WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 13, 205-223. Review Article ISSN 2277– 7105

REVIEW ON EFFERVESCENT TABLET USED FOR ANTI-HYPERKALEMIA

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Article Received on
23 August 2020,

Revised on 13 Sept. 2020,
Accepted on 04 October 2020

DOI: 10.20959/wjpr202013-18916

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ABSTRACT

Recently, oral dosage form most popular way of taking medication. the people are very busy with their schedule and have less time to care for health. Indeed, even in the treatment, They were searching rapid relief and effectively administrable formulations. The anti-hyperkalemia treat by using high dose phosphate supplement containing sodium phosphate. The aim of this was to design and formulate of sodium phosphate effervescent tablet for reduction of calcium and treat low blood potassium. It show sufficient mechanical integrity and to achieve faster disintegration in the water. Effervescent tablet are uncoated tablet that generally contain acid substances and bases and which react rapidly in presence of of water by released carbon dioxide. They intended to dissolved or dispersed in water before use. Effervescent show the special features like less irritation and greater tolerability, swallowing can be prevented; more stability achieved and improved therapeutic effect.

KEYWORDS: Effervescent Tablet, Anti-hyperkalemia, Sodium Phosphate.

INTRODUCTION

Oral dosage bureaucracy are the most popular manner of taking medication, regardless of having a few disadvantages in comparison with other method. One such disadvantage in the chance of sluggish absorption of the energetic pharmaceutical ingredient (API), which may be overcome through administering the drug in liquid form and, therefore, probably allowing using a decrease dosage. However, because many APIs best show a confined degree of balance in liquid form. So, effervescent tablet acts as an alternative dosage form.[1-3]

1. EFFERVESCENT TABLET

Fig. 1.1: Effervescent tablet in glass of water.

1.1. Definition

As in line with revised definition proposed to US FDA, Effervescent tablet is a pill intended to be dissolved or dispersed in water earlier than administration.[4]

Effervescent tablet are uncoated drug that usually include acid and acid salts (Citric, tartaric, malic or any other appropriate acid or acid anhydride) and carbonate or bicarbonates (sodium, potassium or any other appropriate alkali steel carbonate or hydrogen carbonate), which react rapidly inside the presence of water via liberating carbon dioxide. Due to liberation in CO_2 gas, the dissolution of API in water in addition to taste masking effect is enhanced.

In the 1930s, the effervescent products won much importance with the technology of Alka Seltzer. These mixtures have been moderately famous over time since together with medicinal activity they are appealing dosage shape for the patient.[4,5]

1.2 Advantages of Effervescent Tablet

- More reliable feedback – pills introduced with bubbling stratergies have predictable and reproducible pharmacokinetics profile that is a lot more consistent than the tablets.
- Good stomach and intestinal tolerance – tablet are dissolve completely in a buffered solution. Reduced localized touch in higher GIT leads to much less irritation and more tolerability. Buffering additionally prevents gastric acids from interacting with drugs themselves, which can be a major cause of stomach.

- Fast onset of action – effervescent tablet have major benefit that the drug product is already in answer at the time it's miles consumed. Thus the absorption is quicker and more entire than with traditional tablet. Faster absorption mean quicker onset of action. Effervescent drug are added to the belly at a pH tat is just proper for absorption this is hampered through meals or different drug.
- No need to swallow tablet – effervescent medicines are administered in liquid form so they easy to take compared to drug or capsule.
- Effervescent tablet can buffer the aqueous solution of drug, in order that the stomach pH increases (will become much less acidic) and thus prevent the degradation or inactivation of the lively ingredient. This buffering effect (via carbonation) induces the belly to empty quickly typically within 20 mins into small intestine and outcomes in maximum absorption of lively ingredient.
- More transportability – effervescent tablet is greater effortlessly transported than liquid antidotes due to the fact no water is added until it is ready to use.
- Improved palatability – drug delivered with bubbling base, taste higher than most liquids, mixture and suspension. Superior flavor protecting is carried out by restricting objectionable traits and complementing formulations with flavor. So, the flavor much higher than a mixture of non–effervescent powder in water. Moreover, they produce fizzy tablet, which may also have better consumption appeal than the conventional dosage form.
- Effervescent tablet keep away from the first pass metabolism and also produce speedy onset of action. Oral liquid also offered speedy onset of movement however required carefully handling. Slower onset of movement and also undergoes first skip metabolism.
- Effervescent tablet enhance the absorption of number of energetic elements compared to traditional formulation. This is due to the fact the carbon dioxide created via the effervescent response can decorate active aspect permeability due to an alteration of paracellular pathway. The paracellular pathway is the number one course of absorption of hydrophilic active substance in which the solutes diffuse into the intracellular area between epithelial cells. It is past principle that the carbon dioxide widens the intracellular free area among cell which ends up in greater consumption of energetic components (each hydrophilic and hydrophobic).
- Excellent stability is inherent with bubbling formulations, specifically surpassing liquid forms.

