

**COMPARISON STUDIES OF UNCOATED & ENTERIC COATED ASPIRIN FORMULATIONS**

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ABSTRACT

Aspirin is belonging to the class of NSAID having analgesic, antipyretic, anti-inflammatory and antiplatelet activity at regular normal doses. At higher doses it causes gastrointestinal ulcers, stomach bleeding etc. This effect of aspirin can be minimized by preventing the drug exposure to the gastric region which is achieved by using enteric coating of the aspirin tablet. The present study involves comparison of physical evaluation of uncoated tablets with that of enteric coated tablets of Aspirin.

Keywords: Aspirin, Enteric coating, Gastrointestinal Ulcers and NSAID

INTRODUCTION

Tablets are the most widely used unit solid dosage form of the drug(s) administered through oral route. These are administered into the body in order to produce systemic effects of drug to cure, prevent or suppress the diseased condition. More than 90% of the marketed drugs are formulated in the form of tablet dosage form as they produce several advantages in comparison to other dosage forms such as lack of physical and chemical stability of drug in the form of liquids, easy to handle, self medication can be possible etc. There are different classes of tablets available in the market, in that uncoated and coated tablets are one class. Some of the drugs may be damaged in gastric environment and some may irritate the gastric mucosa. Drugs that produce this effect are NSAIDs, potent antibiotics like erythromycin, azethromycin etc. For these type of drugs, layers of coating solution is applied to form a thick coat around the tablet which may prevent the drug exposure to acidic environment and moreover prevents gastric irritation. This type of coating is called as enteric coating which done by the use of several enteric polymers such as Cellulose Acetate Phthalate (CAP), Shellac, Zein, etc. Aspirin is an acetyl salicylic acid^[1] which is one of the drug which

causes gastric mucosal irritation resulting to gastric hemorrhage when it is administered as uncoated tablet. So the effect of aspirin can be prevented by applying a thick enteric coat around the aspirin tablet. Aspirin is considered as one of the lives saving drug belongs to the class of NSAID. It is used as analgesic to relieve minor aches and pains, as an antipyretic to reduce fever and as an anti-inflammatory.

Aspirin also has an antiplatelet effect by inhibiting the production of thromboxane, which under normal circumstances binds platelet molecules together to create a patch over damaged walls of blood vessels. Because the platelet patch can become too large and also block blood flow, locally and downstream, aspirin is also used long-term, at low doses, to prevent heart attacks, strokes, and blood clot formation in people at high risk for developing blood clots^[2]. It has also been established that low doses of aspirin may be given immediately after a heart attack to reduce the risk of another heart attack or of the death of cardiac tissue^[3].

The main undesirable side effects of aspirin are gastrointestinal ulcers, stomach bleeding, and tinnitus, especially in higher doses. So in order to minimize the side effects of aspirin in the gastric

region these are coated with enteric material which causes the release of drug in intestinal region. The exposure of drug in the gastric region is almost prevented. Aspirin is synthesized by esterification reaction of salicylic acid and acetic anhydride [4]. The acid dissociation constant (pK_a) for acetylsalicylic acid is 3.5 at 25 °C (77 °F) [5]. The present study includes comparison of physical evaluation of uncoated tablets with that of enteric coated tablets of Aspirin.

MATERIALS AND METHODS

Two different marketed tablet formulations like uncoated and enteric coated tablets of aspirin were selected for the physical evaluation study. These tablet formulations are subjected for the evaluation tests like General appearance, hardness, friability, weight variation, content uniformity, disintegration and dissolution studies.

General Appearance: The general appearance of a tablet is its identity and elegance essential for consumer acceptance, for control of lot-to-lot uniformity and tablet-to-tablet uniformity. The control of general appearance involves the measurement of size, shape, colour, presence or absence of odor, taste etc.

The size and shape of a tablet can be dimensionally described & controlled. The thickness of a tablet is only variables. Tablet thickness can be measured by micrometer or by other device. Tablet thickness should be controlled within a $\pm 5\%$ variation of standard value.

Unique Identification Marking: These marking are used for the identification of manufacturer's own product by using some form of embossing, engraving or printing. These markings include company name or symbol, product code, product name etc.

Organoleptic Properties: Color distribution must be uniform without mottling. For visual color comparison compare the color of sample against standard color.

