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A REVIEW: NOVEL TECHNIQUES FOR CONTINUES MANUFACTURING PROCESS: PASTILLATION

Mr. Ajay D. Dhoom[1], Mr. Ashvin J. Bhagariya[2], Mr. Nitin G. Saharya[3], Mr. Jitu A. Pawar[4], Mr. Satish L. Vagh[5]

B.Pharm Scholar[1, 2,3,4,5], Shivam Pharmaceutical Studies & Research Center, Valasan, Anand, Gujarat, India

Corresponding Author[1]: Mr. Vedish N. Patel

Assistant Professor, Department Of Pharmaceutics, Shivam Pharmaceutical Studies & Research Center, Valasan, Anand, Gujarat.

Email id: vedishpatel1211@gmail.com

Corresponding Author[2]: Mr. Rikin R. Patel

Assistant Professor, Department Of Pharmaceutics, Shivam Pharmaceutical Studies & Research Center, Valasan, Anand, Gujarat

Email id: patelrikin1211@gmail.com

Corresponding Author[3]: Mr. Mohammad Talha Vahora

Assistant Professor, Department Of Pharmaceutics, Shivam Pharmaceutical Studies & Research Center, Valasan, Anand, Gujarat

Email id: talha.vahora39@gmail.com

Corresponding Author[4]: Dr. Richa Dayaramani

Principal, Professor, Department Of Pharmaceutical Quality Assurance, Shivam Pharmaceutical Studies & Research Center, Valasan, Anand, Gujarat

Email id: richadayaramani1976@gmail.com

Corresponding Author[5]: Mrs. Shilpa Patel

Assistant Professor, HOD, Department Of Pharmacognosy, Shivam Pharmaceutical Studies & Research Center, Valasan, Anand, Gujarat

Email id: Ph.shilpapatel@gmail.com

ABSTRACT: *A novel technique, pastillation to fabricate lipid based oral multiparticulate controlled release dosage forms for time in pharmaceutical field is reported. An in-house laboratory scale device was designed to generate pastilles of doxofylline loaded stearic acid. Pastilles formed were characterized for drug content uniformed, drug release profile ,morphology and contact-angel .The optimized condition for pastillation were 1.00cm dropping height, 20G ,need orifice and 4ºC plate temperature which produced good pastilles of uniform size (2.5-3.0 mm) with contact angle above 90º. This multiparticulate system has very good flow property and is very uniform in size, weight and drug content and is able to sustain the drug release for a period of 24h. This is a very simple method for producing lipid-based multi-particulate system as compared to other available techniques (melt- extrusion and freeze-pelletization) which can further be filled in capsule/sachets. The biggest advantage of this technology is that the large-scale equipment for pastillation is well-established in chemical industries. Therefore, use of this unique dosage form mayopen new avenue in the field of drug delivery which may even be an alternative for line extension or preparing patent non-infringing product of existing formulation.*

Keywords: Principle, Suitable Polymer for pastillation, Method, Case Study, Evaluation of Pastilles, Application, Limitation

INTRODUCTION

The word pastille comes from the same origin as pastry, from the Latin word pastilles, for alump of meal or origin, Which wash from panis, "bread". A pastille was originally a pill- shaped lump of compressed herbs, which was burnt to release its medicinal properties. A pastilles is a type of sweet or medicinal pill made of a thick liquid that has been solidified and is meant to be consumed by light chewing and allowing it to dissolve in the mouth .APastilles is also known as a troche, which is a medicated lozenge that dissolve like sweets.[7]

For chronic treatment, the oral controlled release drug delivery system represent the most popular form of dosage forms. Such system release the drug at constant rate and offer many advantages, such as nearly constant drug level at the site of action, minimum peak-valley fluctuation, reduction in dose of drug, reduced dosage frequency, avoidance of side effect, and improved patient compliance. These formulation show a typical pattern of drug release in which the drug concentration is maintained in the therapeutic window for a prolonged period of time (sustain release), thereby ensuring sustained therapeutic action.

A controlled release multiparticulate system consists of multiple mini drug depot wherein the drug is either dispersed in a matrix or encapsulated in a reservoir. They are diverse in size which may vary from nano to milli scale. They are generally termed as nanoparticles, microparticles, microcapsules, pellets, mini tablets and granules, which can be administeredin a single dose by compressing into a dispersible tablet or filling into capsule or a sachet,in case of high dose. They can be the agglomeration of fine powders or granules of the drugsubstance and excipient using appropriate processing technology and equipment.

