REVIEW ON: FORMULATIONS AND EVALUATION OF EFFERVESCENT TABLET

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ABSTRACT

Oral dosage forms are the most popular form of medication, although there are some problems compared to others methods such as the risk of drug absorption, which can be overcome by administering the drug in a liquid form, therefore, perhaps to allow for the use of low doses. However, the instability of many drugs in the liquid dosage form reduces their use. Formulation of Effervescent tablets can be used as an alternative to developing a dosage form that can accelerate the dispersion and deterioration of drugs, usually used in quick-release arrangements. The benefits of using this method of drug overdose and elimination can be accelerated. Immediate release of the preparation is an example of a product produced in this way. Pills are produced by a broadly effervescent process essential for drug delivery control, ongoing maintenance and control arrangements, drug delivery system, etc. are just a few products of this process. This review reflects the new use of the effervescent tablet.

Keyword: Formulation, Wet Granulation, Dry Granulation, Excipients.

I. INTRODUCTION

Carbon drugs are pills which are designed to dissolve in water and release carbon dioxide. The carbon dioxide is generated by means of a response of a compound containing bicarbonate together with sodium bicarbonate or magnesium bicarbonate, with an acid which includes citric acid or tartaric acid. The oral direction is the maximum desired technique of drug administration however might also have a few effect discomfort as a slow begin to paintings or gradual on foot absorption. This problem may be conquer with the aid of using different dosage forms or control the drug with other routes. while we select the score form or the path of drug administration has positive parameters ought to be considered because the sturdiness and availability of the formulations and lively medicinal substances. effervescent drugs have become increasingly more famous in a selection of sectors together with dietary supplements and pharmaceutical use, thanks to the convenience at some stage in which they will be ate up. effervescent pills are designed to interrupt in contact with liquid like water or juice, often inflicting the pill to dissolve into a solution. Effervescence way CO2 gas emission in reaction to acids and bicarbonates in the presence of H2O different not unusual acids used on this reaction are citric, malic, tartaric, adipic, and fumaric acid and bicarbonate used within the effervescent response is sodium bicarbonate, potassium bicarbonate, sodium carbonate, and potassium. The most not unusual drug response for pharmaceutical use is the acid-base reaction between sodium bicarbonate and citric acid.

$$3\text{NaHCO}_3 (aq) + \text{H}_3\text{C}_6\text{H}_5\text{O}_7(aq) \rightarrow 3\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 (aq) + 3\text{H}_2\text{O}+3\text{CO}_2$$

This reaction takes place in presence of water, despite a small quantity as a catalyzing agent, which will increase the rate of reaction. As water acts as a catalyzing agent for the response so all the moisture-sensitive products or bubbling products are stored in a moisture-loose surroundings. bubbling or carbon pills are pills which can be designed to dissolve in water to launch carbon dioxide . it is a product of compression components in powder form that become thick mass, included with a blister percent, or with a packet packed with fuel desiccant embedded in the cap. to apply them, blend them into the water to make an answer. Powder substances also are packaged and advertised as effervescent powders or may be granulated and bought as effervescent granules. regularly the powered substances start granulated before the tablets are made.

Effervescent tablets are a popular and convenient pharmaceutical dosage form known for their ability to rapidly dissolve in water, producing a fizzy or effervescent solution. These tablets are widely used for delivering various medications, vitamins, and minerals, as well as for making refreshing beverages. The effervescence is typically the result of the reaction between an acid and a carbonate or bicarbonate salt, leading to the release of carbon dioxide gas.
1.1 Benefits of effervescent tablets over regular tablets

1. Top test
Effervescent capsules are very popular due to the fact they may be dissolved in a liquid inclusive of water or fruit juice, because of this they often taste higher than regular drugs. regular drugs dissolve slowly which can result in reduced absorption rates, bubbling capsules, in contrast, have appropriate pace, this means that you get the entire advantage of the substances.

2. Appropriate Distribution
Normal capsules dissolve slowly inside the stomach if imported and might every so often be barely dispersed that can cause infection in a few instances. The gain of an effervescent pill is they completely dissolve similarly which means the ingredients can not gather. this indicates now not best the fine flavor however also much less hazard of inflammation and more performance methods to feature ingredients.

3. Greater Liquid intake
Effervescent tablets provide no longer most effective nutritional benefits however additionally, increase liquid intake. this is beneficial if you are dehydrated or unwell and not eating as a whole lot fluid. bubbling drugs can be the excellent manner of rehydrating as well as taking the blessings you're taking the capsules for whether or not that is a nutritional supplement, herbal or medicinal.

