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Pre and Post Compression Studies of Tablets

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Abstract

Compressing a small quantity of powder to shape a tablet has been finished trillions of times through myriad pharmaceutical companies. Technical innovations in tablet compression machinery have progressed manufacturing fees to the factor where more than 500,000 drugs in step with hour are viable. Forte capsules were crafted for sublingual, buccal, rectal, and vaginal healing use. Launch of the energetic drug element may also variety from a few seconds for hastily disintegrating tablets to approximately 24 hours for controlled or sustained launch products as they transit the complete length of the gastrointestinal machine. in addition, compressed drugs can be meant to be used in analytical or diagnostic packages, or dissolved in drinks previous to ingestion. As we attempt to deliver gold standard first-class compressed pill merchandise, attention can be focused on activities achieved previous to the compression step, at some point of the compression operation itself, and additionally on the performance characteristics required of the drugs after their creation. in preference to speak the activities so as of prevalence, we will perceive the goals, discuss the final effects intended, and then paintings backward to establish the intermediate steps wished to complete with the dreams intended.

Keywords: Tablets, Compression, Low bulk density, Disintegration time, Dissolution time

Precompression study

Angle of repose

Angle of repose is defined as the maximum angle viable between the surface of a pile of the powder and horizontal aircraft [1-6]. The frictional pressure in a unfastened powder or granules can be measured by using angle of repose [7-12].

$$\tan \Theta = h/r$$

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

Where, Θ is the angle of repose his height of pile

r is radius of the base of pile

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Different ranges of flow ability in terms of angle of repose are given in Table.1

TABLE 1. **Relationship between angles of reposes and flow properties.**

Angle of Repose (degrees)	Flow
<25	Excellent
25-30	Good
30-40	Passable
>40	Very poor

Method

A funnel became filled to the brim and the take a look at sample changed into allowed to waft easily through the orifice under gravity[13-18]. From the cone shaped on a graph sheet turned into taken to measure the location of pile, thereby comparing the glide capability of the granules[19-23]. height of the pile became also measured.

Bulk density

Bulk density is described because the mass of a powder divided via the bulk volume. the majority density of a powder relies upon primarily on particle length distribution[24-30], particle shape[31-35], and the tendency of the particles to stick to one another[36-40].

Method

Loose bulk density (LBD) and tapped bulk density (TBD) both were been determined. A quantity of accurately weighed powder (bulk) from every method, formerly shaken to interrupt any agglomerates formed become introduced into a 25 ml Measuring cylinder. After the initial extent changed into observed, the cylinder changed into allowed to fall underneath its very own weight onto a difficult surface from the peak of 2.5cm at 2 sec c language. The taping changed into endured until no in addition exchange in extent was cited [41-46].

LBD and TBD were calculated using following formula;

TBD=Weight of powder Volume of packing

LBD= Weight of powder Tapped packing

True density

True density of granules is carried out by using specific gravity bottle:

- First take the empty bottle weight i.e., W1

- Then add 3/4th of liquid in it, that the weight of that i.e., W2
- Add 1/4th quantity of powder then take the weight i.e., W3
- Finally take the weight of bottle., powder and liquid., W4

It is calculated by using the formula : (W3 – W1)

True density = (W 2 – W4) (W1 – W3)/ ρ

Percentage Porosity

This can be calculated by taking the value of bulk density and true density

Percent Porosity = 1- Bulk density X 100/ True density

Post-Compression parameters

All the method of Turbutaline Sulphate organized had been evaluated for the following bodily and chemical parameters.

Physical Parameters

Size and shape: The tablets formulated were circular in shape with 7 mm diameter[47,48].

Organoleptic Characters

Colour: Turbutaline Sulphate fast dissolving tablets were found to be white in colour [49,50].

Tablet Properties: Hardness test

Capsules require a certain amount of energy, or hardness and resistance to friability[51-53], to withstand mechanical shocks of handling in manufacture, packaging and shipping. The hardness of the pills become determined the usage of Monsanto Hardness tester [54]. It's far expressed in Kg/cm2. Three tablets had been randomly picked from each system and the suggest and trendy deviation values have been calculated.

