

Shinde Shubham Bapusaheb*[1], Rokade Anita Suresh[1], Dr. Khedkar Amol. N.[1]

[1]Saikrupa Institute of Pharmacy, Ghargaon Maharashtra.

ABSTRACT:
Quality of pharmaceutical product is very significant because drugs mustbemarketedassafeandtherapeuticallyactiveformulationswhoseperformance is consistent and predictable. The evaluation of the physicalcharacteristics of the pharmaceutical products can ensure their quality aswellasbioavailabilityandimpartoptimumtherapeuticactivity.Themaintenance of quality with continuous improvement in facilities is veryimportantin pharmaceuticalindustriesbecauseitis directly relatedtohealthcare system. Various quality control tests are done with a view toremove error from every stage in production andmaintain the quality ofthefinalproductwiththecompendialstandardsasspecifiedinthepharmacopoeias. These include criteria for weight variation, disintegration,dissolution,contentuniformity,hardness,friabilityanduniformityofthickness. The purpose of this article is to provide concise information onthe various qualitycontroltestsforpharmaceuticaltablets.

KEY WORDS: Pharmaceutical tablets, Quality control, Pharmacopoeia, Weight variation, Hardness, Friability, Dissolution, Disintegration time Etc.

INTRODUCTION:

Tablet is defined as a compressed solid dosage form containing medicaments with or withoutexcipients. According to the Indian Pharmacopoeia Pharmaceutical tablets are solid, flat orbiconvex dishes, unit dosage form, prepared by compressing a drugs or a mixture of drugs,with or without diluents. They vary in shape and differ greatly in size and weight, dependingon amount of medicinal substances and the intended mode of administration. It is the mostpopular dosage form and 70% of the total medicines are dispensed in the form of Tablet. Allmedicaments are available in the Tablet form except where it is difficult to formulate oradminister. The quantitative evaluation and assessment of a tablet‘s chemical, physical andbioavailabilitypropertiesareimportantinthedesignof tabletsandtomonitorproductquality. These properties are important since chemical breakdown or interactions betweentabletcomponentsmayalterthephysicaltabletproperties,andgreatlyaffectthebioavailability of the tablet system. There are various standards that have been set in thevarious pharmacopoeias regarding the quality of pharmaceutical tablets. These include thediameter, size, shape, thickness, weight, hardness, disintegration and dissolution characters.The diameters and shape depends on the die and punches selected for the compression oftablets. The remaining specifications assure thattablets donotvary from one production lotto another. The manufacturer must give his assurance that the final product is of suitablequality.The clinical effectiveness exerted by tablet formulation depends on at least twofactors such as; the medicamentmust be present in the labeled amount and its availability tothe body[1].The principle target of an oral tablet is to convey the medication to the human bodyat certain and defined amount through the gastro-intestinal system for producing therapeuticeffect[2]. The formulation of the API (active pharmaceutical ingredient) can have a significanteffect on the quality parameters such as weight variation, hardness, friability, disintegrationtime, dissolution profile etc. This also includes the physiochemical properties of the activeingredients and excipients as well as the procedures used in the manufacturing process [3,4].Moreover, physical properties of tablets or quality control parameters are useful tools formaintaining consistency in batch-to-batch

manufacturing and it shouldbe performed forevery drug product. All of these parameters are closely related to each other and have effectondrugabsorption,bioavailabilityetc[5,6].

Thesetestscategorizedasfollowing:

A. Official(Pharmacopoeial)Tests:

- UniformityofDrugContent
- UniformityofWeight
- DisintegrationTest
- DissolutionRate

B. Non-Official(Non-Pharmacopoeial)Tests:

- Hardness(CrushingStrength)
- Friability
- UniformityofThickness
- Generalappearance.

