IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

EFFERVESCENT TABLETS- AN OVERVIEW

Neha Kousar[1], Gunnala Srinidhi[1], R. Prasanthi [1*], T. Mamatha[1]

Department of Quality Assurance, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, Tarnaka, Secunderabad, Telangana state, India.

***Corresponding Author:** R. Prasanthi. Assistant Professor, Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, Tarnaka, Secunderabad, Telangana state, India.

ABSTRACT

Oral dosage forms are the most popular of medication, although there are disadvantages when compared to other medications. But these disadvantages can be masked by manufacturing the medicament in its liquid dosage form. But the problem with liquid dosage form is that there are certain drugs which are unstable in liquid dosage form. Effervescent technique is alternative method to develop such dosage form which can accelerate the dispersion and deterioration of drugs. This technique is usually applied in quick release preparation. The tablets produced by effervescent technique are broadly significant in superior and rapid absorption, increasing patients liquid intake. These tablets also control drug release, sustained and controlled release preparations. This review reflects new application of effervescent technique in preparation of effervescent tablets.

Key Words: Effervescent, Dry granulation method, Tablets, Acid source.

INTRODUCTION

Oral route of administration is the most widely preferred route of administration. This is most utilized among all the routes which are route of administration employed for systemic delivery.

According to USFDA, effervescent tablets are intended to dissolved or dispersed in water before administration. Effervescent tablets release CO_2 when the acid is reacted with bicarbonates in the presence of water. Most common acids used are adipic acid, citric acid, tartaric acid and fumaric acid. Bicarbonates used are sodium bicarbonate and the potassium bicarbonate. In these tablets polyvinylpyrrolidone is used as binder.[1]

Effervescent tablets have special property which allows faster adsorption of the drug. Effervescent tablets are designed in a way to break down when they come in contact with the liquid like water or any juice, which makes the tablet to dissolve into a solution.

$3NaHCO_3 + H_3C_6H_5O_7 \rightarrow 4H_2O + 3CO_2 + Na_3C_6H_5O_7$

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

$C_4H_6O_6$+ 2 $NaHCO_3$→ Na2C4H4O6 + 2H2O + 2CO2 (g) ↑

Tartaric acid + Sodium bicarbonate → Sodium tartrate + Water + Carbon dioxide.

These reactions are the most common drug reactions utilised for pharmaceutical purpose.

These are acid-base reactions. These reactions occur due to presence of water, which are used to accelerate the reaction.[2]

Components Used in Effervescent Tablets

Acid source

- ✓ Adipic acid
- ✓ Citric acid
- ✓ Tartaric acid
- ✓ Fumaric acid
- ✓ Malic acid

Alkali source

- ✓ Calcium carbonate
- ✓ Potassium carbonate
- ✓ Sodium carbonate
- ✓ Sodium bicarbonate

Lubricants

- ✓ Polyethylene glycol (PEG)
- ✓ Sodium lauryl sulphate
- ✓ Magnesium lauryl sulphate

Binders

- ✓ Maltitol

Diluents

- ✓ Lactose
- ✓ Sorbitol
- ✓ Dextrose
- ✓ Xylitol

Sweeteners

- ✓ Sucrose
- ✓ Saccharin
- ✓ Aspartame

Flavours

- ✓ Strawberry Flavour
- ✓ Powdarome Lemon
- ✓ Powdarome Orange
- ✓ Tutti Frutti Flavour

Various Formulation Methodologies

Wet granulation method

Wet granulation is most widely used process of agglomeration. It is the fore most preferred technique for the effervescent granulation. It involves wet massing of powder blend by using granulating liquid, wet sizing and drying.

Steps involved in wet granulation

- Dry mixing of drug and excipients.
- Preparing the binder solution.
- Addition of prepared binder solution to mixer to form a wet mass.
- Drying of wet mass to form dried granules.
- Add disintegrant, glidant and lubricant to the dried granules.

Advantages

1. Enables mechanical handling of powders.
2. Improves flow property of powders by increasing particle size.
3. Powder density is increased.

Disadvantages

1. It is an expensive method because it involves labour, equipment, time, energy and space.
2. Loss of material is highly noted during various stages of processing.[3-5]

Dry granulation method

Dry granulation is the least desirable method of granulation procedure. In this process the powder mixture is pressed without any heat and solvent. In the dry granulation two methods are used.

1. Slugging – It is most commonly used. In this method the powder is recompressed and the tablets or slugs formed are milled to yield the granules.
2. The other procedure is to recompress the powder with pressure rolls using a machine such as Chilsonator.

Roller-compaction method

Chilosonator is a machine used for the compaction of powder by using a pressure roll. Unlike a tablet machine, this machine turns out to be a compact mass with the continuous flow.