Friability test

It is the phenomenon wherein tablet surfaces are damaged and/or show proof of lamination or breakage whilst subjected to mechanical shock or attrition [56-60]. The friability of drugs became determined by way of the usage of Veego Friabilator [61]. It's far expressed in percent (%). Twenty drugs have been initially weighed (Winitial) and transferred into friabilator [62,63]. The friabilator become operated at 25 rpm for four minutes or run as much as 100 revolutions [64,65]. The tablets were weighed again (Wfinal). The percentage friability was then calculated by

$$F = \frac{\text{Initial weight} - \text{Final Weight}}{\text{Initial weight}} \times 100 \quad \text{---------- (d)}$$

% Friability of tablets less than 1% is considered acceptable.

Weight variation test

The pills have been selected randomly from every system and weighed in my view to check for weight variant. The u.s.Pharmacopoeia lets in a touch variation inside the weight of a pill [66-70]. the subsequent percent deviation in weight version is permitted.

Percentage deviation in weight variation

In all the formulations the tablet weight was more than130mg and less than 324 mg, hence 7.5% maximum difference allowed Table 2.

TABLE 2. **Percentage deviation in weight variation.**

Average weight of a tablet	Percentage deviation
130 mg or less	10
More than 130 mg and less than 324 mg 324 mg or more	7.5 5

Drug content uniformity

Twenty tablets had been weighed and overwhelmed in a mortar. Then weighed powder comprise equal to 100mg of drug transferred in 100ml of pH 6.8 [71,72]. Its attention 1000 mcg/ml. 10ml from this stock solution taken and diluted to 100ml of pH 6.8 [73-75], it makes one hundred□g/ml. Then 0.6ml from inventory solution and diluted to 10ml. Absorbance degree at 276nm.

In vitro disintegration time

The process of breakdown of a pill into smaller particles is known as as disintegration [76]. The in-vitro disintegration time of a tablet become determined using disintegration take a look at apparatus as per I.P. specifications [77-80].

I.P. specs: place one pill in every of the 6 tubes of the basket. upload a disc to each tube and run the apparatus the use of pH 6.8 maintained at 37°±2°C as the immersion liquid [81-83]. The meeting ought to be raised and lowered between 30 cycles consistent with minute inside the pH 6.eight maintained at 37°±2°C [85-88] . The time in seconds taken for entire disintegration of the tablet and not using a palpable mass closing in the apparatus changed into measured and recorded.

In vitro dissolution studies

Dissolution rate became studied via using USP kind-II apparatus (DR-6. Campbell apparatus, Dissolution test equipment at 50 rmp) using 900ml of zero.1 N HCl as dissolution medium [89-93]. Temperature of the dissolution medium turned into maintained at 37□zero.5°C, aliquot of dissolution medium turned into withdrawn at each 1 min interval and filtered [94-96]. The absorbance of filtered solution changed into measured by way of UV spectrophotometric method at 276 nm and attention of the drug was determined from fashionable calibration curve [97-100].

In vitro drug release studies details	
Apparatus used	6 Basket dissolution test apparatus
Dissolution medium	pH 6.8 Dissolution medium volume 900ml
Temperature	37 ± 0.5°C Speed of basket paddle 50rpm Sampling
intervals	1 min
Sample withdraw	5 ml Absorbance measured: 276 nm