4. Alternative to regular
They're idea to be a incredible alternative for folks that might also have hassle swallowing because of contamination or age. Older age humans sometimes have trouble in swallowing but want to take medication or supplements often so, bubbling drugs may be loads less difficult. in addition to this, they may be a notable manner to manage medication for individuals with sore throats or scientific issues that make swallowing tough and so are a terrific option to ordinary drugs.
5. **Easy and easy size**

Effervescent drugs dissolve without problems into water or a liquid of your desire and are consistent, mixed, and geared up to drink. Conventional tablets or powders, but, need to be measured and stirred again and again to keep away from a lumpy bit. Even though arousing and measuring it's miles commonplace to have an inconsistent drink with bumps and bumps and this is wherein bubbling tablets work fine. Simply deploy them and take away them absolutely and frivolously to make certain you get all of the benefits of the pill, in addition to being capable of drink it properly.

6. **Convenience**

The ability to dissolve in water offers a convenient dosage form for individuals who may have difficulty swallowing traditional tablets or capsules.

7. **Dosing Accuracy**

Pre-measured Doses: Effervescent tablets usually come in pre-dosed forms, reducing the risk of dosing errors and making them user-friendly.

8. **Stability**

Improved Stability: Effervescent formulations can enhance the stability of certain drugs by protecting them from environmental factors like humidity and light.

![Fig: 3 Benefits](image)

**1.2 Advantages**

1. Drugs brought with bubbling have a predictable and reproducible pharmacokinetic profile that is a lot more steady than normal drugs.
2. Have an excellent belly compatibility.
3. Fast onset of action.
4. Avoid swallowing troubles.
5. Clean to transport.
6. Stepped forward palatability.
7. Right stability.
8. More desirable absorption.
9. Bubbling pill avoids the primary-skip metabolism.
10. Bubbling pills can include an excessive quantity of lively components.

1.3 Disadvantages
1. Cost is relatively high as compared.
2. Large tablets require special packing material.
3. May require more time for full dispersion.
4. Should have a proper packing to protect it from humidity & temperature.
5. Unpleasant taste of some active ingredients.
6. Relatively expensive to produce due to large amount of more or less expensive excipients and special production facilities.
7. Clear solution is preferred for administration although fine dispersion is now Universally acceptable.

II. PREPARATION OF EFFERVESCENT TABLETS

The effervescent tablet is made up of three primary elements: Active component, Acidic source, Alkaline substances (especially carbonates/bicarbonates); The acids and alkalis are the essential components that cause the medicament to effervesce and disintegrate when it comes in contact with water. Citric acid, both hydrated and anhydrorous, is the most extensively utilized acidic component, but other safe acids such as tartaric acid, fumaric acid acidic acid, and malic acid can also be employed anhydrides and salts of acids are also used as acidic sources. Acid The carbonate, supply the carbon dioxide that causes effervescence, is often a water soluble alkaline carbonate. The carbonate employed is critical since, in addition to causing effervescence, it can affect the tablet's stability. Because it is highly soluble and inexpensive, sodium bicarbonate is one of the most commonly utilized carbonates, 45.37.58 Other alkaline or alkaline earth metal carbonates that are physiologically appropriate may be employed, such as potassium carbonateor bicarbonate, calcium carbonate or bicarbonate, sodium carbonate, sodium glycine carbonate etc.

Diluents, buffering agents, ligands, sweeteners, coloring agents, flavoring agents, solubilizes, wetting agents, disintegrates, and other commonly used excipients can be included in the formulation or preparation of effervescent tablets. Effervescent tablet formulations may also involve a lubricant, which must be selected from totally water-soluble compounds that produce a clear solution. Sodium acetate, sodium benzoate, fumaric acid, polyethylene glycol (PEG) more than 4000, glycine, and alanine are examples of this. type of lubricant. Effervescent tab require the use of accurate lubricants, even though formulations using tartaric acid are not more adherent to tablet tools than those containing citric acid. Effervescent products can contain natural water-soluble sweeteners like sucrose, lactose, xylitol, D-glucose, sorbitol, or mannitol, and approved synthetic sweeteners such as ascorbic acid, aspartame, Acesulfame K, or cyclohexane, 67-49 Antifoaming agents are substances used to prevent foaming They include alcohols like cetostearyl alcohol, insoluble oils such as castor oil, polydimethylsiloxanes, stearates, silicone derivatives, ethers, and glycols. However, because acidic and alkaline components add bulk to the tablets, other excipients should be maintained to a minimize and used only when necessary.