- In far off areas, specifically where in parenteral forms are not available because of prohibitive cost, loss of qualified scientific staff, effervescent drug could come to be an alternative.
- Incorporation of massive amounts of active ingredients – In many cases, one effervescent pill will equal to ten conventional drugs in energetic dose quantities.[5,6,8,10]

1.3. Disadvanges of Effervescent Tablet

- Some active ingredients have unpleasant flavor that can't masked by using flavors and sweeteners. This will cause an unacceptable product.
- Relatively costly to produce due to large amount of more or less expensive excipients and unique manufacturing facilities.
- Larger tablet requiring special packaging materials.
- May require a large extent to be fully dispersed.
- Clear answer is desired for administration, even though a nice dispersion is now universally acceptable.
- Reactions due to moisture and protection of specified humidity and temperature is difficult.[1,5,8,11]

1.4 Here we look at 5 benefits of effervescent tablet over regular tablet

Pleasant Taste Compared to Regular Tablets

Effervescent tablets are so famous because of the reality they can be broken down in a fluid, for example, water or organic product juice, implying that they frequently taste superior to normal tablets. Customary tablets break up gradually which can result in decreased ingestion rates, effervescent tablets, interestingly, effervesent tablets are so well known because of the reality they can be broken down in a fluid, for example, water or organic product juice, implying that they frequently taste superior to ordinary tablets. Regular tablets break down gradually which can bring about decreased retention rates, bubbly tablets, conversely, disintegrate rapidly and totally, which means you get the full profit by the fixings.

Circulated More Evenly

Customary tablets break down bit by bit in the stomach once ingested and can now and again just in part disintegrate which can prompt aggravation at times. The advantage of bubbly tablets is that they break down totally and equally implying that limited centralizations of the

fixings can't happen. This implies a superior taste as well as less possibility of disturbance and a progressively effective methods for ingesting the fixings.

Increased Liquid Intake

Effervescent tablets give the wholesome advantages proposed, yet notwithstanding this they additionally increment fluid admission. This can be particularly advantageous in the event that you are dried out or sick and not ingesting as much liquid obviously. Bubbly tablets can be an awesome method of rehydrating just as receiving the rewards you are taking the tablets for whether this is a dietary enhancement, herbally or medicinally.

Simple Alternative to Regular Tablets

They can be an incredible option for the individuals who may experience difficulty gulping either because of sickness or age. More established people may experience issues gulping yet need to take prescription or enhancements all the time and in this regard, Effervescent tablets can be much simpler than gulping a tablet. Likewise, they can be an incredible method of ingesting medication for people with sore throats or clinical issues that make gulping troublesome as are a feasible option in contrast to ordinary tablets.

Basic and Easy to Measure

Effervescent tablets are handily disintegrated into water or a fluid of your decision and afterward sooner or later are reliable, all around blended and prepared to drink. Customary tablets or powders, nonetheless, should be estimated and blended in over and again to stay away from a conflicting beverage with knotty bits. Indeed, even with mixing and estimating it is entirely expected to have a conflicting beverage with knotty bits and an odd taste and this is the place bubbly tablets are increasingly proficient. Essentially drop them in and they break down completely and equitably guaranteeing you get all the advantages of the tablet, just as having the option to serenely drink it.

To Sum Up

Bubbly tablets are getting progressively famous and it is anything but difficult to perceive any reason why. They give a substantially more proficient method of taking enhancements or medicine due to being disseminated equitably and significantly more rapidly than normal tablets. Likewise, they taste better as can be added to water or a fluid beverage of your decision just as being simpler to take for individuals who may think that its hard to swallow.

Every one of these elements consolidate to settle on effervescent tablets an extremely mainstream decision for those taking tablets for either dietary supplementation or restorative reasons.