REFERENCES

1. Samah AEA, Mohamed IW, Fawzia . Development and Validation of Spectrophotometric and Pre-column Derivatization HPLC Method for Determination of Famotidine in Pharmaceuticals by Reaction with Sodium Nitroprusside; Application to Combined Tablets. Pharm Anal Acta 2016;7: 476
2. Tounsia AA, Moussa A, Mohamed T, et al. Matrix Tablets from Algerian Lyophilized Berries (LB) (Arbutus unedo L.) Date (Phoenix dactylifera L.). Nat Prod Chem Res 2016;4(2): 207
3. Yu Y, Shinya M, Ayako N, et al. Dynamics of Swallowing Tablets during the Recovery Period following Surgery for Tongue Cancer. Otolaryngol (Sunnyvale) 2016;5:218
4. Richa S, Devdutt C. Formulation, Characterization and Evaluation of Gastro-Retentive Floating Tablets of Norfloxacin. Journal of Pharmacy and Pharmaceutical Sciences 2015doi:
5. Yoshiaki Kubo, Toshitatsu Nogita, Ikuko Kimura, Mami Chiba and Kanako Sakakibara (2016) Interventional Evaluation of Monoammonium Glycyrrhizinate-Glycine/DLMethionine Combination Tablets in Mild Alopecia Areata. J Clin Exp Dermatol Res 2016, 7: 322
6. Somia Gul and Sidra Sajid (2016) Formulation of Improved Norfloxacin HCl Tablets: Quality Control Assessment and Comparison Study of Acidic and Basic Form of Norfloxacin in Tablet Formulation. J Develop Drugs 2015, 5:145
7. Srilatha Malvey, Naresh Kshirasagar, Yamsani Vamshi Vishnu and J Srikanth (2015) Formulation and Evaluation of Acyclovir Orodispersible Tablets Using Sublimation Method. J Gen Pract 2015, 3: 208
8. Ramu Bandameedi and Shanmuga Pandiyan (2016) Formulation and Evaluation of Floating Osmotic Tablets of Nizatidine. J App Pharm 2016
9. Mahipal Reddy Donthi, Narendar Reddy Dudhipala, Devendhar Reddy Komalla, Dinesh Suram and Nagaraju Banala* (2015) Preparation and Evaluation of Fixed Combination of Ketoprofen Enteric Coated and Famotidine Floating Mini Tablets by Single Unit Encapsulation System. J Bioequiv Availab
10. Mahipal Reddy Donthi, Narendhar Dudipala, Devendhar Reddy Komalla, Dinesh Suram, VinayThallapally and Nagaraju Banala (2015) Design and Evaluation of Floating Multi Unit Mini Tablets (MUMTS) Muco Adhesive Drug Delivery System of Famotidine to Treat Upper Gastro Intestinal Ulcers. J Pharmacovigil 2015, 3:5
11. Belafkih B, Belouafa S, Bennamara A, Skalli A and Abourriche A (2015) LC-MS/MS Analysis of MDMA in Ecstasy Tablets in Morocco. J Forensic Res 2015, 6: 301
12. Vargas M, Bustamante C and Villarraga Ea (2015) Bioequivalence Study of Two Formulations Containing Rosuvastatin 40 Mg Tablets in Healthy Colombians. J Bioequiv Availab
13. Rana Bustami, Sewar Khasawneh, Wafaa' Absi, Hamzeh Feddah, Mohamad Mroueh, Elie Daccache, Jean-Charles

Sarraf and Soula Kyriacos (2015) Bioequivalence of Losartan/Amlodipine Fixed Dose Combination Tablets (Losanet AM) Compared with Concomitant Administration of Single Components of Losartan and Amlodipine Tablets in Healthy Human Volunteers. J Bioequiv Availab