III. GENERAL EXCIPIENT USED IN EFFERVESCENT TABLETS

3.1 Ingredients In Effervescent Tablet

something that enters into a compound or is a component part of any combination or mixture bicarbonate such as sodium bicarbonate or magnesium bicarbonate, with an acid such as citric acid or tartaric acid.

1. Diluents

A dilutes used an agent that dilutes a substance further dilute a solution with less concentrated solution. Lactose, sucrose, sodium bicarbonate and organic acids such as citric and tartaric acid.

2. Disintegrating agent

Disintegrants are agents added to tablet formulations to promote the break-up of the tablet into smaller fragments in an aqueous environment, thereby increasing the available surface area and promoting a more rapid release of the drug substance. Starch, powdered dextrose and/or sucrose.
3. Granulating agent
These are used to convert fine powder into granules. Granulating agent provided proper moisture to convert fine powder into damp mass, which after passing through a sieve of suitable number forms granules. Effervescent salts are granules, or coarse to very coarse powders, containing the medicinal agent in a dry mixture usually composed of sodium bicarbonate, citric acid, and tartaric acid. When added to water, the acids and the base react to liberate carbon dioxide, resulting in effervescence.

4. Lubricant
A substance that helps to reduce friction between surfaces in mutual contact, which ultimately reduces the heat generated when the surfaces move. An admixture of spray dried magnesium lauryl sulfate powder and micronized polyethylene glycol polymers has been found to be an excellent lubricant system in tabletting processes for making water-soluble, effervescent tablets such as tabletted denture cleansers, antacids, analgesics, and the like.

5. Binding agents
Material or substance that holds other materials together mechanically, chemically, or as an adhesive, to form a cohesive whole hot-melt extrudable binders which can be used in the effervescent granules include acacia, tragacanth, gelatin, starch, cellulose materials such as methyl cellulose and sodium carboxy methyl cellulose, alginic acids and salts thereof, polyethylene glycol, guar gum, polysaccharide, bentonites, sugars, invert.

6. Adsorbing agents
Aluminium hydroxide, deferoxamine, clozapine, stearic acid.

7. Colours, flavours and sweetening agents

**Fig: 4** Preparation of effervescent
The most commonly used are acesulfame K and aspartame, sucrose, glucose,

IV. MANUFACTURING OF EFFERVESCENT TABLETS
Effervescent tablet production is similar to regular tablet production but requires controlled environmental conditions. Temperature and humidity must be carefully regulated to prevent the raw materials from absorbing moisture and initiating the effervescent reaction. Low relative humidity (maximum of 25% or less) and moderate to cool temperatures (25°C) are necessary to prevent product degradation and sticking to machinery. The most popular method to produce tablets with desirable properties is granulation. There are many different granulation processes available, ranging from one-step granulation utilising water or organic solvents to two-step granulation such as granulating the acid and alkali phases separately.
The most recommended approach for effervescent granulation is still wet granulation, despite significant drawbacks. This process produces uniform tablets, either in terms of weight or the amount of active component, and produces homogeneous granules suited for compression.

1. Two-step granulation technique
Before adding lubricant for tableting, the acidic and basic components are separately granulated and then drily mixed using standard machinery like a fluid bed spray granulator, single pot, or high-shear granulator. Alternatively, one among the effervescent sources can be granulated and the other incorporated as a powder during final blending with additional chemicals like flavors and lubricants. This method boosts productivity and lowers costs by avoiding a full granulation stage.

2. One-step granulation technique
The one-step granulation technique involves granulating acidic and alkaline components together using a small amount of water or organic solvents like alcohol, isopropanol, or other solvents with a binder. This technique produces dry effervescent granules instantly, regulating the effervescent reaction and leading to granule formation. It is essential for the effervescent and other components to be insoluble in the organic solvent used.

3. Fluidized bed granulation
The components of an effervescent combination are all granulated in one step using fluid-bed granulator-dryer technology. With this technique, a fluidized bed is created by suspending a dry mixture of an acid source and a carbonate source in a heated air stream. When water, the most common granulating fluid, is injected in a little volume, it reacts briefly before being vaporised. When water is no longer sprayed and the drying phase is completed with warm dry air, the reaction is terminated. To create effervescent vescent granules a rotor fluid bed spray-granulator can be used as an alternate approach. This technique reduces contact between two effervescent system components. This is a continuous two or three-step technique for making effervescent granules. Granulating alkaline components in the rotary fluid bed is the first stage. In the following step, the granulating solution is sprayed along with acidic powders onto the alkaline spheres. This results in the formation of an outer acidic layer on the spheres, which is separated from the binder by a neutral layer. Agglomeration is finished, and then drying is initiated.