1.5. Mechanism of Effervescent

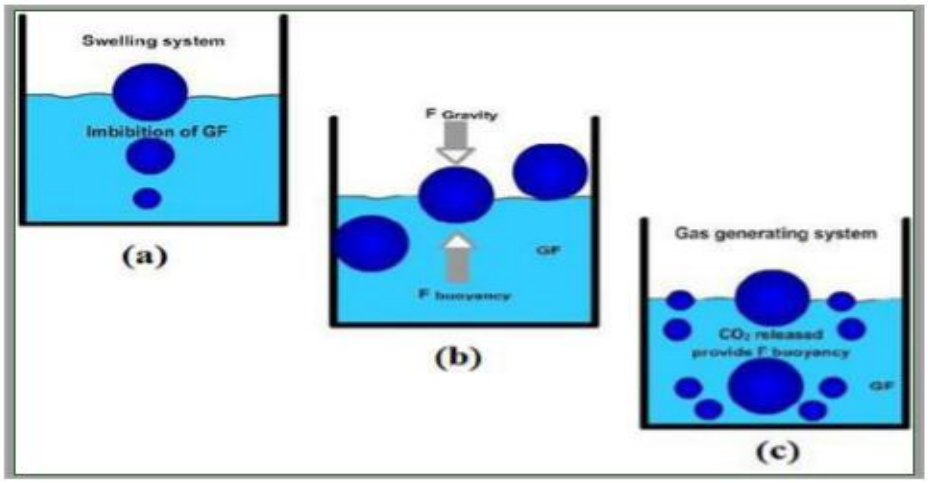

Fig. 1.2: Effervescent tablet mechanism.

The reaction of citric acid and sodium bicarbonate containing result is release of carbon dioxide shown as follows:

$C_6H_8O_{7(aq)} + 3NaHCO_3(aq) \rightarrow 3Na_3C_6H_5O_7(_{aq}) + 3H_2O(l) + 3CO_2\ (g) \uparrow$

Citric acid+Sodium bicarbonate → Sodium citrate + Water +Carbon dioxide

From those equation, it is able to also be deduced why maximum effervescent capsules are highly large. If it is assumed that a placebo tablet such as 192 mg of citric acid ($C_6H_8O_7$) and 252 mg of sodium bicarbonate ($NaHCO_3$) comes into touch with a 100 ml of water, it will react to supply 258 mg of sodium citrate ($C_3OH_5(COO\ Na)_3$) + 132 mg of CO_2 + 54 mg (of extra) H_2O. Under ordinary condition (well know temperature and pressure), 1 mol of CO_2 is same to 22.4L; therefore, the 132 mg of CO_2 formed through the response of the tablet is identical to 67.2 mL of fuel. Because the solubility of CO_2 consistent with 100 mL of water, no longer much of the fuel produced through the pill with form bubbles, however will go directly into solution.

This response will begin even if only a completely small amount of water is added, as water is also one of the response products. Thus, at some stage in manufacture and storage, all touch with water need to be minimized. Therefore production will be done under managed climatic circumstance to avoid bubbling reaction.[1,2,5,8]

1.6. FORMULATION

General Manufacturing Components for Effervescent Products

1. Raw Materials

The Effervescent formulation mainly consists of three components-

- Acid ingredients
- Acid source
- Alkaline compound, constituted by a carbonate or bicarbonate.[6]

Table no1.1.Components of Effervescent Formulation.

Acid Source	**Alkaline Source**
Citric acid, Tartaric acid, Fumaric acid, Adipic acid, Malic acid, Ascorbic acid, Acid Citrate salts.	Sodium Bicarbonate, Potassium Carbonate, Calcium Carbonate, Sodium Carbonate, Sodium Glycine Carbonate
Lubricants	**Other agents**
Sodium Benzoate, Sodium Acetate, Fumaric acid, Polyethylene Glycols (PEG) Higher than 4000, Alanine and Glycine.	Binders, Glidants, Disintegrants, Antiadherants, Sweeteners, Flavors, Colors, Surfactants.

1.7 MANUFACTURING

The effervescent drugs are generally manufacturing in same way as traditional tablet manufacturing process, but need managed environmental conditions. Thus, humidity and temperature manipulate in production vicinity is an essential step inside the manufacturing of those drug.

A. Environmental Conditions

The prerequisite for controlled environment is because of the hygroscopic nature of the raw materials used for its production and possibilities of initiation of an effervescent reaction because of uptake of moisture via these materials. Low relative humidity (most of 25% or less) and slight to chill temperatures (25^0C) in the production areas are crucial to save you the granulations or pills from sticking to the machinery and from selecting up moisture from the air, which may motive product degradation.

