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A REVIEW ON: EFFERVESCENT TABLET

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ABSTRACT

Effervescent tablets are becoming increasingly popular due to their ease of administration and rapid onset of action. They typically contain acidic materials and carbonates or bicarbonates that react quickly in the presence of water, releasing carbon dioxide and improving API solubility and flavor masking. However, effervescent tablets can be bulky, and the reaction rate is difficult to control due to water's catalytic effect. This article discusses the advantages and disadvantages of effervescent tablets, common effervescent reactions, active ingredients that can be formulated, and the preparation and manufacturing process. It also evaluates effervescent granules and tablets and explores the latest advancements in effervescent technology. Overall, effervescent tablets offer a promising option for drug delivery, and ongoing research will undoubtedly yield even more advanced formulations in the future.

INTRODUCTION

Granules are a unique type of dosage form which are composed of dried aggregates of powder solid particles which contain one or more Active Pharmaceutical Ingredients, with or without other ingredients.[1] effervescent is derived from a Latin word which means the escape of gas from an aqueous or water solution.[2] Effervescent tablets are becoming increasingly popular in a variety of sectors include supplement and pharmaceutical use, thanks to the convenience during which they will be consumed.

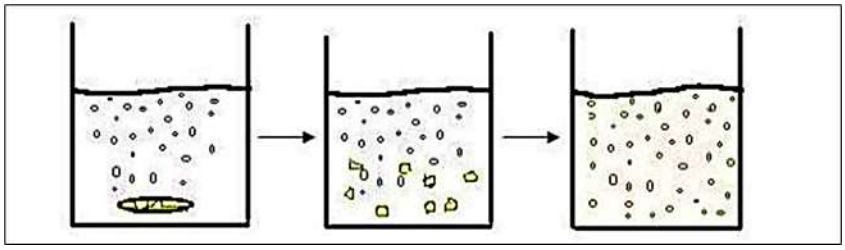


Figure No. 1. Evolution of bubbles of gas from a liquid.

Effervescent tablet is designed to break in contact with liquid like water or juice, often Causing the tablet to dissolve into solution as shown in fig.1. Effervescent means CO_2 gas emission in reaction to acid and bicarbonate in the presence of H_2O Other common acidic used in citric, malic, tartaric, Adipic and fumaric acids and bicarbonate uses in the effervescent reaction is sodium bicarbonate, Potassium bicarbonate, sodium carbonate and Potassium.[2,3]

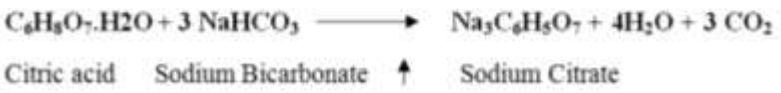
Figure No. 2: Effervescence Reaction.

From the fig.2 the reaction starts in the presence of water, even with a very small amount as a catalyzing agent, and because water is one of the reaction products, it will accelerate the rate of reaction. leading to difficulty in stopping the reaction. Thus, the whole manufacturing and storage of effervescent products is done by minimizing contact with water in controlled environment in suitable container.[4]

Formulation of effervescent preparation mainly consists of three components: Active ingredients (drug), acid source, and alkaline source constituted by carbonate and bicarbonate. Acid substance and carbonates or a bicarbonate substance reacts rapidly in the presence of water by releasing carbon dioxide. They are usually dissolved or dispersed in water before administration. They provide a pleasant taste due to carbonation which helps in taste masking of objectionable medicaments. This is a unique advantage of this dosage form over other fast release dosage forms which required use of method of taste masking. Other excipients are

diluents. Binders, disintegrating agent, lubricant, glidant, antiadherent, sweetener, flavors, colours.[5]

The reaction between Citric acid and Sodium bicarbonate, which results in liberation of carbon dioxide shown as follows[6],



Why Effervescent Tablets are Used?

The doses can be taken easily. The ingredients (carbonate and acid) serve as buffer for the stomach with optimum pH. The absorption occurs at 5 min. Effervescent tablets are uncoated tablets, was susceptible to the stomach. They may be taken in liquid form. The patients have swallowing difficulty which cause the tablet to disintegrate and dissolve after effervescent reaction, CO_2 is produced.[7]

Effervescent tablets are used for[7]

- **Rapid and enhanced absorption:** It is dissolved in liquid and the ingredients are absorbed quickly. Conventional tablets are dissolved slowly and absorption is reduced.
- **Optimal compatibility:** The effervescent tablet contains a balanced ratio of acids and carbonates forming a buffer. It has optimal compatibility with the stomach.
- **Increase in liquid intake:** Effervescent tablets provide both the medicinal value intended and additional liquid intake. In diarrhoea and high temperature in summer, intake of effervescent table with water contributes to daily liquid intake.
- **Advantages in case of swallowing problems:** Effervescent tablets present an alternative for these patients.
- **Simple handling and measuring into exact doses:** Effervescent tablets are dissolved quickly and the patients can obtain exact doses.