A. Officialmethods: Officialqualitycontroltestaredescribedasbelow

Weight variation: The weight of a tablet is determined by quantity of fill in the die of atablet press. The volume of fill is adjusted with the first few tablets to yieldthe desiredweight and content.The variation of the weight of individual tabletis a validindicationof the corresponding variation in the drug content[7]. Controlling tablet weights within atight range will contribute to better tablet hardness and friability [8].Take 20 tablets andweighed individually. Calculate average weight and compare the individual tablet weightto the average. Not more than two of the individual weights deviate from the averageweight by more than the percentage shown in table below and none deviates by more thantwice that percentage. The weight variation tolerance for tablets differs depending onaverage tabletweightaccordingtotable1.

Table1:WeightVariationTolerancefortablets

Averageweightoftablet(According to IP/BP)	**Limit**	**Averageweightoftablet(AccordingtoUSP)**
80mgorless	±10%	130mgorless
Morethan80mgorLessthan 250mg	±7.5%	130mgto324mg
250mgormore	±5%	Morethan324mg

For all tablet following mathematical equation was used for calculation of highest and lowestweightvariation [4].

$$\textbf{\textit{Higestweightvariatio}}(\%)=\frac{Higestweig\square t-Averageweig\square t}{Averageweight}X100$$

$$\textbf{\textit{Lowestweightvariatio}}(\%)=\frac{Lowestweight-Averageweight}{Averageweight}X100$$

This test is done on 20 tablets that willater be used in the friability test.

Significance: The objective of the weight variation test is to ensure - good manufacturing practices(GMP),appropriatesizeofthetabletsandthecontentuniformityoftheformulation[9].

Disintegration: Disintegration is the first physical change observed for a drug when it enters in to the body,thus to see simulate the disintegration of the tablet in the body the disintegration test is performed. It is the time required for the tablet to break into particles, the disintegration test is a measure only of the time required under a given set of conditions for a group of tablets to disintegrate into particles. In the present disintegration test the particles are those that will pass through a 10-mesh screen [10].Complete disintegration occurs when noresidue of the tablet still present on the screen except the insoluble ingredients as the shell or the coat of the tablet. This time was recorded. Mean disintegration time was calculated foreachofthebrandtablet[11].

Disintegration device (According to Indian Pharmacopoeia)[12]:

- **a.** A rigid basket-rack assembly supporting six cylindrical glass tubes, 77.5 ± 2.5 mmlong,21.5 mminternal diameter and withawallthicknessofabout2mm(seeFig).
- **b.** The tubes are held vertically by two superimposed transparent plastic plates,90±2mm in diameter and 6.75±1.75 mm thick perforated by six holes having the samediameter as the tubes. The holes are equidistant from the centre of the plate and areequally spaced from one another. Attached to the underside of the lower plate is apiece of woven gauzemadefrom stainless steel wire 0.615±0.045 mm in diameterand having nominal mesh apertures of 2.00 mm. The upper plate is covered with astainless steel disc perforated by six holes, each about24±2 mm in diameter, whichfits over the tubes and holds them between the plastic plates. The holes coincide withthoseoftheupperplasticplate andthe upperopenendsofthe glass tubes.
- **c.** The plates are held rigidly in position and 77.5 mm apart by vertical metal rods at theperiphery and a metal rod is also fixed to the centre of the upper plate to enable theassembly to be attached to a mechanical device capable of raising and lowering itsmoothly at a constant frequency of between 28 and 32 cycles per minute through adistance of 50 to 60 mm. The design of the basket-rack assembly may be somewhatdifferent provided specifications for the glass tubes and the screen mesh size areunchanged.
- **d.** A cylindrical disc for each tube, each 20.7 ± 0.15 mm thick in diameter and 9.5 ± 0.15mm thick, made of transparent plastic with a relative density of 1.18 to 1.20, andpierced with five holes, each 2 mm in diameter, one in the centre and the other fourspaced equally on a circle of radius 6mm from the centre of the disc. Four equally-spaced grooves are cutin the Lateral surface of the disc in such a way thatat theupper surface of the disc they are 9.5mm wide and 2.55mm deep and at the lowersurface 1.6mmsquare.
- **e.** The assembly is suspended in the liquid medium in a suitable vessel, preferably a1000-ml beaker. The volume of liquid is such that the wire mesh at its highest point isat least 25mm below the surface of the liquid, and at its lower point is at least 25mmabove thebottomofthebeaker.
- **f.** A thermostatic arrangement for heating the liquid and maintaining the temperature at37°± 2°.