The current pharmaceutical technology has already realized the tremendous potential of controlled release multiparticulate system in terms of its flexibility in product development and therapeutic benefits to the patient in comparison to the conventional single unit dosage form. The release of drug from any modified release dosage form, of multiple strengths, changes as a function of its surface area. In case of matrix tablet of different dosage strengths, if the same blend is compressed at different weights, the change in surface area (due to change in tablet dimension) is not usually proportional to it dosage strength which results in altered drug release profile. While in case of multiparticulate system, microparticles can be divided as per the desired dosage strengths without any effect on the dimension of the individual particles. Therefore, the overall surface area of a dosage form changes proportionately with dosage strength which does not significantly alter the drug release profile. This eases the process of scale up and down and reduce the extra time and cost incurred in carrying out bioequivalence studies for all other strengths. Moreover, they can also be used for delivery of incompatible drugs together or to administer drugs at different release rates in the gastrointestinal tract. When administered orally, they generally disperse uniformly in the gastrointestinal tract, maximize absorption, minimize localized side effect and reduce intra and inter subject variability. Multiple unit system can also offer added advantages of prolonged gastrointestinal resistance and shorter absorption lag- time.[1]

PRINCIPLE OF PASTILLES

Pastilles provide an efficient, cost effect process for the continues converting of molten product into uniform , round and dust free granules ideal for bagging , transporting and bulk material handling system.

The size of pastilles is 1-25 in diameter and viscosities is 5-30,000 mpas.[10]

Pastilles are made by pouring a thick liquid into a powdered, sugared, or waxed mold and them allowing the liquid to set and dry. The substances contained in the dried liquid are slowly released when chewed and allowed to dissolve in the mouth and absorb by mucus membrane of oral cavity or in Gastro intestinal tract. Due to oily nature of these active substances, pastilles are usually based on mixture of starch and gum Arabic, which emulsifies the substance and bind them in a hydro colloidal matrix. The starch and gum also reduces the rate in which the pastilles dissolve and moderates the amount of active substance delivered at a time.[7]

THEORY

The present research work involves the use of wax/lipid as a major excipient in the product development. Several technique are available in literature for the processing of wax/lipid excipients.[1]

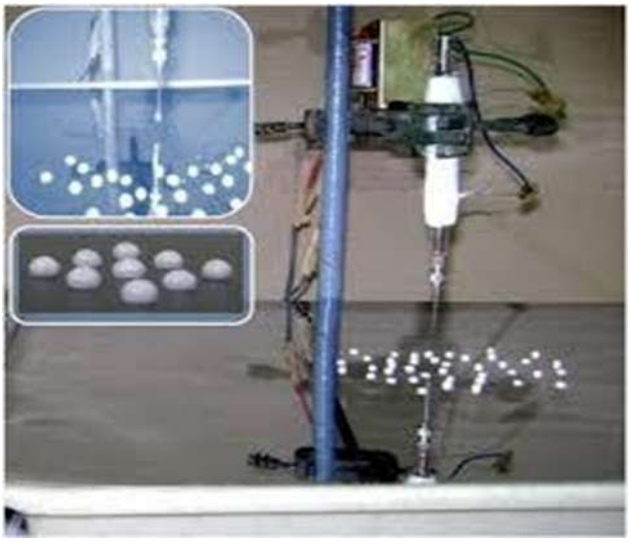
1. Melt granulation
2. Melt extrusion

3. **Pastillation**
4. Melt dispersion
5. Melt solidification
6. Multi-particulate

Pastillation is a widely used technique in chemical, petrochemical and agrochemical industries for the solidification of dusty hazardous powder of chemical into pastilles (hemispherical Solidified unit of uniform size) which eases their handling .in this process, the drops of chemical substance in molten state are deposited on a cooled stainless steel surface for rapid solidification to generate pastilles of uniform dimensions. Depending on the size of the drops and the physical properties of the melt, the drops flatten to a certain extent. The solidified drop, therefore, has the typical pastille-like shape. The production process can easily be carried out at large scale with the help of specially designed equipment's called "Rotoformer". In a rotoformer a pump delivers the Melton product from a vessel or pit to the rotoform system via heated pipes and filters. The rotoform itself consist of a heated cylindrical stator- which is supply with liquid product- and a perforated rotating shell that turns concentrically around the stator. Drops of the product are deposited by the nozzle bar across the whole operating width of a continuously running stainless steel belt.[11]

A system of baffles and internal nozzle built into the stator provides uniform pressure across the whole belt width, providing an even flow through all holes of the perforated rotary shell. This ensures that all pastilles are uniform size, form one edge of the belt to the other.[11]