The powder is fed between the roller from hopper. The hopper contains a special auger to feed the powder into the compaction area. Granules are produced by screening or milling of slugs or aggregates. [6]

Advanced Techniques Used For Granulation

Steam granulation

It is a modified wet granulation technique. In steam granulation system steam is used a binding agent instead of the water. It has several benefits which includes higher distribution uniformity, high diffusion rate into powders, more favourable heat balance during the drying step. Steam granules are special in shape, have large surface area so increased dissolution rate of drug occurs, the processing time is shorter, i.e., high number of tablets are produced per set. It has no health risks to the operators, no restrictions by ICH on the traces left in granules, the steam is sterile which is free from contamination. Hence the total value cab be kept in control, lowers the dissolution rate which can be used for preparation of flavour granules without modification of drug availability.[7]

Melt granulation (or) Thermoplastic method

Binder which can be moulded is added for achieving granules. These binders act as solid at room temperature but melts in the temperature range of 50-80^{0}C. The melted binder now acts a binding liquid. In this process, there is no need of a drying phase since the dried granules are obtained by cooling them at room temperature. Type of flow of granules based on angle of repose given in Table 1.

EVALUATION OF THE EFFERVESCENT GRANULES

Table 1: Type of flow of granules based on angle of repose

Angle of repose (degrees)	Type of flow
<20	Excellent
20-30	Good
30-34	Passable
>40	Very poor

Angle of repose Ɵ

Angle of repose is defined as the maximum angle possible between the surface of the pile of powder and the horizontal plane. This measures the frictional force in a loose powder or the granules. It is the flow property of a powder.

To measures angle of repose, the powder mixture was allowed to flow through the funnel which is fixed to a stand at a definite height. The angle of repose was then calculated by measuring the height and radius of the heap of the powder.[8]

$$\theta=\tan^{-1}(H/R)$$

θ= Angle of repose

H= Height of the pile

R= Radius of base of pile

Flow Rate

The flow rate is defined as rate at which the material emerges out through the orifice of funnel having a suitable diameter. Weighed quantity of granules poured into a funnel, allowed to pass through funnel having the orifice of diameter 8mm. The time required for complete granules to emerge out from the orifice was recorded by a stopwatch.

Flow rate = weight of granules/ time in seconds

Bulk density

The value of bulk density is obtained by dividing weight of powder to that of the bulk volume in cm^3. The powder of about $50cm^3$ is taken and poured into a graduated cylinder of 100ml and allowed to dropped at 2 second interval for three times from a height of 1 inch onto a hard wooden surface. Bulk density is then calculated by using the equation below[9]

$$D_b = M/V_f$$

Where, D_b= bulk density

M = weight of samples in grams

V_f = final volumes of granules in cm^3 in cylinder.

Tapped density

Tapped density can be obtained by dividing the mass of a powder by the tapped volume in cm^3. The sample of about 50 cm^3 of powder has been passed through a standard sieve no. 20, has to carefully introduced into a 100 ml graduated cylinder. The cylinder has to drop at two second interval onto a hard surface 100 times from a height of 1 inch. The tapped density of each formulation is obtained by dividing the weight of sample in grams by the final tapped volume in cm^3 of the sample present in the cylinder. Equation for tapped density is given below

$$D_t = M/V_f$$

Where, D_t = bulk density

M = weight of samples in grams

V_f = final volumes of granules in cm^3 in cylinder.

Carr`s index

Carr's index is also called as carr's compressibility index. It is an indirect method of measuring powder flow from bulk density and was developed by Carr. The percentage compressibility of the powder is a direct measure of potential powder arch or the bridge strength and stability.[10] Carr's index indicating flow of powder given in Table.2.

%Compressibility= **Df-Do/Df×100**

Where,

D_f= Fluff or poured bulk or bulk density

D_0=Tapped or consolidated bulk density

Table 2: Carr's index indicating flow of powder

Carr's index	Types of flow
5-15	Excellent
12-16	Good
18-21	Fair
23-28	Slightly poor
28-35	Poor
35-38	Very poor
>40	Extremely poor

Evaluations effervescent tablets

Weight variation

Weight variation is determined to know whether the batches of tablets having uniformity. Weigh 20 tablets individually. Calculate the average weight and compared individual weight of tablets to the average. The tablets meet the test if not more than two tablets are outside the % limit and none of the tablet differ by more than two time of the % limit. Weight variation specification given in Table 3.

Table 3: Weight variation specification

IP/BP	Limit	USP
80mg or less	10%	130mg or less
More than 80 or less than 250mg	7.5	130 mg to 324mg
250mg or more	5%	More than 324mg

Thickness and diameter

Vernier calipers is used for measuring the thickness and diameter. These parameters are important for uniformity of tablet size.

Hardness

Monsanto hardness tester is used to measure the tablet hardness. Resistance of tablet is generally depending on the hardness of tablet. It is an important factor is tablet may get damaged during transportation storage and handling. It is measured in kg/cm^2.Hardness is the force required to break a tablet in diametric compression. 3-5kg/cm^2 is considered to be satisfactory for uncoated tablets.

Friability

Roche friabilator is used for determining the friability of tablet. It is measured to know to know the effect of shock or abrasion on the tablets. In this device pre weighed tablets are place inside the friabilator and allowed to rotate at 25rpm and dropping a tablet at a height of 6 inches in each rotation.