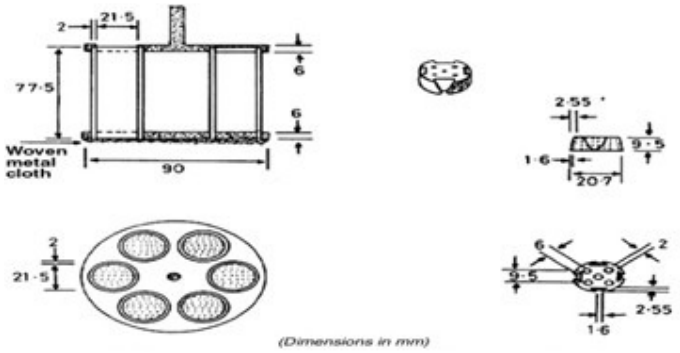


Fig: 1 Apparatus for disintegration of Tablets

Table2:Disintegration test for tablets

UncoatedTablet	NMT15 min,inwaterwithDisc37^{0}C±2^{0}C
CoatedTablet	NMT30min,InwaterwithDiscforFilmcoatedtablet,and NMT60 minOtherthanFilmcoated tablet
EntericCoatedTab	Intactfor1hrin 0.1NHCl & disintegratewithin2hrinMixed 6.8Phosphatebuffer.AccordingtoUSP1hrinSimulatedgastric fluid,theninSimulatedIntestinalFluid.
Dispersible/Soluble	Within3min in waterat25^{0}C±1^{0}C(**IP**)&15–25^{0}C(**BP**)
Orodispersible	Within1min
EffervescentTab	5minin250mlwaterat20–30^{0}C(**IP**)&5minin200ml water at 15-25^{0}C(**BP**)
Buccal&Sublingual	NotApplicablebutdissolvewithin15–30min.

***NMT=Notmorethan**

Factors affect Disintegration Time:

It has been recognized that one should not expect a correlation between Disintegration &Dissolution. However, since the dissolution of a drug from the fragmented tablet appears topartially or completely control the appearance of the drug in the blood, disintegration is stillused as a guide to the formulator in the preparation of an optimum tablet formula and as in-processcontroltesttoensurelotto-lotuniformity.

The formulator should be aware that the medium used, the temperature of the medium, andthe operator recording the results can have a significant effect on disintegration time. Inaddition many factors involved with a tablet's formula and method of manufacture can affectthe disintegration such factors are: the diluents used, the binder, the nature of the drug, thetype and amount of disintegrating agent, the type of amount of lubricant, as well as themethod of incorporation for all of these additives. The compaction pressure used to make thetablets also influences the disintegration, in general disintegration time's increase with anincreaseinpressure.

Dissolution: The definition of dissolution is deceptively simple. It is defined as the rate ofmass transfer from a solid surface into the dissolution medium under standardized conditionsof liquid/solid interface, temperature and solvent composition. It is a dynamic

property thatchanges with time and describes the process by which a homogenous mixture of a solid or aliquidcanbeobtainedina solvent.

Significanceofdissolution test:

- Disintegration test simply identifies the time required for the tablet to break up underthecondition ofthetestbutitdoesnotensurethedrugreleaseinthebulkofthefluid [13].
- Rateofdissolutionisdirectlyrelatedtotheefficacyofthedrug.
- Rate of dissolution is a good index for comparing the bioavailability of two tabletproductsofthesamedrug.