14. Vargas M, Bustamante C and Villarraga EA (2015) Fed and Fasting Bioequivalence Study for Two Formulations of Bosentan 125 Mg Tablets in Healthy Colombian People. J Bioequiv Availab
15. Enrique Muñoz, Daniel Ocampo and Natalia Yepes (2015) Bioequivalence Study of Two Formulations of Escitalopram Oxalate 20 mg Tablets in Healthy Volunteers. J Bioequiv Availab
16. Vargas M, Bustamante C and Villarraga Ea (2015) Bioequivalence Study of Two Formulations Containing Irbesartan 300 Mg Tablets in Healthy Colombian Volunteers. J Bioequiv Availab
17. Michael R. Liebowitz, Ester Salmán, Ann Johnso and Rita Hanover (2015) A 12-Week Double-Blind, Placebo-Controlled, Flexible-Dose Trial of Desvenlafaxine Extended-Release Tablets in Generalized Social Anxiety Disorder. J Depress Anxiety 2015, S1: 014
18. Nagashree K (2015) Solid dosage forms: Tablets. PHARMACEUTICAL ANALYSIS doi:
19. Sasidhar R (2015) Characterisation of Sustained Release Bilayer Tablets of Pioglitazone and Metformin. PHARMACEUTICAL ANALYSIS
20. Sasidhar R (2015) Evaluation of Oral Mucoadhesive Metoprolol succinate Controlled Release Tablets. PHARMACEUTICAL ANALYSIS
21. Sasidhar R (2015) Floating Tablets of Glipizide using Eurayle Ferox seeds for the treatement of Diabetis Mellitus. PHARMACEUTICAL ANALYSIS
22. Sowjanya P, Sathyaraj A (2015) Formulation and development of Mucoadhesive tablets of Lamivudine by direct compression technique. PHARMACEUTICS AND NANOTECHNOLOGY
23. Hadad GM, Abdel Salam RA and Elkhoudarya MM (2015) Simultaneous Determination of Clarithromycin, Tinidazole and Omeprazole in Helicure Tablets Using Reflectance Near-Infrared Spectroscopy with the Aid of Chemometry. Pharm Anal Acta 2015, 6: 354
24. AlSayed Sallam, Isam I. Salem, Dalia AlJohari, Mohannad Shawer, Bilal Abu Alaasal and Derar Omari (2015) Bioequivalence of Two Oral Formulations of Modafinil Tablets in Healthy Male Subjects under Fed and Fasting Conditions. J Bioequiv Availab
25. Agatonovic-Kustrin S, Morton DW, Ragini Singh, Baboota S and Talegaonkar S (2015) Biorelevant Dissolution Studies of Pioglitazone Hcl Immediate Release Tablets and the Determination of an In Vitro In Vivo Correlation. J Bioequiv Availab
26. Prasanth VV, Ashutosh Lohumi, Sourav Tribedi, Rinku Mathappan and Sam T Mathew (2013) Formulation and Evaluation of Gastro Retentive Floating Tablets of Stavudine. Journal of Pharmacy and Pharmaceutical Sciences
27. V Sai Kishore, B Tejeswara Rao, Y Sai Kumar, and D Nagasen (2013) Design of Orodispersible Tablets of Losartan Potassium Using Novel Co-Processed Superdisintegrants. Journal of Pharmacy and Pharmaceutical Sciences
28. V Sai Kishore, D Gowtham Kumar, B Sudheer and M Sandeep (2013) Design and Development of Fast Dissolving Tablets of Ibuprofen. Journal of Pharmacy and Pharmaceutical Sciences
29. Chinmay Anand, Gali Vidyasagar and Manisha Rajmane (2013) Approach of Solid Dispersion and Polymer Coating in Formulation of Rapid Dispersible Tablets of Paracetamol. Journal of Pharmacy and Pharmaceutical Sciences
30. (2013) Formulation and Evaluation of Matrix Tablets of Albendazole for Colon Site Specific Drug Delivery. Journal of

Pharmacy and Pharmaceutical Sciences

31. Gunturu Abhilash, Beny Baby, B Prakash Rao, S Raja Rajan, K Ramesh and G Ravi Kumar (2013) Comparative Study on the Efficiency of Various Binder Combinations for Metformin Tablets. Journal of Pharmacy and Pharmaceutical Sciences
32. Murari Pavan, Prasanth VV, Abhishek Sharma, Ajay Chauhan, Rinku Mathappan, and Sam T Mathew (2014) Formulation and Evaluation of Dicloxacillin Sodium Floating Tablets.. PHARMACY AND PHARMACEUTICAL SCIENCES
33. Rajnikant M Suthar, Narendra P Chotai1, Digesh D Shah, Rutvik M Thumar, Hardik K Patel, Mukesh B Jadeja (2012) Development of Fast Dissolving Tablets Containing Ondansetron via Camphor Sublimation and its Characterization.. Journal of Pharmacy and Pharmaceutical Sciences
34. Pushpa Kumari K, Gowri Sankar1, P. Sowjanya and S. Madhubabu (2014) Stability Indicating RP-HPLC method Development and Validation of Salicylic Acid in Choline Magnesium Trisalicilate (Trilisate) Tablets. J Pharma Care Health Sys 2014, 1: 4
35. Devineni D, Curtin CR, Ariyawansa J, Weiner S, Stieltjes H, Vaccaro N, Shalayda K, Murphy J, DiProspero NA and Wajs E (2014) Bioequivalence of Canagliflozin/Metformin Immediate Release Fixed- Dose Combination Tablets Compared with Concomitant Administration of Single Components of Canagliflozin and Metformin in Healthy Fed Participants. J Bioequiv Availab
36. Xiaogao Zhang and Shengjun Zhang (2014) Bioequivalence Study of Two 30 Mg Tolvaptan Tablets Formulations in Healthy Chinese under Fed Condition. J Bioequiv Availab
37. Ashish Shedage, Abhishek Khanna, Milind Gole, Shrinivas Purandare and Geena Malhotra (2014) Comparative Steady State Cross-Over Bioequivalence Study of 35mg Trimetazidine Extended-Release Tablets. J Bioequiv Availab
38. Bimal Malhotra, Kyle Matschke, Candace Bramson, Qiang Wang and Joanne Salageanu (2014) Relative Bioavailability Study of an Abuse-Deterrent Formulation of Extended-Release Oxycodone with Sequestered Naltrexone (ALO-02) Versus Immediate-Release Oxycodone Tablets in Healthy Volunteers. J Bioequiv Availab
39. Iwao Osaka, Shigeki Ono, Akinori Aikawa, Akira Kimura, Yoshie Shizusawa and Isamu Adachi (2014) Prophylactic Use of Fentanyl Buccal Tablets for Predictable Breakthrough Pain: A Case Report. J Palliat Care Med 2014, 4: 191
40. Iyad Naeem Muhammad, Muhammad Harris Shoaib and Rabia Ismail Yousuf (2014) Pharmacokinetic and Bioequivalence Studies of Oral Cefuroxime Axetil 250 mg Tablets in Healthy Human Subjects. J Bioequiv Availab
41. Dalia Jawhari, Mahmoud Alswisi, Mahmoud Ghannam and Jamil Al Halman (2014) Bioequivalence of a New Generic Formulation of Erlotinib Hydrochloride 150 mg Tablets versus Tarceva in Healthy Volunteers under Fasting Conditions. J Bioequiv Availab
42. Renati Damodar and Babji Movva (2014) Preparation and In-vitro Evaluation of Metformin HCl Tablets Containing Sustained Release Beads for Increasing Therapeutic Window. J Bioequiv Availab
43. Enrique Muñoz, Daniel Horacio Ocampo, Edgar Emilio Espinal and Natalia Yépes (2014) Bioequivalence Study of Two 10 mg Montelukast Immediate-Release Tablets Formulations: A Randomized, Single-Dose, Open-Label, Two Periods, Crossover Study. J Bioequiv Availab
44. Chik Z, Deril NM, Didi EMH, Basu RC, Ratnasingam J and Mohamed Z (2014) A Bioequivalence Comparison of Two Captopril Formulations (25 mg Tablets): An Open-Label, Randomized, Two-Treatment, Two-Way Crossover Study in Healthy Volunteers. J Bioequiv Availab