Advantages of Effervescent Tablets[8]

- No need to swallow tablets
- Good stomach and intestinal tolerance
- Superior stability
- More consistent response

- Accurate dosing
- Improved therapeutic effects
- High patient compliance
- Enhanced Absorption

DISADVANTAGES OF EFFERVESCENT TABLETS[9,10]

- Unpleasant taste of some active ingredients.
- Larger tablets requiring special packaging materials.
- Relatively expensive to produce due to large amount of more or less expensive excipients and special production facilities.
- Clear solution is preferred for administration, although a fine dispersion is now universally acceptable.

1.1.1. General Manufacturing Process for Effervescent Tablet

The effervescent formulation mainly consists of Three components-

- Active ingredient
- Acids sources
- Alkaline compound, constituted by a carbonate or bicarbonate.[11]

Table No. 1: Components of Effervescent Tablet.

Acid Sources	Alkali Soucres
Citric acid, tartaric acid, Fumaric acid, Adipic acid, Malic acid, Ascorbic acid, Acid citrate salts.	Sodium bicarbonate, Potassium carbonate, Calcium carbonate, Sodium Carbonate.

Lubricants	Other Agents
Sodium benzoate, Sodium acetate, Fumaric acid, Polyethylene Glycol (PGE) Higher than 4000, Alanine And Glycine	Binders Glidants, Disintegrate, Antiadherents, sweeteners, Flavours, Colours, Surfactants.

a) Wet granulation

Wet granulation is still the method of choice for effervescent granulation despite having significant drawbacks. This approach can generate uniform tablets in terms of weight or amount of active component since it provides homogeneous granules for compression. According to the number of crucial phases involved in wet granulation, there are two

additional categories of wet granulation methods. wet granules drying. mixing a powder combination with a binder solution to create a wet mass. Binder solution preparation. The blending of the drug(s) and excipients the blending of screened granules with lubricant, glide, and disintegrate.

Advantages of wet granulation

- Permits mechanical handling of powders without loss of mix quality.
- Improves the flow of powders by increasing particle size and sphericity.
- Increases and improves the uniformity of powder density.

Limitation of wet granulation

Loss of fabric during various stages of processing. Two-step granulation method the best disadvantage of wet granulation is its cost. It's a fashionable process due to labor, time, equipment, and energy and space requirements.

b) Direct compression

Another alternative process for dry granulation is direct compression. This was successfully used for preparing effervescent tablets of acetyl hydroxy acid. This helps in overcoming operational and stability problems during the method. This can be a perfect process of producing, but its use is restricted because of the need of requirements of sophisticated material mixture (Compressible, free flowing and non-segregating).

c) Dry granulation

Granulation by slugging (slugs or large tablets that are compressed using heavy-duty tableting equipment) or roller compaction is suitable for materials that can't be wet granulated. Slugs and therefore the material from the roller compactor are reduced to the right size. Lubrication is usually necessary during slugging but not always with roller compaction. The acidic and basic components could also be dry granulated separately or together.

d) High shear granulator

This is the foremost common configuration used on an industrial scale for the assembly of pharmaceutical granules. Again, this technique allows full integration with upstream and downstream equipment's, and even includes a wet mill between the granulator and dryer. With modern control systems, it's easy to load, mix and granulate a second batch within the

high shear granulator whilst drying the previous batch within the fluid bed before discharge. All equipment may be cleaned in situ in a very single automatic process.

e) Fluid bed granulation

The production of effervescent granules which will be accustomed prepare effervescent tablets was accomplished using fluidized bed granulation. A dry mixture of the powdered sort of an acid and carbonate source is suspended in a very stream of hot air, forming a constantly agitated, fluidized bed. An amount of granulating fluid, usually water, is introduce before its vaporized. This causes the ingredients to react to a limited extent forming single granules of the 2 reactive components. The granules are larger than the powder particles of the starting materials and suitable for compression into tablets after drying has been completed within the fluidize bed apparatus. This procedure has the advantage of ingredient mixing, granulating, and drying dead one piece of kit with minimal loss of carbonic acid gas.

f) Hot melt granulation

In a melt granulation process, the binder solution of a regular wet granulation process is replaced with a melt able under. This binder may be added in molten form, but the high shear process offers the advantage of allowing the binder to be added in its solid state. Melting is achieved by the energy added through the mixer friction and therefore the heated jacket of the bowl.[12-16]

Pre-Compression Evaluation of Effervescent Tablet

The tablet blend was subjected to the pre-compression evaluation in which various parameters like angle of repose, bulk density, tapped density, compressibility index and Hauser ratio was determined.