Dissolution Apparatusaccordingto USP[14]:

Apparatus 1 (Basket Apparatus): It consists of a vessel, which is made up of glass or otherinert transparent material, a motor, a metallic drive shaft and a cylindrical basket. The vesselis partially immersed in a suitable water bath or heated by a suitable device such as a heatingjacket.Thewaterbathorheatingdevicemaintainthetemperatureinsidethevesselat37±0.5° C during the test and keep the bath fluid in a constant and smooth motion. Thecylindricalvesselhavinghemisphericalbasewiththefollowingdimensionsandcapacities: for anominal capacity of 1 L, the height is 160 mm to 210 mm and it's inside diameter is 98mm to106mm; for a nominal capacity of 2 L, the height is 280 mm to 300 mm and its insidediameteris98mmto106mm; andforanominalcapacityof4L,theheight is280mmto300mm and it's inside diameter is 145 mm to 155mm. Its sides are flanged at the top and a fittedcover may be used to retard evaporation. The shaft is positioned so that its axis is not morethan 2 mm at any point from the vertical axis of the vessel and rotates smoothly and withoutsignificant wobble that could affect the results. The total height of the basket is 37±3.0mm. Amotor with a speed regulator capable of maintaining the speed of rotation within ±4% of thatspecified in the individual monograph. The vent hole is 2.0±0.5mm. The clear opening is20.2±0.1mm. Shaft and basket components of the stirring element are fabricated of stainlesssteel,type316,orotherinertmaterial.Adosageunitisplacedinadrybasket atthebeginningof each test. The distance between the inside bottom of thevessel and the bottom of thebasketismaintainedat25±2mmduringthetest.

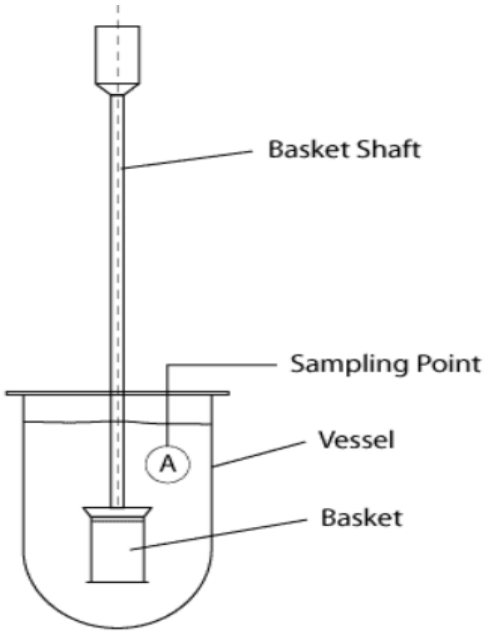


Fig:2Schematicview ofRotatingBasketDesigned

Apparatus2(Paddletype):

TheassemblyissameasApparatus1,exceptthatinthestirringelementthebasketisreplacedbyapaddle. Theshaftissituatedsothatitsaxisisnotmorethan2mmfromtheverticalaxisofthevesselandturnseasily withouthugewobblethatcouldinfluencetheresults.Theverticalcentrelineofthebladepassesthrought heaxisoftheshaftsothat the bottomofthebladeisflushwiththebottomoftheshaft.The distanceof25 ± 2 mm between the bottom of the blade and the inside bottom of the vessel is maintainedduring the test. The height and thickness of the blade is 19.0±0.5 and 4.0±1mm. The radiusdisk of the paddle is 41.5±0.5mm. The dosage unit is allowed to sink to the bottom of thevessel before rotation of the blade is started. A small, loose piece of nonreactive materialhavingfewturnsofwirehelixmaybeattachedtodosageunitsthatwouldotherwisefloat.