The whole process is usually executed in a totally closed and integrated managing system, which includes intermediate bulk containers (IBCs), tumblers for IBCs, docking and dosing stations. Effervescent granulations can be blended in traditional mixing equipment, inclusive of ribbon, twin-cone, and V-kind blenders. Complete drying of all of the equipment after a cleansing process is crucial to prevent erratic granulation and lost batches. All these

equipments must also allow proper venting of air with sufficiently low moisture content. This approach is particularly useful for mighty drug, which require a excessive level of personal safety for operators. The alternative is the dealing with of the product, which permits using a whole lot simpler sort of equipment, but manufacturing area ought to have more tolerable moisture levels.[6,8]

B. Method for manufacturing

Commercial tablet formulation are compressed using excessive – speed rotary pill presses and as a result it's far necessary that cloth fed in these pill presses ought to have some special characteristic, not most effective to keep away from segregation, but additionally to guarantee homogeneous filling of the dies for retaining weight homogeneity. To put together tablet with acceptable characteristics, granulation technologies is maximum broadly used. Many exclusive granulation technology are available, ranging from dry granulation and moist granulation strategies which encompass two-step granulation (granulating acid and alkali phase one by one) to one-step granulation using water or organic solvents.

1. Wet Granulation Method

Wet granulation is the most preferred technique for bubbling granulation. It offers homogeneous granules suitable for compression, and is able to offer uniform drugs either in terms of weight or active component content.

Two-step granulation method

Two-step is a useful alternative to dry granulation. The acidic and basic components are separately granulated and in the end followed with the aid of dry mixing, before adding the lubricant for tableting. This may be finished the usage of high shear granulator. This approach require most effective traditional gadget which may be used for granulation and drying of other materials. Alternatively a commonplace manner is to granulate best one of the effervescent resources and add the alternative as powder shape for the duration of the final blending. Other additives like flavors and lubricants are brought to it and mixed. This method will increase productivity and reduce price by using saving the value of a whole granulation step.

One-step granulation method

One step granulation process present dry bubbling granules directly through granulating the acid resources and the alkaline materials together. This is carried out through using limited

amount of water, which initiates but controls the bubbling reaction, for this reason forming granules. Granulation is also accomplished with the aid of using organic solvent like alcohol (diluted with water), isopropanol or other solvent with binder. The effervescent and different components of the formulation have to be insoluble in organic solvent.[1,5,6,8]

2. Dry Granulation Method

Wet granulation method destroys the product by using beginning the effervescent reaction. Thus, other option had been established. One of them is dry granulation with the aid of slugging (slugs or big tablets that are compressed using heavy-duty tableting gadget) the usage of curler compactors or direct compression stratergies.

Direct compression

Direct compression is another alternative method for dry granulation. This was successfully used for making ready bubbling pills of acetyl salicylic acid. This facilitates in overcoming operational and stability issues throughout manner This is an ideal manner of manufacturing but its limited due to the need of requirements of sophisticated raw material aggregate (Compressible, unfastened flowing and non-segregating).[1,5,8]

3. Granulation via heating

This is an alternative era to wet granulation. It does not require granulating liquid. Agglomeration of the particle of a powder mixer can be carried out by melting hydrated citric acid (approximately 100^0C) in order to launch the hydration water, which acts as the granulating liquid. The granules are cooled for obtaining right hardness and mechanical stability. The techniques used are:

- Surface hot melt granulation
- Hot soften granulation

Surface hot melt granulation entails mixing all of the uncooked collectively in a blender and the drying the combination in an oven at 90^0C. Water is then released from citric acid and other components to shape granules. However, this method has less reproducibility. This procedure is sporadic and hard to manipulate in a static bed dryer.

Hot soften granulation is finished in high-shear-granulator-dryer. The bowl is heated up, which facilitates in launch of water of hydration of citric acid. Sometimes this process initiate the bubbling reaction, which produce additional water. This then acts as a binding liquid. The

equal process has been implemented to fluid mattress spray-granulator in which low melting point polymer like polyethylene glycols (PEG's) or polyoxyethylene glycol which act as binders are used.

C. Tableting of Effervescent Granules

The bubbling granulations may be tableted in the equal manner as traditional tablet granulations however in a place having low moisture content material (0.2%) while conventional tablet manufacturing can be finished within the area having moisture content material of even 2%. Normally bubbling drugs require tablet presses that may deliver high compression forces. These tablets are quite large, which often leads to inadequate pill hardness and consequently damaged or damaged tablets. This results in a poor yield and additionally a need to forestall the clicking of packaging line. This trouble can be solved by using growing reside time which may be made possible via enhancing the precompression assembly of the tablet press.