45. Judith Kutzleb, Nancy Elmann, Andrew Fruhschien, Stephen Angeli, Angel Mulkay, Jarrett Bauer, Rohan Udeshi and Dan Priece (2014) The Use of 4G Android Tablets for Enhanced Patient Activation of Chronic Disease Self-Management in People with Heart Failure. J Nurs Care 2014, 3:158
46. Hesham Salem, Safa M Riad, Mamdouh R Rezk, Kholoud Ahmed (2014) Simultaneous Determination of Omeprazole, Tinidazole and Clarithromycin in Bulk Powder and Helicure Tablets by HPLC. J Chromat Separation Techniq 2014, 5: 221
47. Christian Friedrich, Tobias Brand, Arne Ring and Thomas Meinicke (2014) Bioequivalence of Glucophage? (Metformin) Tablets from Europe and the United States Tested in Healthy Volunteers. J Bioequiv Availab
48. Damodar Renati, Vinay CV (2014) Role of Novel Hole Technology in Fast Dissolving Tablets. J Mol Pharm Org Process Res 2014, 2: 001
49. (2010) Determination of 3,4-methylenedioxymethamphetamine (MDMA) in Confiscated Tablets by High-Performance Liquid Chromatography (HPLC) with Diode Array Detector. J Forensic Res 2010, 1: 106
50. Mohammed A Kassem and Gamal O El-Sayed (2014) Adsorption of Tartrazine on Medical Activated Charcoal Tablets under Controlled Conditions. J Environ Anal Chem 2014, 1: 102
51. Shahnaz Usman, Aftab Alam, Nadda Nadeem, Rameesha Khawar and Zainab Intesar (2014) Biowaiver Studies of Atenolol Tablets (100mg) - An Alternative to In Vivo Bioequivalence Studies. Nat Prod Chem Res 2014, 2: 125
52. Mirjana Menkovska (2013) The Newest Experience with Effervescent Tablets Containing Royal Jelly as Functional Food on Packing, Dosage and Synergistic Action in Prevention, Prophylaxis and Healing. J Food Process Technol 2013, 4: 272
53. Lories IB, Mostafa AA and Girges MA (2013) High Performance Liquid Chromatography, TLC Densitometry, Firstderivative and First-derivative ratio spectrophotometry for de-termination of Rivaroxaban and its alkaline Degradates in Bulk Powder and its Tablets. J Chromat Separation Techniq 2013, 4: 202
54. Cathy J Watson, David de Souza, Claudio Silva, Dedreia Tull, Suzanne M Garland and Larry L Lawson (2013) Attempt to Detect Garlic Allyl Sulphides from Saliva after Consumption of Garlic Tablets Using GC-MS. J Microbial Biochem Technol
55. MS Raghu, K Basavaiah (2012) Simple, Sensitive and Eco-Friendly Methods for the Determination of Methdilazine in Tablets and Syrup Using Cerium (IV). CSJ 2012, 3: 047
56. Liandong Hu, Deliang Gu, Qiaofeng Hu, Hailei Zhang and Xun Yang (2013) A Novel Approach to Formulate and Optimize Orally Disintegrating Tablets of Bambuterol Hydrochloride. Pharmaceut Anal Acta 2013; 4: 216
57. Menon S, Kandari K, Mhatre M and Nair S (2013) Bioequivalence and Pharmacokinetic Evaluation of Two Formulations of Armodafinil 250 mg Tablets in Healthy Indian Adult Male Subjects. J Bioequiv Availab 2013, 5: 095-098
58. Eliangiringa Kaale, Bugusu C Nyamweru, Vicky Manyanga, Mhina Chambuso and Thomas Layloff (2013) The Development and Validation of a Thin Layer Chromatography Densitometry Method for the Analysis of Diclofenac Sodium Tablets. Pharmaceut Anal Acta 2013; 4: 202
59. Higuchi T, Rao AN, Busse LW, Swintosky JV. (1953) The physics of tablet compression, the influence of degree of compression on properties of tablets. J. Am. Pharm. ASSOC. Sci. Ed, 42: 194-200.
60. Krycer I, Pope DG, Hersey JA (1982) The interpretation of powder compaction data, a critical review. Drug Devel. Ind. Phorm 8: 307-342.

