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CHEMICAL STABILITY STUDIES ON SOME LOCALLY MANUFACTURED TABLETS USING INSTRUMENTAL METHODS

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ABSTRACT

The objective of the present study is to evaluate the quality of tablets formulated by two different Pharmaceutical companies and compare it. Niacinamide, Ferrous fumerate, Paracetamol in combination with Ibuprofen, Nimesulide and Ciprofloxacin of 'X' and 'Y' companies were selected for analysis and quality evaluation. The tablets were screened for two post-formulation instrumentation tests: Disintegration and dissolution rates, following standard Indian Pharmacopeia (IP) procedures. The observations were used to make various plots to correlate the test parameters. From the results obtained and analysis, it was observed that there was no much variation in the pattern of disintegration and dissolution rates of the tablets. The quality maintained by both the companies was found to meet IP standards and reliable.

Key words: Disintegration rate, Dissolution rate**,** Tablets, Chemical stability, Pharmaceutical quality and Instrumental methods.

INTRODUCTION

Tablets have got the best-combined properties of chemical, mechanical and microbiologic stability of all the oral forms. They provide the greatest ease of swallowing with the least tendency for 'hang up' above the stomach especially when coated, provided that tablet disintegration is not excessively rapid. Drugs with slow dissolution properties are difficult to formulate as a tablet will provide adequate drug bioavailability. The oral route for systemic effects, parenteral route for insulin therapy and topical route for angina and motion sickness are the routinely used drug administration methods. Nevertheless, 90% of all drugs are administered by the oral route. Drugs which are administered orally, solid oral dosage forms such as tablets and capsules represent unit dosage forms in which one usual dose of the drug has been accurately placed[1]. Liquid oral dosage forms such as syrups, suspensions, emulsions, solutions and elixirs are usually designed to contain one dose of medication in 5 to 30 mL. Such doses are typically in error by a factor ranging from 20 to 50% when the drug is self administered by the patient. To design tablets and later monitor tablet production quality, quantitative evaluations and assessments of a tablet's chemical, physical and bioavailability properties that represent their stability profiles must be made. The three properties must be interrelated to know the chemical breakdown or physical property changes of tablets due to interactions among tablet components which in turn greatly change the bioavailability of a tablet system. The standard quality control tests such as uniformity of weight, thickness, hardness, friability, percentage of medicament, rates of disintegration, dissolution and solubility can be carried out on compressed tablets for their

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evaluation. Five different drugs of tablets from each of the companies 'X' and 'Y' were collected and the quality control test cited above were conducted in order to study the effect of composition of formulations in drug release rate[2].

Previous work review

Studies were conducted to evaluate the changes in the physical properties of compressed tablets as the operation of a rotary tableting machine was varied. Increasing the compressional speed reduced the crushing strength and increased the capping tendency, but did not affect the friability of compressed tablets[3]. The disintegration of a tablet immersed in a liquid appears to be essentially a mechanical phenomenon. Noticed that the carboxymethylstraches which swell much less in a gastric medium, produce even shorter disintegration times in this medium. The destruction of the cohesion forces between the constitutive elements of the tablet under the action of water may be ascribed to the creation of a repulsive force when the elements of the tablet enter into contact with water[4]. The matrix permeability and rates of permeation of the matrix by the solvent can individually limit drug release rates and found to be a function of the pore size distribution of the matrix and the permeation pressure of the release media. The results have been used to develop models to illustrate the possible systems that can be encountered. Concepts such as rates of pore permeation, varying solubility dependence and tortuosity were developed and applied to these models[5].

The absorption rates of several types of commercial aspirin tablets have been determined by the urinary excretion method. The results indicate that the *in vivo* absorption rate is proportional to *in vitro* dissolution rate determined by a method previously described. For the conflicting results obtained by different clinical investigators on absorption rates of different types of aspirin, proposed that an U.S.P. tablet disintegration test be replaced by a dissolution test[6]. Dissolution behavior of drugs has a significant effect on their pharmacological activity. Dissolution tests are used to confirm compliance with compendial specifications and are needed as part of a product license application[7]. The effects of hardness on disintegration and dissolution characteristics of uncoated caffeine tablets made at eight different pressure levels were studied. The hardness governed the dissolution over all the stages from tablet to the smallest particles after the breakage by disintegration. The dissolution rates of the J. P. method were greater than those of the U.S.P. method[8]. A study was undertaken with uncoated caffeine, aspirin and proxyphylline tablets using two dissolution methods to find a relation existed between the dissolution rate theory of Kitazawa et al.,[8] and that of Wagner[9] both theoretically and experimentally. Suggested that the 1n W^{∞}/ (W^{∞} - W) versus time plot devised by Kitazawa et al.[10], might be a useful and simple means of obtaining the dissolution rate constant of an active ingredient from a dosage form such as compressed tablet .