Hardness: Tablet requires a certain amount of strength or hardness and resistance to friability to withstand mechanical shakes during handling in manufacture, packaging and shipping. Hardness generally measures the tablet crushing strength.

Friability: Friability of a tablet can determine in laboratory by Roche Friabilator. This consists of a plastic chamber that revolves at 25 rpm, dropping the

tablets through a distance of six inches in the friabilator, which is then operated for 100 revolutions. The tablets are reweighed. Compressed tablet that lose less than 0.1 to 0.5 % of the tablet weigh are consider acceptable.

$$\% \text{ Friability} = \frac{(\text{Initial Weight} - \text{Final Weight})}{(\text{Initial Weight})} \times 100$$

Weight Variation Test (U.S.P.): 20 tablets are selected randomly and weighed individually. Calculate average weight and compare the individual tablet weight with the average. The tablet pass the U.S.P. test if no more that 2 tablets are outside the percentage limit and if no tablet differs by more than 2 times the percentage limit.

Content Uniformity Test: Randomly 30 tablets are select. 10 of these assayed individually. The tablets pass the test if 9 of the 10 tablets must contain not less than 85% and not more than 115% of the labeled drug content and the 10th tablet must contain not less than 75% and not more than 125% of the labeled content. If these conditions are not met, remaining 20 tablets assayed individually and none may fall outside of the 85 to 115% range.

Disintegration Test (U.S.P.): The U.S.P. device to test disintegration consists of 6 glass tubes that are 3inch long; open at the top and 10 mesh screen at the bottom end. During the disintegration test, one tablet is placed in each tube and the basket rack is positioned in a 1-L beaker of either water, simulated gastric fluid or simulated intestinal fluid at 37 ± 2 °C such that the tablet remain 2.5 cm below the surface of liquid on their upward movement and not closer than 2.5 cm from the bottom of the beaker in their downward movement. Move the basket containing the tablets up and down through a distance of 5-6 cm at a frequency of 28 to 32 cycles per minute. Floating of the tablets can be prevented by placing perforated plastic discs which also facilitates the process of disintegration on each tablet. According to the test the tablet must disintegrate and all particles must pass through the 10 mesh screen in the time specified. If any residue remains, it must have a soft mass.

Disintegration time: Uncoated tablet: 5-30 minutes
Coated tablet: 1-2 hours

Assay: Weigh and powder 20 tablets. Weigh accurately a quantity of powder equivalent to about 0.5 grams of aspirin. Add 30ml of 0.5M NaOH, boil gently for 10mins. Cool and titrate excess alkali with 0.5M HCl using phenol red as indicator. Repeat the operation without the substance being examined. The

difference between the titrations represents the amount of NaOH required. Each ml of 0.5M NaOH is equivalent to 0.04504gms of $C_9H_8O_4$.

DISSOLUTION:

The in-vitro drug release from the aspirin uncoated tablets (AUT) and enteric coated tablets (AET) were performed in USP II apparatus (Paddle type) by using 0.1 N hydrochloric acid as dissolution media, maintained at a temperature of $37^\circ\text{C} \pm 0.5^\circ\text{C}$. The standard curve was plotted by making serial dilutions of aspirin (API) by measuring the absorbance at 540nm for AUT and at 314nm for AET. The samples from AUT and AET were collected for 60 min and 120 min respectively and absorbance was measured for each sample and dissolution medium was taken as blank.

RESULTS AND DISCUSSION

The aspirin uncoated tablets and enteric coated tablets were physically evaluated. The size and thickness of AET were found to be greater than the AUT. The results related to hardness, friability, average weight of tablet, % weight variation, assay and disintegration time of AUT and AET were mentioned in the *table no 1*. The disintegration time for AET was more as compared with that of AUT because the dissolution fluid needs more time to dissolve the enteric coating layer and for this reason the process of disintegration is slow for AET. The time required for the release of maximum amount of drug is more for AET due to presence of enteric

Table No: 1

S.No.	Parameter	AUT	AET
1	Colour	Orange	White to Off white
2	Odour	Salicylic Acid	Salicylic Acid
3	Shape	Round	Round
4	Size (Diameter)	1.26 cm \pm 0.14	1.06 \pm 0.05
5	Average wt. of Tablet (mg)	432 \pm 4.0	542 \pm 3.2
6	% Weight Variation	2.95 \pm 0.638	0.555 \pm 0.44
7	Thickness (mm)	2.53 \pm 0.11	3.24 \pm 0.15
8	Hardness (Kg/cm)	3.125 \pm 0.75	4.75 \pm 0.7
9	Friability (% w/w)	0.24 \pm 0.12	0.27 \pm 0.18
10	Assay	NLT 92% & NMT 96%	NLT 89% & NMT 94.3%
11	Disintegration Time	2 min	56 min

coating over the tablets. The drug was released into the dissolution medium only after dissolution of coating layer which requires more time, so the time required to release drug from the AET formulation was more as that of AUT.