1. Angle of Repose

Angle of repose is determined by using funnel method. Effervescent Granules are poured from the funnel, that can be raised vertically until a maximum cone height, h, diameter of cone, D, is measured. The repose angle 0 is calculated by formula:

$$\mathbf{Tan0= 2h/ d}$$

2. Bulk Density

Bulk density is determined by placing Effervescent Granules into a graduated cylinder and measuring the volume and weight.

3. Tapped density

Tapped density is determined by placing a graduated cylinder, containing a known mass of Effervescent Granules on mechanical tapping apparatus, which is operated for fixed number of taps until the Effervescent Granules bed volume is reached a minimum. Using the weight of Effervescent Granules bed in a cylinder and this minimum volume, the tapped density is calculated.

4. Compressibility index and Hausner ratio

It is measured for the property of Effervescent Granules to be compressed. As such they are measured for relative importance of interparticipant interactions. Compressibility index is calculated by the following equation

Where Dt Tapped Density. Db Bulk Density Hausner ratio was calculated by the following equation

$$(Dt/Do) X 100$$

Where Dt = Tapped Density.

Db = Bulk Density.

Pre-Compression Evaluation of Effervescent Tablet

The following physicochemical tests were conducted to evaluate the tablets.

1. Weight Variation

Weight Variation Twenty tablets were randomly selected and weighed individually and so the weights of tablets were compared with the calculated mean weight. During this method, less than two tablets should have a deviation greater than pharmacopoeia limits ± 5%.

2. Friability Test

Friability of the tablets makes up my mind using friabilator. It subjected the tablets to the combined abrasion and shock in a very plastic chamber revolving at 25 rpm for 4 minutes and dropping a tablet at height of 6 inches in each revolution. The tablets were reweighed. Tablets were de-dusted employing a soft muslin cloth and reweighed. The proportion of the Tablets friability was calculated as. The desirable friability make up my mind as below 1%.

3. Thickness

A venire micrometer was wont to determine the thickness of randomly 10 selected tablets. Hardness Test The force required to interrupt down a tablet in a very compression is defined because the hardness or crushing strength of a tablet. During this study, ten tablets were

randomly selected and individually placed in a very hardness tester then the hardness of tablets reported.

4. Effervescence Time

Three tablets were put in 3 beakers of water and so the effervescence time was measured employing a stopwatch Effervescence time was defined because the moment when a transparent solution was obtained.

5. Content Uniformity

After selecting 10 tablets randomly, the content of every tablet makes up my mind separately.

Applications of Effervescent Tablets

- Better stability and easy transporting.
- Alternative to parenteral forms, where administration through parenteral route is difficult.
- Zero order release is achieved by incorporation of low levels of effervescent mixtures with within the tablet matrix.
- It's helpful in pulsatile system; a fast-releasing core was formulated so as to get rapid drug release after the rupture of the polymer coating.
- The concentration of effervescent agents significantly affects the floating time in floating drug delivery systems.
- Programmed drug delivery is achieved.
- Effervescent osmotic pump tablets were used for controlled release.
- Cosmetic effervescent tablets were also available.
- Effervescence induced enhancement is seen like opening of tight junctions and
- Increase the hydrophobic nature of the membrane across rat and rabbit's bowel.

CONCLUSION

Effervescent tablets are a popular dosage form that offers several advantages over other methods of drug delivery. They dissolve quickly in water and are absorbed by the body, resulting in a faster onset of action and better bioavailability. They are also more convenient for patients who have difficulty swallowing and have a better taste, which increases patient compliance. Effervescent tablets can also reduce gastrointestinal irritation, are easier to store and transport, and have good stability. They can improve absorption, prevent first-pass metabolism, and allow for precise dosing. Effervescent tablets can be formulated with a

variety of active ingredients, including drugs that are challenging to digest or have stomach disturbances, pH-sensitive medications, drugs that require a high dose, and drugs that are sensitive to oxygen, moisture, or light. However, effervescent tablets have some drawbacks, such as their larger size, complex manufacturing process, sensitive packaging, and longer disintegration time. Despite these limitations, effervescent tablets have proven to be an effective and convenient dosage form for a variety of therapeutic purposes.

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