EXPERIMENTAL

Materials and methods

Materials

The tablets listed below were collected from each of the companies to study their chemical stability in terms of disintegration and dissolution rates.

X- Company

(a) **Floriguard - B** (coated, Niacinamide), (b) **Glyziron - C** (coated, ferrous fumerate), (c) **I.P.M. forte** (uncoated, paracetamol and ibuprofen), (d) **Nimsun** (uncoated, nimesulide) and (e) **Ciprosun** (film coated, Ciprofloxacin).

Y- Company

(a) **Neurosol** (coated, Niacinamide), (b) **Redisules** (coated, Ferrous Fumerate), (c) **Fencin – M.R** (uncoated, Paracetamol and Ibuprofen), (d) **Nimesulide** (Uncoated, Nimesulide) and (e) **Mitycip – 500** (Coated, Ciprofloxacin).

Instruments

Disintegration apparatus B.P. standard, Dissolution apparatus U.S.P. standard and U.V. Spectrometer.

Chemicals

Phosphate buffer solution, 0.1 N hydrochloric acid, Glacial acetic acid, Ceric Ammonium sulphate, Perchloric acid, Sodium hydroxide, 95% Ethanol.

Methods

Disintegration test

The disintegration tests are performed to find out within how much time the tablet disintegrates as it is very important and necessary for all the tablets, coated or uncoated to be swallowed because the dissolution rate depends upon the time of disintegration, which ultimately affects the rate of absorption of drugs. Tablets were introduced into each tube of disintegration test apparatus and a disc was added to each tube. The assembly was suspended in the beaker containing the specified liquid and operated for specified time. The assembly was removed from the liquid after all the tablets have been disintegrated. If 1 or 2 tablets fail to disintegrate, the test on 12 additional tablets will be repeated until not less than 16 of the total of 18 tablets tested disintegrate. If the tablets adhere to the disc and the preparation being examined fails to comply, the test will be repeated omitting the discs[11].

Dissolution test

Stated volume of the dissolution medium, free from dissolved air was introduced into the vessel of the apparatus. The dissolution medium was warmed between 36.5^{o} and 37.5^{o} C. The tablet was allowed to sink to the bottom of the vessel prior to the rotation of the paddle. Wire helix was used to keep the tablet horizontal to avoid floating at the bottom of the vessel. Air bubbles were removed from the surface of the tablet. A sample from the surface of the dissolution medium was withdrawn, analysed for absorbance as directed in the standard monographs using UV-spectrophotometer. The whole operation was repeated for five times and the amount of dissolved active ingredient of the tablet in the solution as a percentage of the stated amount was calculated[12].

RESULTS AND DISCUSSION

Tablets with the same basic drug and variation in the composition of excipients, consisting of niacinamide, ferrous fumerate and paracetamol in combination with ibuprofen, nimesulide and ciprofloxacin of two different pharmaceutical companies have been collected from 'X' and 'Y' companies. The chemical stability tests of disintegration and dissolution rates were conducted on the tablets to evaluate the best composition of this drug formulary abiding by standard Indian Pharmacopoeia procedures. After performing the tests the observations have been recorded and various plots have been drawn to correlate the tested parameters.

Fig. 1-5, indicate that the disintegration rates of tablets were decreased with increase in time with all the products of both the companies.