Packaging effervescent pills in foil or tube needs cautions interest for controlling tablet parameters throughout compression. Poor content material of binder in pill result in capping and lamination problem and supply inferior quality of tablets. Good fine pill is acquired by means of compressing granules when it's far nonetheless slightly wet, or not dried. This pill is then dried and stabilized by way of a method step in a static ventilated oven (70-75^{0}C). They are immediately then packed in aluminum foil coated with polyethylene. To remedy lubrication problem, anti-adherent materials are sprayed directly onto the dies of the tablet press, at some point of the pause phase of compression. This external lubrication technique is however, less compliant to GMP suggestion and thus no longer very suitable.

Tablet machine manufacturers have implemented numerous diversification to their existing equipment to avoid troubles due to inner lubrication and punch adhesion. Several sorts of steels are used inside the manufacture of compression tooling. Material wealthy in nickel was located to have the fine resistance to rusting caused through hydrochloride salt. However, environmental conditions (temperature and humidity) and contact time were additionally located to be accountable for rusting.

Alternative to use of lubrication is find of steady level powder feed gadget and punch faces and dies wall lubrication system. The bubbling granules without lubricant possess terrible flowability and sticking of the pill on die partitions or on the punch phases. Problem of

terrible flowability may be overcome by way of employing steady level powder feed machine which includes a rotary valve guarantying steady powder pressure at the compelled filling station which in connection with two independently driven feed wheels will guarantee an correct filling of the dies.

Sticking of tablets to punch surfaces may be overcome by way of use of flat confronted punches with discs of polytetrafluoroethylene. If the hassle of tablet sticking to die wall isn't remedied, it gives trouble ejection of tablet from die cavity. Common practices to overcome this hassle are use of punch face and die wall lubrication systems. These system allow the addition of a totally small share of solid or liquid lubricant to the punch faces and the die walls simply before they arrive in contact with the granules.[1,8]

Effervescent Tablet Used For Anti-Hyperkalemia

Sodium phosphate effervescent tablet used for high dose phosphate supplement. Normal potassium levels are generally considered to be between 3.5 and 5.3 mmol/L. when levels above 5.5 mmol/L generally indicate hyperkalemia and those below 3.5 mmol/L indicate hypokalemia.

Mechanism of Action

Oral administration of inorganic phosphates produces a fall in serum calcium in patients with hypercalcaemia. The sodium ions in effervescent tablets aid in the correction of the dehydration and sodium depletion which is seen in hypercalcaemia. In cases of hypercalcaemia associated with impaired renal function and hypophosphataemia, the main effect of oral phosphate is to bind calcium in the gut and thus reduce calcium absorption.

Indications

Sodium phosphate is used as an oral phosphate supplement in treatment of conditions such as

1) Hypercalcaemia associated with such condition as:

- Hyperparathyroidism (overactivity of the parathyroid glands),
- Multiple myelomatosis (cancer of blood), and
- Metastatic bone disease

2) Hyperphosphataemia associated with Vitamin D-resistance rickets.

Precautions

- In case of impaired renal capacity associated with hypercalcaemia and in cases where restricted sodium intake is required. Eg. Congestive cardic failure, hypertension or pre-eclamptic toxaemia, the sodium and potassium content should be taken into consideration. In case of hypercalcaemia associated with impaired renal capacity and hyperphosphataemia, the primary impact of oral phosphate is to bind calcium in the gut and diminish calcium absorption.
- The effect of oral phosphate on serum phosphate is likely to be minimal, but close monitoring of serum level is recommended.
- Soft tissue calcification and nephrocalcinosis have been reported in isolated cases intravenous therapy with phosphate.
- This is thought to be a function of dosage and rapidly of phosphate administration. while such effects appear less likely to occure following treatment with oral careful surveillance of patients is recommended. The effect of oral phosphate on serum phosphate is likely to be minimal, but close monitoring of serum level is recommended.

Side-effects

- Difficulty in breathing
- Swelling of the eyelids, face or lips
- Rashes or irritation (especially affecting your whole body)
- Gastro-intestinal symptoms such as nausea and diarrhoea
- Allergic reaction

Interactions

- Concurrent administration of antacids, containing agents such as aluminum hydroxide, may results in displacement of calcium from binding to oral phosphate, thus reducing efficacy.
- Parathyroid hormone (PTH) increase the urinary excretion of phosphate by blocking tubular reabsorption.
- The risk of ectopic calcification may b increased by concurrent use of calcium supplements
- Vitamin D increase the gastrointestinal absorption absorption of phosphate and therefore increase the potential for hyperphosphataemia.