61. Hiestand EN, Wells JE, Peot CB, Ochs JF (1977) Physical processes of tabletting. J. Pharm. Sci, 66: 510-519.
62. Jetzer WE, Johnson WB, Hiestand EN (1985) Comparison of two different experimental procedures for determining compaction parameters Inl. J. Phorm, 26: 329-337
63. Smith AN (1949) Compressed tablets, resistance to wear and tear. Pharm. J, 163: 194-195.
64. Little A, Mitchell KA (1963) Tablet Making, 2nd edn. Northern Liverpool.
65. Hiestand E, Smith D (1980) Time dependent factors of compaction. Proceedings of the International Powder and Bulk Solids Handling and Processing Conference/Exhibit, Rosemont, IL, Powder Advisory Centre, London NWI 10PG, UK, 13-15.
66. NystrSm C, Alderborn G, Duberg M, Karehill P (1993) Bonding surface area and bonding mechanism--two important factors for the understanding of powders and compactibility Drug Dev. Ind. Pharm, 19: 2143-2196.
67. Armstrong NA, Abourida NM, Gough AM (1983) A proposed consolidation parameter for powders. J. Pharm. Pftarmocol, 35: 320-321.
68. Charlton B, Newton JM (1984) Theoretical estimation of punch velocities and displacements of single punch and rotary tablet machines, J. Pharm. Pharmacol, 36: 645-651.
69. Rippie EG, Danielson DW(1981) Viscoelastic stress-strain behaviour of pharmaceutical tablets analysis during unloading and postcompression periods, J. Phorm. Sci, 70: 476-482.
70. Bateman SD, Rubinstein MH, Wright P (1987) The effect of compression speed on the properties of ibuprofen tablets, J. Pharm. Pharmacol, 39: 66
71. Pitt KG, Newton JM, Richardson R, Stanley P. (1987) The effect of punch velocity on the tensile strength of aspirin tablets. J. Pharm. Pharmocol, 39: 65.
72. Leuenberger H, Rohera BD (1986) Fundamentals of powder compression. The compactibility and compressibility of pharmaceutical powders. Phorm Res, 3: 12-22.
73. Rees JE. Postgraduate school on the theory and practice of solid dosage forms and anufacture. London 1980.
74. Hunter BM, Fisher DG, Pratt RM, Rowe RC (1976) A high speed compression simulator. J. Pharm. Phormncol, 28: 65.
75. Bateman S (1988) High speed compression simulators in tableting research. Pharm. J, 240,632-633.
76. Armstrong NA, Palfrey LP (1987) Punch velocities during the compaction process. J. Pharm. Pharmacol,39: 497-501.
77. Baba M, Nagafuji N (1965) Studies in tablet compression, compressibility of various powders. Annu. Rep. Shionogi Res. I & IS, 138-146.
78. Seitz JA, Flessland GM (1965) Evaluation of physical properties of compressed tablets, 1: tablet hardness and friability. J.Phorm. Sri, 54: 1353-1357.
79. Fassihi A, Falamarzian M, Parker MS (1980) The influence of the rate of production of tablets at constant pressure upon their physical properties. Drug Devel. Ind. Pharm, 6: 440-450.
80. Roberts RJ, Rowe RC (1985) The effect of punch velocity on the compaction of a variety of materials. J. Phorm. PhormacoI, 37: 377-384.
81. Heckel RW (1961) An analysis of powder compaction phenomena. Trans. Metall. Sot. AIME, 221: 671-675.
82. Armstrong NA, Blundell LP (1985) The effect of machine speed on the compaction of some directly compressible tablet diluents. J. Pharm. Pharmacol, 37: 28.
83. Armstrong NA, Palfrey LP (1987) The effect of machine speed on the consolidation of four directly compressible tablet diluents. J. Pharm. Pharmacol., in press Roberts RJ and Rowe RC. Source and batchwise variability in the