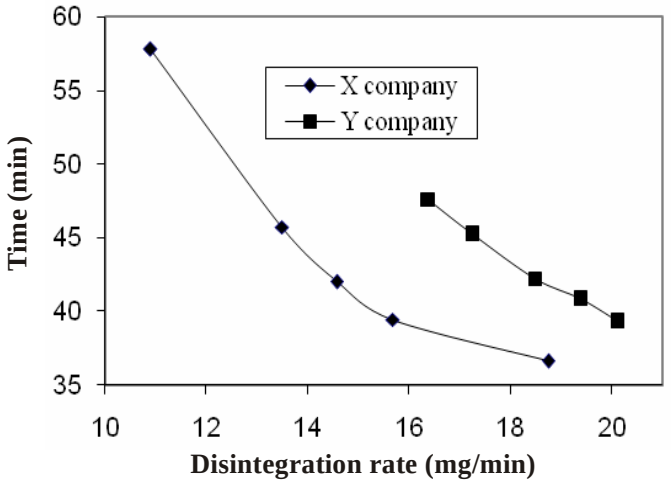

Fig. 1: Disintegration rate vs time (Niacinamide)

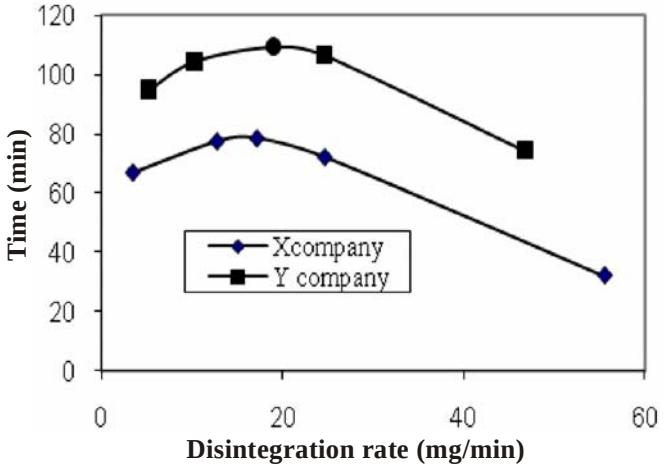

Fig. 2: Disintegration rate vs time (Ferrous fumerate)

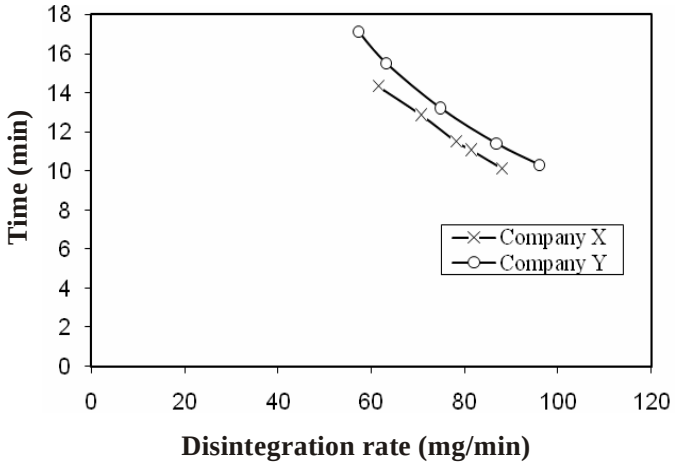

Fig. 3: Disintegration rate vs time (Paracetamol and Ibuprofen)

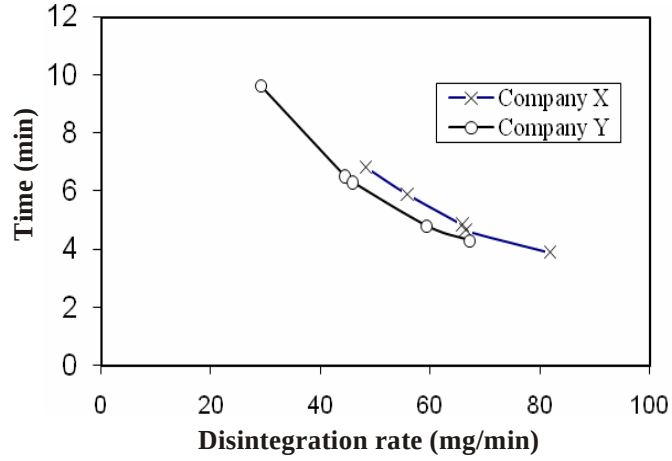

Fig. 4: Disintegration rate vs time (Nimesulide)