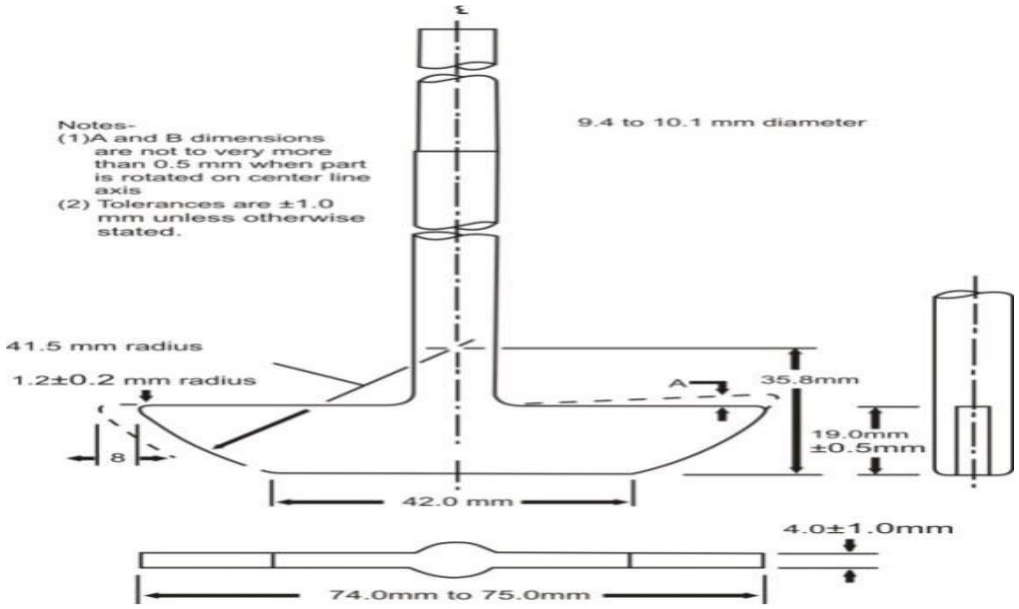


Fig: 3 Schematic view of Rotating Paddle Designed

VariousDissolutionApparatusaccordingtoI.P.

1) **Apparatus 1(Paddle type):** The design andmeasurements of this apparatus is sameasUSPapparatus2(Paddletype)exceptheheightofthevesselandbladeis168±8mman d19.0mmandtheradiusdiskofthepaddleis41.5mm.
2) **Apparatus 2(Basket type):** The design andmeasurements of thisapparatus is sameas USP apparatus 1(Basket type) except the height of the basket is36.8±3.0mm, theclearopeningis22.2±1.0mmandtheventholewhichisattachedtoshaftis2.0mm.

Table:2Listofofficialdissolutionapparatus

VariousOfficialDissolutionTestapparatus					
	IP	**USP**	**BP**	**EP**	**JP**
Type1	Paddle Apparatus	Basket Apparatus	Basket Apparatus	Basket Apparatus	Basket Apparatus
Type2	Basket Apparatus	Paddle Apparatus	Paddle Apparatus	Paddle Apparatus	Paddle Apparatus
Type3		Reciprocatingcylinder	Flowthroughcell Apparatus	Flowthroughcell Apparatus	Flowthroughcell Apparatus

Type4		Flowthroughcell Apparatus			
Type5		Paddle over Disk			
Type6		Rotating cylinder			
Type7		Reciprocating Holder			

USPapparatus(non-official)

- Rotatingbottlemethod
- Diffusioncell
- Peristalsiscell
- Intrinsicdissolutionmethod

When Apparatus 1 is used, allow the tabletto sink to the bottom of the vessel prior to therotation of the paddle. A suitable device such as a wire of glass helix may be used to keephorizontal at the bottom of the vessel tablets or capsules that would otherwise float. Careshould be taken to ensure that air bubbles are excluded from the surface of the tablet. WhenApparatus 2 is used, place the tabletin a dry basket at the beginning of each test. Lower thebasketintopositionbeforerotation.Operatetheapparatusimmediatelyatthespeedofrotation specified in the individual monograph. Within the time interval specified, or at eachof the times stated, withdraw a specimen from a zone midway between the surface of thedissolutionmediumandthetopoftherotatingbladeorbasket,notlessthan10mmfromthe wall of the vessel. Except in the case of single sampling, add a volume of dissolution mediumequal to thevolumeof thesamples withdrawn.Perform theanalysis as directedin theindividual monograph. Repeat the whole operation five times. Where two or more tablets aredirectedtobeplacedtogetherintheapparatus,carryoutsixreplicatetests.
For each of the tablet tested, calculate the amount of dissolved active ingredient in solutionasapercentageof thestatedamountwheretwoormoretabletsareplacedtogether,determineforeachtesttheamountofa ctiveingredientinsolutionpertabletandcalculateasa percentage of the stated amount. If the results donot conform to the requirements at stageS1 given in the accompanying acceptance table (Table 1), continue testing with additionaltabletsthrough stages S2 and S3 unless the result conform at stage S2.Correction factorsshould not be greater than 25% of the stated amount. In the given table below *D is theamount of active ingredient specified in the individual monograph, expressed as a percentageofthelabelledcontent.