Therefore, the objective of the present work was to explore the pastillation technology for the development of immediate and controlled release multiparticulate drug delivery system.Briefly, the operating parameters for the fabrication of pastilles were optimized and then the effect of the excipients on the in vitro drug release from the dosage form was studied along with their morphological and solid state characterization. Doxofyline, an anti- asthmatic drug used for treatment of asthma and chronic obstructive pulmonary disorder has been used for the present study. [1]



In house Laboratory Design For Pastillation

GOOD PASTILLES REQUIER A NUMBE OF CHARACTERISTICS:

- Uniform size, low friability and high impact abrasion resistance.
- Good flow characteristic.
- Low moisture content
- Stable properties over time.
- Consistent quality.
- High bulk density and angle of repose.

ADVANTAGES OF PASTILLES

- Pastilles is the increase the retention time of the dosage form in oral cavity which isincrease bioavailability, reduce gastric irritation and bypass first pass metabolism
- Pastilles provide palatable means of dosage form administration and enjoy its position in pharmaceutical market owing to its several advantages but it suffer fromcertain advantages too.
- This dosage form can be adopted for local as well as systemic therapy and a widerange of active ingredient can be incorporated in them.
- The present review covers more or less all aspect associated with pastilles and alsothrough light on the application of Pastilles.[9]
- Avoid first pass metabolism, thus increase in bioavailability can be used for purposeof both and local and systemic effect through buccal mucosa.
- It offers better patient compliance can be given to those patients who have difficulty in swallowing.
- Easy to manufacture and store.

- Medicated pastilles also have drawbacks like non-ubiquitous distribution of drugwithin saliva for local therapy and possible draining of drug from oral cavity to stomach along with saliva.[6]

SUITABLE POLYMER FOR PASTILLATION[1,5]

1. **Fatty Acid**

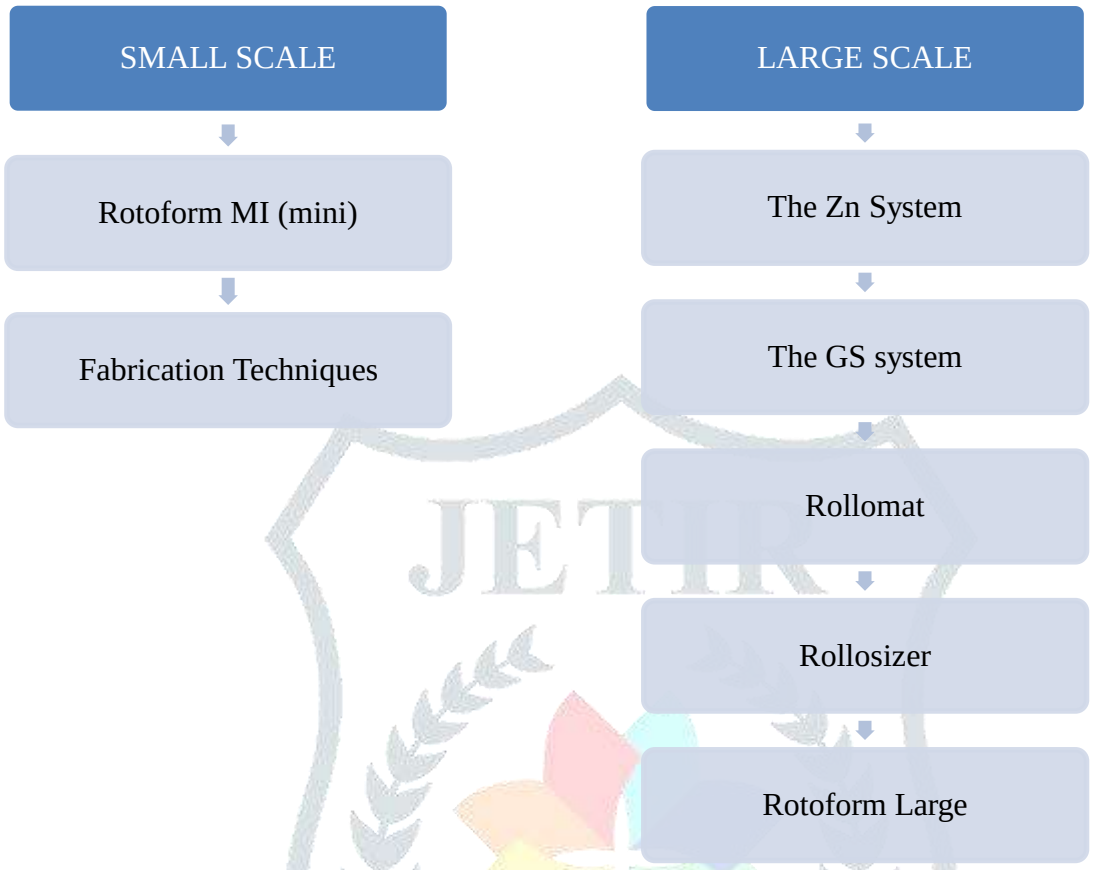
- Stearic Acid
- Hydrogen Castor oil

2. **Water soluble**

- Polyethylene glycol (PEG) 400
- Polyethylene glycol (PEG) 4000
- Polyethylene glycol (PEG) 6000