Tablets were dusted and reweighed. According to USP the limit should be 0.5-1%.

$$F=W_{initial}-W_{final}/W_{inital}\times 100$$

Measurement of effervescence time

In a beaker 200ml of purified water is taken to that add single tablet at 20±-1 °C. Note the time in stopwatch. Final time is noted when tablet is dispersed completely**.**

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 3times for each formulation.

Measurement of CO_2 content

One effervescent tablet solved in 100 ml of 1N 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 3determinations.

Evaluation of the water content

10 tablets of each formulation are dried in desiccators, which contains activated silica gel for about 4 hours. Water content should be of 0.5% or less.[10]

Uniformity of Content

10 tablets were selected randomly. Transfer each tablet into a 50mL volumetric flask, dissolved and diluted to 50 mL with phosphate buffer containing pH 6.8.1 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 using UV spectroscopy at 246 nm. The Standard limits for uniformity of content are

IP: Active less than 10mg or 10%,

BP: Active less than 2 mg or 2%,

USP: Active less than 25mg or 25%.

- 10 tabs limit NMT 1 tab deviate 85 – 115% & none outside 75 – 125% of the Average value/IP/BP/USP (Relative Standard Deviation less than or equal to 6%),
- If 2 or 3 individual values are outside the limits 85 – 115% of the Average value, & none outside 75 – 125% repeat for 20 tablets.

Advantages

- No need to swallow tablet.
- Improved palatability.
- Less irritation and greater tolerability.
- Faster onset of action.
- Enhanced absorption.
- Superior stability.
- Have a good stomach compatibility.
- Dose is accurate.
- More consistent response.
- Readily absorbed because it has to consume in solution form.
- Good in taste.
- Large amount of active ingredients can be easily incorporated.

Disadvantages

- Excipients are costly.
- Unpleasant taste of some active ingredients.
- Special production facilities.
- Larger tablets requiring special packaging materials.
- Delicate packaging process.[11]

CONCLUSION

Effervescent tablets are good alternative to regular tablets. Elderly people and people who have swallowing problems can easily have effervescent tablets, which can be taken after dissolving them in water. Effervescent tablets increase the masking the taste of some ingredient. Now-a-days effervescent tablets are widely manufactured which are having various advantages such as rapid & enhanced absorption, increase liquid intake, advantages in case of swallowing problem, simple handling, optimal compatibility.

ACKNOWLEDGMENTS

We would like to thank Sarojini Naidu Vanita Pharmacy Maha Vidyalaya for providing access to facilities.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Radha Rani, Komal Masoan, Sherry. A Recent Updated Review On Effervescent Tablet, International Journal of Creative Research Thoughts, 2020: 8(4), 3928-3935.

2. Patel SG, Siddaiah M. Formulation and evaluation of effervescent tablets: a review. JDDT. .2018, 8(6):296-03.

3. Ka¤an ‹pci1, Tu¤ba Öktemer2, Leman Birdane3, Niyazi Alt›ntopra Effervescent tablets: a safe and practical delivery system for drug administration. 2016, 6(1), 46-50. doi:10.2399/jmu.2016001009.

4. Prajapati BG, Mishra O. Concept, Manufacturing and Characterization of Effervescent Tablets: A Review, Sun Text Rev Pharm Sci. 2021, 2(1): 110.

5. Sangram Biranje, Akshata More, Trusha P. Shangrapawar, Ashok Bhosale. Ijppr.Human, 2021; Vol. 21 (3): 476-486.

6. P.B. Savant, M.A. Qureshi, N. Kshirsagar, Manjusha Kareppa, Avinash B Thalkari, P.N. Karwa. Preparation and Evaluation of Diclofenac Sodium Effervescent Tablet. Research Journal of Pharmaceutical Dosage Forms and Technology. 2021; 13(4):305-1. doi: 10.52711/0975-4377.2021.00050

7. Tambe, B. (2021). Formulation and Evaluation of Paracetamol Effervescent Tablet. Asian Journal of Pharmaceutical Research and Development, 9(4), 47-51. https://doi.org/https://doi.org/10.22270/ajprd.v9i4.982.

8. Nurliyana Tazulazhar, Saw Hong Loh, Marinah Mohd Ariffin, Optimization of Effervescent Tablet-Assisted Dispersive Liquid-Liquid Microextraction with Central Composite Design for Preconcentration of Stimulant Drug, (2021) 50(1): 109-121 http://dx.doi.org/10.17576/jsm-2021-5001-12.

9. Thoke Sagar B.*1 , Sharma Yogesh P.1 , Dr. Rawat Swati S.1 , Nangude Satish L, Formulation Development & Evaluation Of Effervescent Tablet Of Alendronate Sodium With Vitamin D3. Journal of Drug Delivery & Therapeutics; 2013, 3(5), 65-74.

10. Rosch M, Lucas K, Al-Gousous J, Pöschl U, Langguth P. Formulation and Characterization of an Effervescent Hydrogen-Generating Tablet. Pharmaceuticals (Basel). 2021 18;14(12):1327. doi: 10.3390/ph14121327. PMID: 34959728; PMCID: PMC8707073.

K.Divya, G.Vamshi, T.Vijaykumar, M.Sandhya Rani , B.Kishore Review on Introduction to Effervescent Tablets and Granules Kenkyu Journa