CONCLUSION

Aspirin is a salicylate drug used as an analgesic to relieve aches and pains, as an antipyretic to reduce fever, and as an anti-inflammatory drug and is also having antiplatelet activity by inhibiting the production of thromboxane. Aspirin is available in different doses and in different forms as uncoated tablets and enteric coated tablets for various pharmacological purposes. In the present study both the uncoated and enteric coated aspirin tablets were selected and their physical characteristics were evaluated by different evaluation tests.

The main comparison study was done by considering the disintegration time and dissolution studies for both uncoated and enteric coated tablets. Aspirin enteric coated tablets were found to have more disintegration time and more time to release the drug from the formulation. This is due to the presence of coating material which retards the release of drug from the formulation. This indicates the presence of coating on to the drug particles prevents the degradation of drug and also mitigates the gastrointestinal bleeding effect of drug.

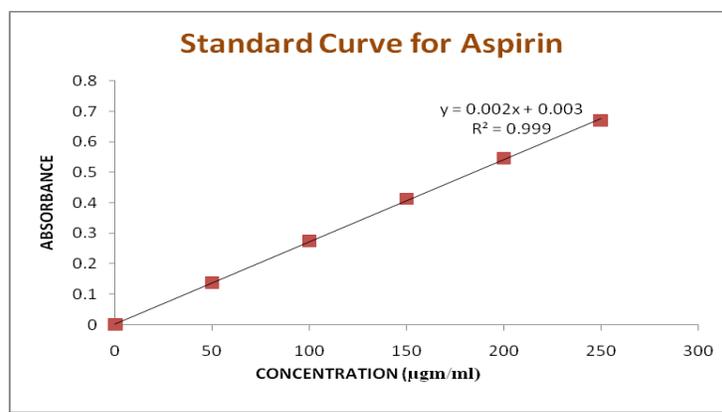


Fig 1: Standard Curve

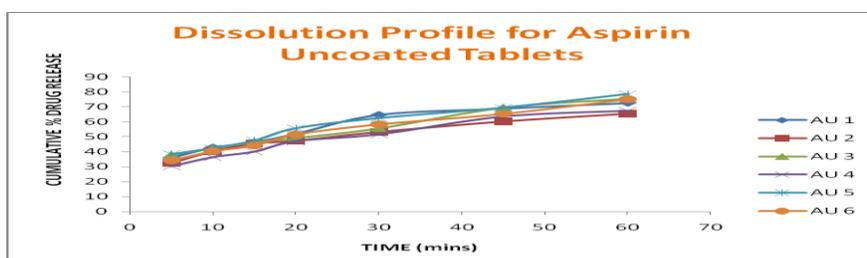


Fig 2: Drug Release from AUT

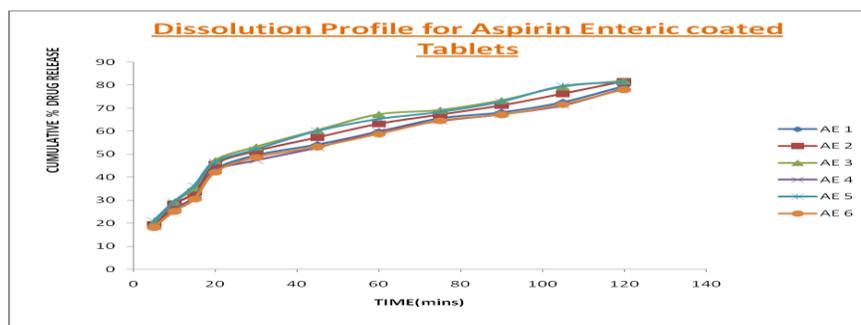


Fig 3: Drug Release from AET

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