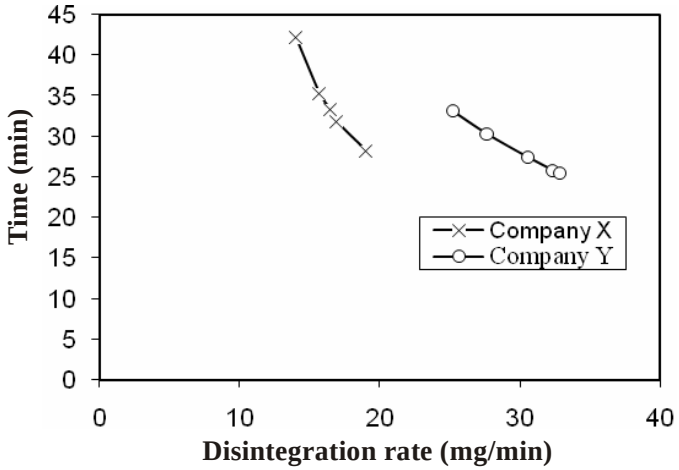

Fig. 5: Disintegration rate vs time (Ciproflaxacine)

Fig. 6-11, indicate that the absorbance were increased with increase in time for niacinamide, ferrous fumerate, paracetamol, nimesulide and ciprofloxacin except in case of ibuprofen for both the companies.

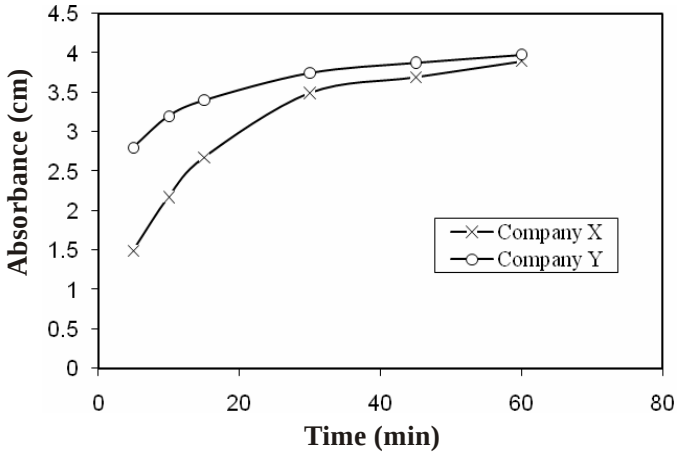

Fig. 6: Time vs dissolution rate (Niacinamide)

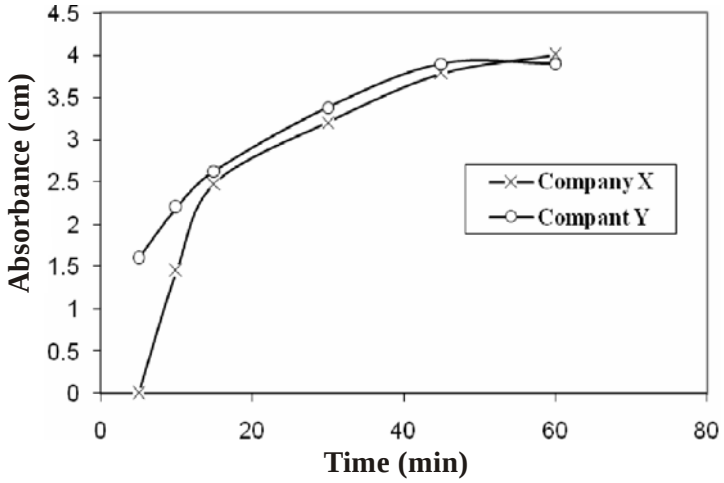

Fig. 7: Time vs absorbance (Ferrous fumerate)

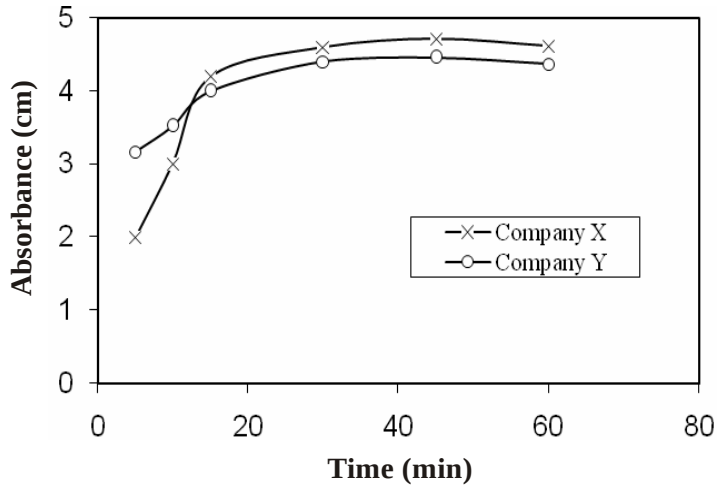

Fig. 8: Time vs absorbance (Paracetamol)