Dosage

- **Adults**

Hypercalcaemia: up to 6 tablets daily

Vitamin D-resistant rickets: 4-6 tablets daily

- **Children**

Hypercalcaemia: up to 3 tablets daily

Vitamin D-resistant rickets: 2-3 tablets daily

Adverse drug reactions

System Organ Class	Preferred Terms
Renal and urinary disorders	Nephrocalcinosis (acute phosphate nephropathy) leading to acute renal failure
Gastrointestinal disorders	Abdominal pain, nausea, vomiting and diarrhea
Metabolism and nutrition disorders	Low blood potassium, low blood calcium, low level of phosphate in blood and high level of sodium in blood.

Sodium phosphate effervescent tablet used Ingredient and Their Roles.

Sr. No.	Name of Ingredient	Role of Excipient
1.	Sodium Phosphate	API
2.	Citric Acid	Acidifying Agent
3.	PVPK-30	Binder
4.	Sodium Bicarbonate	Alkalizing Agent
5.	Potassium Bicarbonate	Alkalizing Agent
6.	Capsil Orange SCI	Flavor
7.	Sodium Saccharin	Sweetening Agent
8.	Sucrose	Diluent, Sweetening Agent
9.	Sodium Benzoate	Lubricating Agent

Precompression Tests

1. Angle of repose (USP/NF 2007): Angle of repose has been utilized to describe the flow properties of solids. It is a trademark identified with between particulate grinding or resistance to movement between particles. This is the most extreme angle possible between surface of heap of powder or granules and the horizontal plane. Angle of repose for blend of every formulation was determined by fixed funnel method. The funnel is secured with its tip with height h, above a plane of paper kept on a flat horizontal surface. The powders were carefully poured through the funnel until the apex of the conical pile so formed just reaches the tip of funnel. Angle of repose was determined by substituting the values of the base radius 'r' and height of the pile 'h' in the given eq. given below,

$$\tan \theta = h / r$$

$\theta = \tan^{-1} h / r$

Where, θ = angle of repose

H= height of heap circle.

Table 8.2: Scale of flowability of angle of repose.

Sr. No.	Angle of repose	Type of flow
1	<25	Excellent
2	25-30	Good
3	30-40	Passable
4	40 >	Very Poor

2. Bulk Density (USP/NF 2007): The bulk density was obtained by dividing the mass of a powder by the bulk volume in cm^3. The example of about 50cm^3 of powder, recently been passed through a standard sieve no.20, was carefully introduced into a 100ml graduated cylinder. The cylinder was dropped at 2- second intervals onto a hard wood surface three times from height of 1 inch. The bulk density of every formulation was then acquired by partitioning the weight of sample in grams by the final volume in cm^3 of the sample contained in the cylinder. It was determined by utilized equation given below:

$$D_f = M/Vp$$

Where, D_f = bulk density,

M= weight of samples in grams

Vp = final volumes of granules in cm^3

3. Tapped Density (USP/NF 2007): The tapped density was obtained by dividing the mass of a powder by the tapped volume in cm^3. The example of about 50cm^3 of powder, recently been passed through a standard sieve no.20, was carefully introduced into a 100ml graduated cylinder. The cylinder was dropped at 2-second intervals onto a hard wood surface 100 times from a height of 1inch. The tapped density of every formulation was then acquired by partitioning the weight of sample in grams by the final tapped volume in cm^3 of the sample contained in the cylinder. It was determined by utilized equation given below:

$$D_0 = M/Vp$$

Where, D_0 = bulk density,

M= weight of sample in grams and

Vp = final tapped volumes of granules in cm^3

4. Carr's Index (USP/NF 2007): It is used to evaluate flowability of powder by comparing the bulk density and tapped density of a powder. The percentage compressibility of a powder is immediate proportion of the capability of powder curve or extension quality is determined by the equation given below;

$$\textbf{Carr's index (\%)} = \frac{\text{Tapped Density} - \text{Bulk Density}}{\text{Tapped Density}} \times 100$$

Table 8.3: Grading of the powders for their flow properties.

Carr's index	Flow
5-15	Excellent
12-16	Good
18-21	Fair to passable
23-35	Poor
33-38	Very poor
>40	Extremely poor

5. Hausner's ratio (USP/NF 2007): Hausner found that the ratio tapped density/bulk density was related to inter particulate friction as such, could be used to predict powder flow properties. The Hausner's ratio was calculated by the formula as given below;

$$\textbf{Hausner's ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

Table 8.4: Scale of flowability.