3. Dextran
4. Polyurethrane

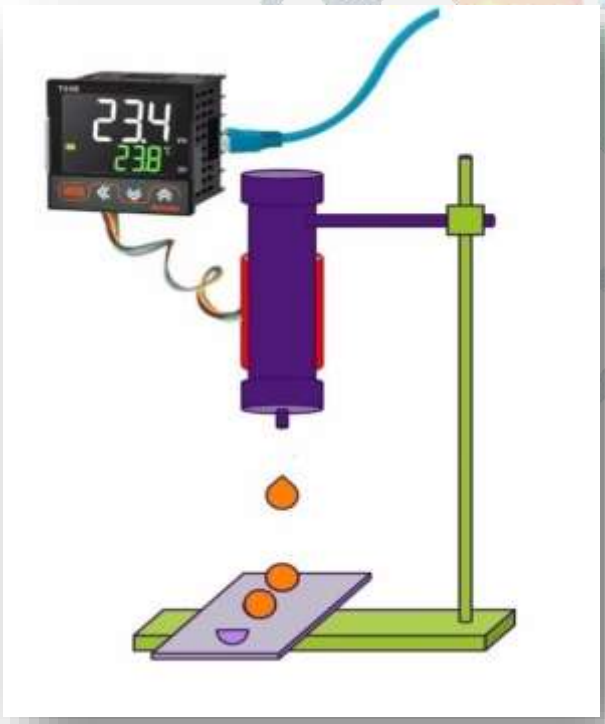
METHOD OF PASTILLATION



SMALL SCALE METHOD

1: Fabrication technique[1]

A laboratory scale device was designed in – house for producing pastilles. The device consisted of a glass syringe with stainless steel plunger, hypodermic needles (metallic), a metallic plate, heating coil and a 1.5A transformer. The heating coil was wrapped on the external surface of an open ended ceramic tube and coated with a thick layer of ceramic clay for insulation. The coil was then connected with the transformer before being connected to electricity. The syringe with hypodermic needle attached was inserted into the ceramic tube. This assembly was arranged over the metallic plate with the help of the burette folder. The metallic plate was cooled with the help of ice cube in the ice tray plate below it. The drug and other required excipients were added to lipid/PEG melt under heating condition (140-150ºC) and were manually stirred till a clear miscible mixture was produce, which ensures homogenous distribution of drug in the matrix, the mixture of was then poured into the preheated syringe and was allowed to fall drop-wise (with pressure regulation managed manually with plunger of the syringe) on to the cold plate to generate pastilles. After solidification, the pastilles were scraped with the help of a sharp metallic scrapper. They were then manually filled into size '0' capsules.



❖ The operating parameters

- Needle size
- dropping height (distance between the needle tip and plate surface)
- Temperature of plate and product
- Contact angle

❖ Advantages of Fabrication technique

❖ Easily performed in small scale laboratory.

❖ Need minimum equipment

❖ Processing of extremely low viscosity product

❖ Melting point of product is low

2: ROLLOSIZER MI (mini)[11]

Delivering all the benefits of standard rotoform system but on a small scale, the rotoform MI (mini) is ideally suited to use in laboratory testing operations to define quality, production rates and other key parameters of products in the development stages. System capacity depends on the product being processed and can be up to 20 kg/h. product with viscosities from 10 – 5000 mPas can be handled successfully.

❖ Advantages of Rotoform MI (mini)

❖ Maximum system versatility

❖ Premium quality Rotoform pastilles

❖ Simple operation and accurate system control.

❖ Typical product

- Antioxidant
- Calcium nitrate
- Detergents
- Diaminodiphenylmethane

LARGE SCALE METHOD

1: The ZN system [10]

The ZN system, predecessor the "DN" from KAISER originated in 1953 making it the first Pastillation process invented. The ZN system operates on a drop forming principle achieved through the up-and-down motion of the needle inside the nozzle. The pastilles size is primarily determined by the diameter of the needle and nozzle, the liquid level inside the tub and the number of needle stroke.