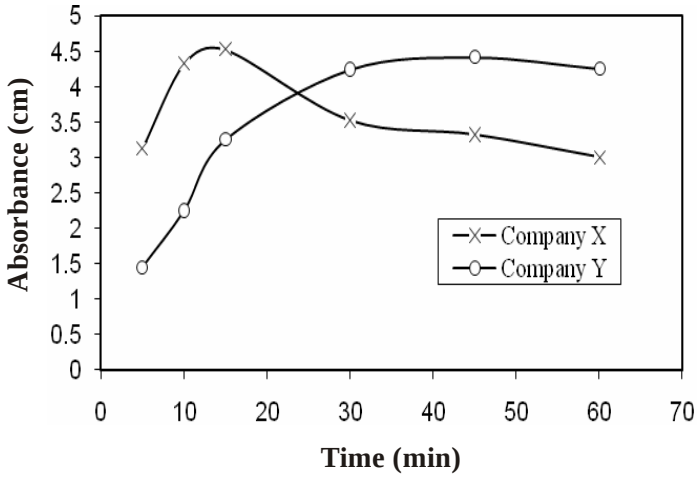

Fig. 9: Time vs absorbance (Ibuprofen)

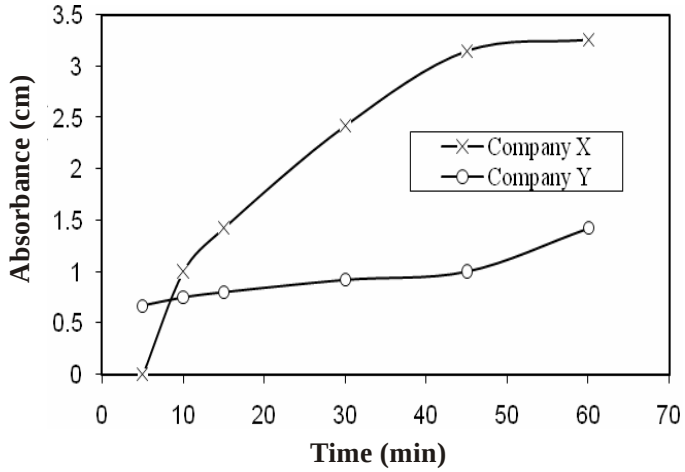

Fig. 10: Time vs absorbance (Nimesulide)

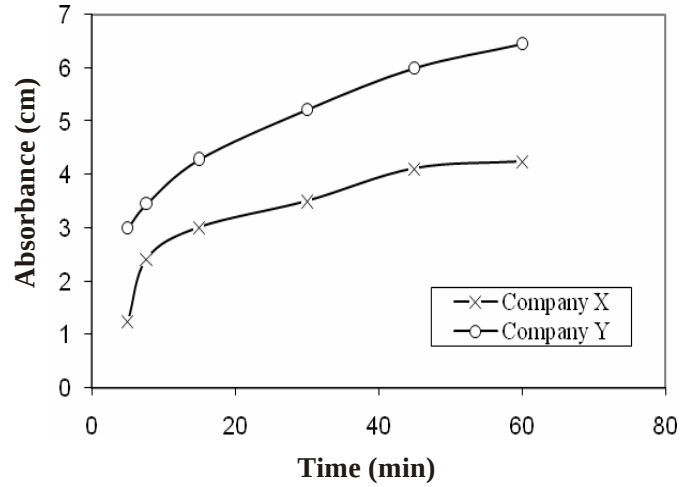

Fig. 11: Time vs absorbance (Ciproflaxacin)

CONCLUSION

As far as the standard tests of disintegration rate and dissolution rate are concerned, the product of formulations of both the companies have shown the same pattern as per I.P. Standards. Since there is a combination of other drugs in some of the formulations there may be an effect of these drugs in performing the qualitative tests. However, in overall it is concluded from the above results that the formulation 'Y' company products are better when compared to the products of 'X' company.

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