Hausner's Ratio	Flow
1.00-1.11	Excellent
1.12-1.18	Good
1.19-1.25	Fair
1.26-1.34	Passable
1.35-1.45	Poor
1.46-1.59	Very poor
>1.60	Very very poor

Post Compression Tests

1. Tablet Thickness and Diameter

Thickness and diameter of tablets are significant for consistency of tablet size. Thickness and diameter were estimated utilized digital Vernier caliper. Thickness and Hardness both are measured in unit mm.

2. Tablet Hardness

The resistance of tablets to delivery or breakage under state of capacity, transportation and dealing with before utilization depends on its hardness. The hardness of tablet of every formulation was estimate by Erweka Hardness Tester. The hardness was measured in terms of kg/cm^2.

3. Weight Variation test

The weight of tablet is measured to ensure that a tablet contain the proper amount of drug. Weight variation test was carry out as per USP. Twenty tablets were selected randomly and weighed. Average weight of the tablet was determined. Not more than the two of the individual weights deviate from the average weight by more than 5 % deviation.

Table 8.7: USP standards for uniformity of weight.

Sr. No.	Average weight of tablet	Percentage (%) deviation
1.	130 mg or less	10
2.	From 130 mg to 324 mg	7.5
3.	More than 324 mg	5

4. Disintegration Time

The disintegration time is indicating the time required to dissolved the tablet in 200 ml of water at 17.5 ± 2.5^0C.

5. pH of the solution

The pH of solution was determined with one tablet in 200 ml of purified water at 20 ± 1°C by using pH meter (HI 2211, IHANNA), immediately after completing the solution time.

6. Drug content uniformity

The drug content of sodium phosphate tablet were determined by UV visible spectrophotometer. The drug content was carried out by Weighing 20 tablets and calculated the average weight. Then tablet were triturated to get a fine powder. From the resulting triturate, powder was weigh accurately.

Dissolve equivalent 100 mg of sodium acid phosphate in 50 ml water and dilute to makeup 100 ml with water. Dilute 10 ml of stock & sample solution to 100 ml with water.

Transfer 5ml each of stock and sample solution to 50ml volumetric flasks. Add 1ml of dilute sulphuric acid and about 20ml of distilled water. Then add 5ml of molybdate reagent. Mix and add 2ml of metol reagent, mix and allow to stand for 10min. Make up the volume to 50ml with distilled water and shake well. Measure the absorption of both the solution at about 650nm against blank and calculate the result.

$$\% \text{ ASSAY} = \frac{\text{SPL Abs.} \times \text{STD Wt.} \times 10 \times 100}{\text{STD Abs.} \times 100} \times \frac{100}{100} \times \frac{\text{AVG Wt. of tablet}}{\text{SPL Wt.} \times 10} \times \frac{\text{Label Claim}}{100}$$

Stability Study

In any rationale design and evaluation of dosage forms for drugs, the stability of the active component must be major criteria in determining their acceptance or rejection. During stability studies the product is exposed to accelerated conditions of temperature and humidity. However the studies will take a longer time and hence it would be convenient to carry out the accelerated stability studies where the product is stored under extreme conditions of temperature for short period of time. The optimized formulations sealed in aluminum packaging or high density polypropylene tubes packaging and kept in the humidity chamber maintained at 25ºC/60% RH, 30ºC/65% RH and 40ºC/75% RH conditions for three months

COMMERCIALLY AVAILABLE

Commercially available effervescent tablets from brand leaders in INDIA.		
Name of product	**Active Ingredient**	**Manufacturer**
Histac	Ranitidine HCL	Ranbaxy
Pepfiz-O&L	Papain, Fungal Diastase, Simeticone	Ranbaxy
Effcal	CaCO3, Vitamin D3	Ranbaxy
Tagament	Cimetidine	Glaxo Smithkline
Vitalmag	Magnesium Citrate, Folic Acid, Vitamin B6	Glaxo Smithkline
Ca-C 1000	Calcium, Ascorbic Acid	ICN hungary
Hangoverz	Aspirin, Caffeine	Pious Pharma. Ltd
Solapado	Paracetamol, Codeine Phosphate	Sanofi-aventis
Prolyte Fizz	Glucose + Potassium Chloride + Sodium Bicarbonate + Sodium Chloride + Citric Acid	Cipla

CONCLUSION

Recent trends design of patient oriented dosage form to achieve patient compliance and better drug release profile. The number of formulation related factors contributes non compliance

and inadequate drug release. Hence, there is need to design patient oriented drug delivery system. Effervescent tablet are ideal ones to improve patient compliance.