TABLE3-AcceptanceTable

Stage	Number Tested	Acceptance
S1	6	Eachunitis notlessthanD*5%**.
S2	6	Averageof12units(S1+S2)isequaltoorgreaterthanD,andno unitislessthanD*- 15%**.
S3	12	Averageof24units(S1+S2+S3),IsequaltorgreaterthanD*,not, Morethan2unitsarelessthanD*-15%**andnounitislessthanD*-25%**.

Content uniformity: The content uniformity test is used to ensure that every tablet containsthe amount of drug substance intended with little variation among tablets within a batch. Dueto increased awareness of physiological availability, the content uniformity test has beenincluded in the monographs of all coated and uncoated tablets where the ranges of size of thedosage form available include 50mg or smaller sizes. Tablet monographs with a contentuniformityrequirementdonothave weightvariationrequirements

According to USP: For contentuniformity test, representativesamples of 30tablets areselected and 10 are assayed individually. At least 9 must assay within ±15% of the declaredpotencyandnonemayexceed± 25%.

According to Indian Pharmacopoeia: This test is applicable to tablets that contain less than10 mg or less than 10% w/w of active ingredient. For tablets containing more than one activeingredient carry out the test for each active ingredient that corresponds to the aforementionedconditions.Determinethecontentof activeingredient(s)in each of 10tabletstakenatrandom using the method given in the monograph or by any other suitable analytical method.The tablets comply with the test if not more than one of the individual values thus obtained isoutside the limits 85 to 115% of the average value and none is outside the limits 75 to 125%of the average value. If two or three of the individual values are outside the limits 85 to 115%of the average value and none is outside the limits 75 to 125%, repeat the determination usinganother 20 tablets. The tablets comply with the testif in the total sample of 30 tablets notmore than three of the individual values are outside the limits 85 to 115% and none is outsidethe limits 75to125%ofthe averagevalue.

B. Non-official: Non-officialqualitycontroltest aredescribed asbelow

Hardness: Tabletrequiresacertainamountofstrengthorhardnessandresistancetofriabilitytowithstandmechanicalshakesofhandlinginmanufacture,packagingandshipping. Hardness generally measures the tablet crushing strength. The strength of a tabletwasdeterminedbyfollowingways;

(a) By cracking the tablet between 2nd and 3rd fingers with the thumb acting as a fulcrum.Ifthereisasharpsnap,thetabletis anacceptablestrength.

(b) Tablet hardness can be defined as the force required breaking a tablet in a diametriccompression. In this test the tablet is placed between two anvils, force is applied to the anvils,and the crushing strength that just causes the tablet to break is recorded. Generally usedHardnesstesters are:

Instrumentsused:

1. MonsantoHardnessTester
2. Strong CobbHardnessTester.
3. PfizerHardnessTester
4. HeberleinSchleunigerHardnessTester
5. ErwekaHardnessTester
6. CasburtHardnessTesters.

Hardnessforcompressedtabletis5to8kg.