4. High shear granulation
It is conceivable to quickly switch from the granulation phase to the drying phase in high-shear granulator-dryer technology, by creating a vacuum inside the bowl. This causes the water boiling point to decrease rapidly and the bowl is heated up to provide energy for evaporation. Within seconds, water on the surface of the wet granules is removed and the effervescent reaction stops. Microwave radiation combined with vacuum can also
be applied to dry effervescent granules and stop the reaction. 2475 TOPO granulation can be utilised for this type of granulation, where a vacuum can be applied to stop the reaction.

**Dry granulation**

The effervescent reaction is sparked by the wet granulation process, which degrades the substance. As a result, other options have been developed. One of these is dry granulation by slugging, which involves compressing big tablets or slugs using roller compactors or directly compressed other forms. These are the most successful alternatives to the wet granulation process.

1. **Slugging**

To make slugs or large tablets, a roller compactor or chilsonator is often used to compress mixed powders between two counter-rotating rollers under higher pressure. The resulting slugs are then reduced to the appropriate size for tablet granulation. Lubrication may be necessary during the slug-making process. This technique is effective in producing effervescent tablets using dry granulation with acidic and basic substances. However, it involves the use of costly excipients and is only suitable for manufacturing small batches of tablets. The technique is simple, cost-effective, increase product throughput, and requires fewer operators and less space, but it also requires less air ventilation.

2. **Direct compression**

Making effervescent tablets with acetylsalicylic acid has successfully used direct compression as an alternative way to dry granulation. Addressing problems with the process's operational effectiveness and stability is helpful with this procedure. However, on account of the need for complex raw material combinations that are compressible, free-flowing, and non-segregating this technology can only be used in the most perfect of manufacturing environments, which limits its application in real-world applications.

3. **Granulation by heating**

Dry granulation techniques, such as hot melt granulation can be used as an alternative to wet granulation. In hot melt granulation, hydrated citric acid is melted to release the hydration water that serves as the granulating liquid, agglomerating the powder mixer's particles. The resulting, granules are then chilled to achieve the required hardness and mechanical stability. Hot melt granulation can be accomplished using a high-shear granulator-dryer, or with low melting point polymers like PEGs as binders in a fluid bed spray-granulator. Hot melt extrusion is another unique technique that requires hot-melt extrudable binder, extruders with temperature-controllable heating zones, and an extrusion die.
V. EVALUATION OF EFFERVESCENT GRANULES

1. Angle of repose

Angle of repose is defined as the maximum angle possible between the surface of a pile of the powder and horizontal plane. The frictional force in a loose powder or granules can be measured by angle of repose. It is an indicative of the flow properties of the powder.

\[
\tan \theta = \frac{H}{R} \\
\theta = \tan^{-1} \left( \frac{H}{R} \right)
\]

Where,
\( \theta \) is the angle of repose.
\( H \) is height of pile.
\( R \) is radius of the base of pile.

The powder mixture was allowed to flow through the funnel fixed to a stand at definite height (H). The angle of repose was then calculated by measuring the height & radius of the heap of powder formed. Care was taken to see that the powder particles slip & roll over each other.

**Angle of repose as an indication of powder flow properties**

![Angle of repose and flow property table]

- **Angle of repose**
  - >25\(^0\): Excellent
  - 25\(^0\)-30\(^0\): Good
  - 37\(^0\)-40\(^0\): Fair
  - Beyond 40\(^0\): Poor

2. Flow rate

Flow rate of a powder has been defined as the rate at which the particular mass emerges through the office of funnel of a suitable diameter. The flow rate for granules of each formulation was determined by pouring accurately weighed quantities of granules in funnel with an orifice of 8 mm diameter. The time required for the complete granule mass to emerge out of the orifice was recorded using a stopwatch. The flow rate was calculated from the following equation:

**Flow Rate = Weight of granules / Time in seconds**

3. Bulk Density

The bulk density was obtained by dividing the mass of a powder by the bulk volume in cm\(^3\).

\[
D_f = \frac{M}{V_p}
\]

Where,
\( D_f \) = bulk density
\( M \) = weight of samples in grams
\( V_p \) = final volumes of granules in cm\(^3\)

4. Tapped density

The tapped density was obtained by dividing the mass of a powder by the tapped volume in cm\(^3\).

\[
D_o = \frac{M}{V_p}
\]

Where,
\( D_o \) = bulk density
\( M \) = weight of samples in grams
Vp = final volumes of granules in cm³

5. Carr’s Index

An indirect method of measuring powder flow from bulk densities was developed by Carr. The percentage compressibility of a powder was a direct measure of the potential powder arch or bridge strength and stability. Carr’s index of each formulation was calculated according to equation given below:

\[
\% \text{Compressibility} = \frac{D_f - D_o}{D_f} \times 100
\]

Where,

\( D = \) Fluff or Poured bulk or bulk density.