compressibility of microcrystalline cellulose. J. Pharm. Phormocol, 39: 70.

84. Armstrong NA, Patel AN (1987) The effect of water content on tablet porosity, Proceedings, 6th Pharmaceutical Technology Conference, Canterbury, 2: 329-334.
85. David ST, Augsburger LL (1977) Plastic flow during compression of directly compressible fillers and its effect on tablet strength. J. Pharm. Sci, 66: 155-159.
86. Rees JE, Rue PJ (1978) Work required to cause failure of tablets in diametral compression, Drug Duel. Ind. Pharm, 4: 131-156.
87. Malamataris S, Bin Baie S, Pilpel N (1984) Plastoelasticity and tabletting of paracetamol, Avicel and other powders. J. Phorm. Phormocol, 36: 616-617.
88. Leuenberger H, Hiestand E, Sucker H. (1981) Ein beitrag zur theorie der pulverk compression, Chem.-Ing.-Tech, 53: 45-47.
89. Tabor D. The Hardness of Metals. Oxford University Press, London 1951.
90. Nies CW, Messing GL (1984) Binder hardness and plasticity in granule compaction. Forming of Ceramics in: Mangels JA,Messing GL, (Eds.), Advanced Ceramics 9, The Am. Ceram. Soc., Columbus, OH 58-66.
91. Meng-Chih L, Duncan-Hewitt W(1994) Deformation kinetics of acetaminophen crystals. Int. J. Pharm, 106, 187-200.
92. Lee EH, MRadok JR (1960) The contact problem for viscoelastic bodies. J. Appl. Mech. 27, Trans. ASME, 82, series E, 438-444.
93. Greenwood JA, Johnson KL (1981) The mechanics of adhesion of viscoelastic solids, Phil. Mag, 43: 697 711.
94. Rumpf H (1962) The strength of granules and agglomerates, in: Knepper W.A. (Ed.), International Symposium on Agglomeration, Interscience, New York, 379-414.
95. Hiestand E (1985) Dispersion forces and plastic deformation in tablet bond, J. Pharm. Sci, 74: 768-770.
96. Hiestand EN, Wells JE, Peot CB, Ochs JF (1977) Physical processes of tableting, J. Pharm. Sci, 66: 510-519.
97. Rippie EG, Morehead WT (1994) Structure evolution of tablets during compression unloading, J. Pharm. Sci, 83, 708-715.
98. Hiestand EN, Smith DP (1984) Indices of tableting performance, Powder Technol, 38: 145- 59.
99. Hiestand E (1978) Physical processes of tableting, 2. Proceedings of the International Conference on Powder Technology and Handling., Switzerland, June, 6-8.
100. Armstrong NA, Morton FSS (1979) An evaluation of the compression characteristics of some magnesium carbonate granulations. Pharm. Weekbi, 114: 1450-58.