Factorsaffectinghardness:

- Hardness is a function of the applied pressure and is therefore the factors whichcontribute the force to vary also affect it. As additional pressure is applied to make atablet, the hardness values increase, this relationship olds up the maximum valuebeyondwhichincreasesinpressurecausethetablettolaminateorcap,thusdestroyingt heintegrityofthetablet.
- Tabletsgenerallyareharderseveralhoursaftercompressionthantheyareimmediately after compression. Lubricant can affect the tablet hardness when mixedfor too long period or used in too high concentration. The lubricant will coat thegranulesandinterfere withtabletbonding.
- Larger tablet require a greater force to cause fractures (harder) than small tablet. Anappropriate balance between a minimally acceptable tablet hardness to produce anadequatefriabilityvalueandamaximumacceptabletablethardnesstoachieveadequateta bletdissolutionmayberequired.

SignificanceofHardnessmeasurement:

- Hardness determinations are made throughout the tabletruns todetermine the needforpressureadjustmentsonthe tabletingmachine.
- Hardnesscan affectthe disintegration.Soif thetabletistoohard,itmaynotdisintegrate in the required period of time.And if the tablet is too soft, it will notwithstandthehandlingduringsubsequentprocessingsuchascoating or packaging.

In general, if the tablet hardness is too high, we first check its disintegration before rejectingthe patch.Andifthe disintegrationiswithinlimit,weacceptthe patch.

FriabilityTest[15]:Tablethardnessisnotanabsoluteindicatorofstrengthsincesomeformulations, when compressed into very hard tablets may produce chipping, capping andlamination problems. Therefore anothermeasure of tabletstrength i.e.friability is oftenmeasured, i.e. the friability A friability test is performed to determine the ability of tablets towithstand abrasion during packaging, handling, and shipping processes. A maximum weightlossofnotmorethan1%is generallyconsideredacceptable.

Roche Friabilator*:* Subjects a number of tablets to abrasion and shock by utilizing a plasticchamber that revolves at 25 rpm, dropping the tablets a distance of 6inches with eachrevolution.After a given number of rotations the tablets are weighed and the loss in weightindicatestheabilityofthetablets towithstandthistypeofwear.

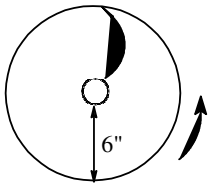
Procedure:

1. Weigh20tabaltogether= W_1
2. Putthesetabletsinthefriabilatorandadjusttheinstrumentat100rpm (i.e.=25rpmfor4min)

3. Weighthe20 tablets(onlytheintact ones) =W_2

4.Friability(%loss)=$\frac{Weightbeforetest(W1)-Weightaftertest(W2)}{Weightbeforetes(W1)} X100$

Factors affecting tablet friability: Tablets friability may also influence by the moisturecontent of the tablets granulation in the finished tablets. A low but acceptable moisturelevel frequently serves to act as a binder. Very dry granulation that contain only fractionalpercentagesofmoisturewilloftenproducemorefriabletabletsthanwillgranulesconta ining2to4%moisture.



25rpm
4mins

RocheFriabilator

Fig:4Friabilitytestapparatus

Generalappearance:Thegeneralappearanceofatablet,itsidentityandgeneralelegance is essential for consumer acceptance, for control of lot-to-lot uniformity andtablet-to-tabletuniformity. The control of general appearanceinvolves themeasurementofsize,shape,color,presenceorabsence ofodor,tasteetc.

a. **Size & Shape**: It can be dimensionally described & controlled. The thickness of atablet is only variables. Tablet thickness can be measured by micrometer or by otherdevice. Tablet thickness should be controlled within a ± 5% variation of standardvalue.
b. **Unique identification marking**: These marking utilize some form of embossing,engraving or printing. These markings include company name or symbol, productcode,productnameetc.
c. **Organoleptic properties**: Color distribution must be uniform with no mottling. Forvisualcolorcomparisoncompare the colorofsample againststandardcolor.

ThicknessUniformity:

Tablets thickness should be controlled with 5% or less of a standard value. Any variationintabletthicknessshouldnotbeapparenttotheunaidedeyetomaintainproductaccepta nce by consumer as well as to facilitate packaging. At constant compressive load,tablet thickness varies with changes in die fill and tablet weight. Whereas, with a

constantdiefill,thicknessvariesinvariationincompressiveload.