\( D_e = \) Tapped or Consolidated bulk density.

VI. EVALUATION OF EFFERVESCENT TABLETS

1. Weight variation

Weight variation was determined to know whether different batches of tablets have uniformity. Weighed 20 tablets individually, calculated the average weight and compared the individual tablet weights to the average. The tablets meet the test if not more than two tablets are outside the % limit and none of the tablets differ by more than two times the limit. Weight variation specification as per IP.

Weight variation specification.

<table>
<thead>
<tr>
<th>Average weight of tablet (According to IP/BP)</th>
<th>Limit</th>
<th>Average weight of tablet (According to USP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 mg or less</td>
<td>±10%</td>
<td>130 mg or less</td>
</tr>
<tr>
<td>More than 80 mg or Less than 250 mg</td>
<td>±7.5%</td>
<td>130 mg to 324 mg</td>
</tr>
<tr>
<td>250 mg or more</td>
<td>±5%</td>
<td>More than 324 mg</td>
</tr>
</tbody>
</table>

2. Tablet Thickness and Diameter

Thickness and diameter of tablets were important for uniformity of tablet size. Thickness and diameter were measured using Vernier Calipers.

3. Tablet Hardness

The resistance of tablets to shipping or breakage under conditions of storage, transportation and handling before usage depends on its hardness. The hardness of tablet of each formulation was measured by Monsanto Hardness Tester. The hardness was measured in items of kg/cm². Hardness or tablet crushing strength is the force required to break a tablet in a diametric compression. The force is measured in kg and the hardness of about 3-5 kg/cm² is considered to be satisfactory for uncoated tablets.

4. Friability (F)

Friability of the tablet determined using Roche friabilator. This device subjects the tablet to the combined effect of abrasion and shock in a plastic chamber revolving at 25 rpm and dropping a tablet at a height of 6 inches in each revolution. Pre weighted sample of tablets was placed in the friabilator and were subjected to the 100 revolutions. Tablets were dusted using a soft muslin cloth and reweighed. USP limit is 0.5 to 1%. The friability (F) is given by the formula.

\[ F = \frac{W_{initial} - W_{final}}{W_{initial}} \times 100 \]

5. Measurement of effervescence time

A single tablet is placed in a beaker containing 200 ml of purified water at 20 °C 1 °C Whenever a clear solution. Without particles is obtained effervescence time has finished. The mean of three measurements of each formulation is to be reported.
6. Determination of effervescent solution pH
pH of solution is determined with one tablet in 200 ml of purified water at 20 ± 1 °C by using pH meter, immediately after completing the dissolution time. Repeat experiment 3 times for each formulation.

7. Measurement of CO₂ content
One effervescent tablet solved in 100 ml of IN sulphuric acid solution and weight changes were determined after dissolution end. The obtained weight difference is shown the amount (mg) of CO₂ per tablet. Reports the averages of determinations.

8. Evaluation of the water content
10 tablets of each formulation are dried in a desiccators containing of activated silica gel for 4 hours. Water content of 0.5% or less is acceptable.

9. Uniformity of Content
10 tablets were selected randomly. Each tablet was transferred into a 50ml volumetric flask, dissolved and diluted to 50 ml with phosphate buffer pH 6.8. One ml of this solution was diluted to 100 ml with phosphate buffer pH 6.8. The amount of drug present in each tablet was determined by UV spectroscopy at 246 nm. Standard limit for uniformity of content is
IP: Active less than 10mg or 10%,
BP: Active less than 2 mg or 2%,
USP: Active less than 25mg or 25%.

VII. CONCLUSION
Effervescent tablets are a good alternative to regular tablets as they are easy to administer. Elderly people or people who have swallowing problems can easily have effervescent tablets as they need to be taken after dissolving in water and need not be swallowed. The effervescent tablets have a good therapeutic effect as bioavailability is good. Nowadays supplements are manufactured more in effervescent form as can be taken easily and increase patient compatibility. Effervescent tablets not only increase ease of administration but also mask the taste of some ingredients so flavoring agents are not needed to be used. The use of effervescent tablets may decrease problems with regular tablets such as stomach compatibility. As effervescent tablets have a fast onset of action, the person administered will fill better soon.
Effervescent tablets are best to mask the taste of the drug, have a quicker onset of action, good compatibility, good therapeutic effect and the best is it increases patient compliance.

VIII. REFERENCES