Effervescent technology provided a novel dosage for nutritional supplement and pharmaceuticals. The ability to incorporate large dosage of a wide variety of a active ingredient in an easy to swallow liquid and increase absorption of active ingredient offers advantages over conventional tablet.

REFERENCES

1. H. Stahl, "Effervescent Dosage", Pharmaceutical Technology Europe Magazine, April 2003; 25-28.
2. K.R. Srinath, "Formulation and Evaluation of Effervescent Tablets of Paracetamol", International Journal of Pharmaceutical Research & Development, 12, May, 2011; 3(3): 76-104.
3. H.K. Patel, "Formulation and Evaluation of Effervescent Tablet of Paracetamol and Ibuprofen", International Journal for Pharmaceutical Research Scholars, 2012; 1(I-2): 509-520.
4. P. Palanisamy, "Formulation and Evaluation of Effervescent Tablet of Aceclofenac", International Research Journal of Pharmacy, 2011; 2(12): 185-190.
5. K. Bala Krishna, "A Review on Effervescent Tablets", International Journal of Pharmacy & Technology, March, 2011; 3(1): 704-712.
6. R.E. Lee, "Effervescent Tablets- Key Facts about a Unique, Effective Dosage Form", Tablets & capsule; CSC Publishing; 1-4.
7. K. Khalifa, "Design, Formulation, and Evaluation of *Senna* Effervescent Tablets", Journal of Forest Products & Industries, 2012; 1(2): 21-25.
8. M. Shah, "Effervescent Tablets", Do You Know. In, June 2010.
9. N.O. Lindberg, "Effervescent Pharmaceuticals", Encyclopedia of Pharmaceutical Technology, 2002; 1037-1040.
10. S.B. Shirsand, "Formulation Design and Optimization of Fast Disintegrating Lorazepam Tablets by Effervescent Method", Indian Journal of Pharmaceutical Sciences, Jul-Aug, 2010; 72(4): 431-436.
11. S. Shahi, "Effervescent Tablet: A Review", Journal of Medical and Pharmaceutical Innovation, 4: 22-2017.

12. S.I. Pather, “Effervescent Drug Delivery System for Oral Administration”, Patent no.: US, May 2002; 6,391,335 B1: 1-8.
13. F. Wehling, “Pediatric Effervescent Dosage Form”, Patent no.: US, June 1993; 5,223,264: 1-9.
14. R. R. Irani, “Effervescent Medicinal Compositions”, Patent no.: US, June 1967; 3,325,357: 1-3.
15. R. N. Sass, “Rapid Dissolving Effervescent Granules”, Patent no.: US, June 1978; 4,093,710: 1-5.
16. P. Bonsen, Method of Delivering Drug with Aid of Effervescent Activity Generated in Environment of Use”, Patent no.: US, May 1981; 4,265,874: 1-9.
17. K. Khalifa, “Design, Formulation, and Evaluation of *Senna* Effervescent Tablets”, Journal of Forest Products & Industries, 2012; 1(2): 21-25.
18. W. Tritthart, “Effervescent Formulations”, Patent no.: US 6,242,002 B1; June 2001; 1-5.
19. G. Gergely, “Method for Manufacture of Effervescent Tablets”, Patent no.: US 3,773,922; November, 1973; 1-5.
20. P.D. Sethi, “Quantitative Analysis of Drugs In Pharmaceutical Formulations’’ Third edition;
21. G. Rajalakshmi, “Formulation and Evaluation of Diclofenac Potassium Effervescent Tablets”, International Journal of Pharmaceutical and Biomedical Research, 2011; *2*(4): 237-243.
22. A. Aslani, “Formulation, Characterization and Physicochemical Evaluation of Potassium Citrate Effervescent Tablets”, Advanced Pharmaceutical Bulletin, 2013; 3(1): 217-225.
23. A. Patidar, “A Review on- Recent Advancement in the Development of Rapid Disintegrating Tablet”, International Journal of Life Science & Pharma Research, Oct-Dec, 2011; 1(1): 7-16.
24. US Pharmacopoeia 30- NF 25; 2007; 1317: 1742.
25. The leaflet of “Phosphate Sandoz Effervescent Tablet”.