Threesetoffactorsinfluencetabletthicknessandtabletthicknesscontrol:

- Thephysicalpropertiesofrawmaterialsincludingtruebulkdensityandcrystalform.
- Controloflowerandpunchlengths, whichshouldbestandardized.
- The granulation prosperities including tapped density, bulk density, particle size, andparticle sizedistribution.

Conclusion: From the above review it can be concluded that Indian Pharmacopoeia andUnited States Pharmacopoeia included the most of quality control tests. These quality controltestsareessentialtomaintainthequalityofthedosageforms.

REFERENCES:

1. JabeenS, Ali A, Hassan F, Fatima, N, (2006), Studies on the effects of cyclodextrinpolymer as a tableting aid on some selected analgesics. Pakistan Journal ofPharmacology,23(1),67-71.
2. Islam SMA, Islam S,Shahriar M, Dewan I,(2011), Comparative in vitro dissolutionstudy of aceclofenac marketed tablets in two different dissolution media by validatedanalyticalmethod.JournalofAppliedPharmaceuticalScience,1(9),87-92.
3. Ofori-Kwakye K, Osei-YeboahF, KipoSL,(2010), Formulation and qualityevaluation of two conventional release tablet formulations. International Journal ofPharmaceuticalSciences Review andResearch,4(1),94-99.
4. Kalakuntla, R, Veerlapati U, ChepuriM, Raparla R, (2010), Effect of various superdisintegrantsonhardness,disintegrationanddissolutionofdrugfromdosageform.J.Adv.Sci.Res,1(1),15-19.
5. Awofisayo SO, Awofisayo OA, Eyen N, Udoh IE, (2010),Comparative assessment ofthequalitycontrol measurementsofmultisource ofloxacintabletsmarketedinNigeria.Dissolutiontechnologies,17(2),20-25.
6. Jain N, Mandal S, Banweer J, Jain S,(2012), Effect of superdisintegrants onformulationoftastemasked fastdisintegratingciprofloxacintablets.InternationalCurrentPharmaceuticalJournal,1(4),62-67.
7. Rawlins EA, (1977), Bentley's text book of pharmaceutics (8th ed., pp. 289-290),Bailliere Tindalpublisher.

8. Tousey,MD,(2011).Tabletpro:Atabletmakingtrainingresourcefortabletmakingprofessionals. Techceuticals, 4(1),1-15. www.dipharma.com/TP_V4.pdf [Accesseson:09.03.2012]

9. Yoshida I and Sakai Y, (1999), The applications of the content uniformity test and theweight variation test on process validation tests of multiple ingredient preparations.ChemPharmBull,47(5),678-83.

10. Banker GS and Anderson NR, (2009). Tablets. In Lachman, L. and Lieberman, H.A,The theory and practice of industrial pharmacy (Special Indian ed., pp 229-345), CBSPublishersandDistributorsPvt.Ltd.,India

11. Gangwar S, Singh S, Garg G, Garg V, Sharma PK, (2010). To compare thedisintegrating property of papaya starch and sago starch in paracetamol tablets. Int JPharmacyPharmSci,2(Suppl2),148-151.

12. IndianPharmacopoeia,(2010),DisintegrationTest.Volume1,page no.187-189.

13. KishoreBH,VenkareswararaoT,SankarKR,RaoBS,(2011),Studiesondissolutionrate of paracetamol tablets by using different polymers. Journal of Global Trends inPharmaceuticalSciences,2(1),1-10.

14. Dissolution(711),UnitedStatesPharmacopoeiaandNationalFormularyUSP32-NF27,(2009),Vol.1.

15. Banker, G.S. and Anderson, N.R. (2009). Tablets. In Lachman, L. and Lieberman,H.A, The theory and practice of industrial pharmacy (Special Indian ed., pp 229-345),CBSPublishersandDistributorsPvt.Ltd.,India.