❖ Advantages Of Zn System

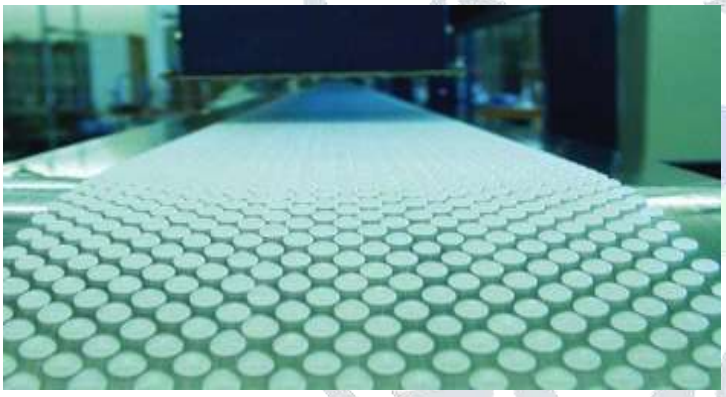
- ❖ Low cost solution for low to medium capacities.
- ❖ Processing of extremely low viscosity product.
- ❖ Electrical heating capacities.
- ❖ Gastight housing available.
- ❖ Feeding temperature up to 400º.

❖ Typical Product Of Zn System

- ❖ Acetanilide
- ❖ Bisphenol A
- ❖ Caustic soda
- ❖ Disodiumtetrasulfide
- ❖ Fatty acid
- ❖ Fatty alcohol
- ❖ Maleic anhydride
- ❖ Monoglycerate
- ❖ Paraffin
- ❖ Potassium soda

2:THE GS SYSTEM[10]

The system was designed for medium to high viscosity product. Contrary to the ZN system, the needles are replaced by a cylinder and piston arrangement. The up and down movement of the cylinder and piston allows the molten product to be deposited on to the belt creating uniform pastilles.



❖ Advantages of GS system

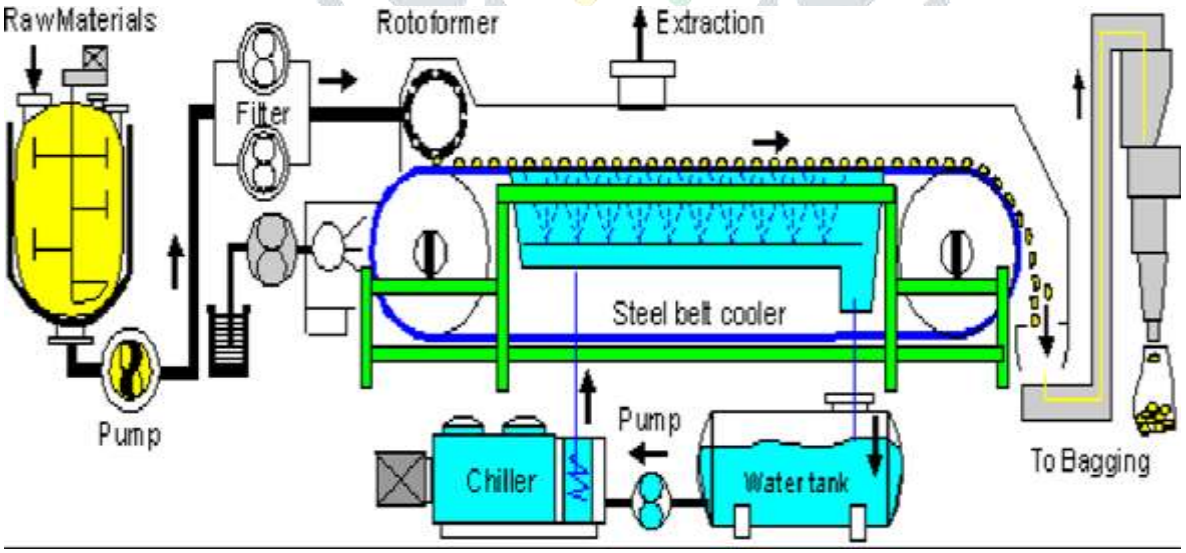
- ❖ Low cost solution to medium capacities.
- ❖ Processing of extremely low viscosity product.
- ❖ Electrical heating capabilities'
- ❖ Gastight housing available.
- ❖ Feeding temperature up to 400º.

❖ Typical product of GS system

- Acetanilide
- Caustic soda
- Neopenthylglycol
- Pet food
- Potassium soda

3: ROLLOMAT[10]

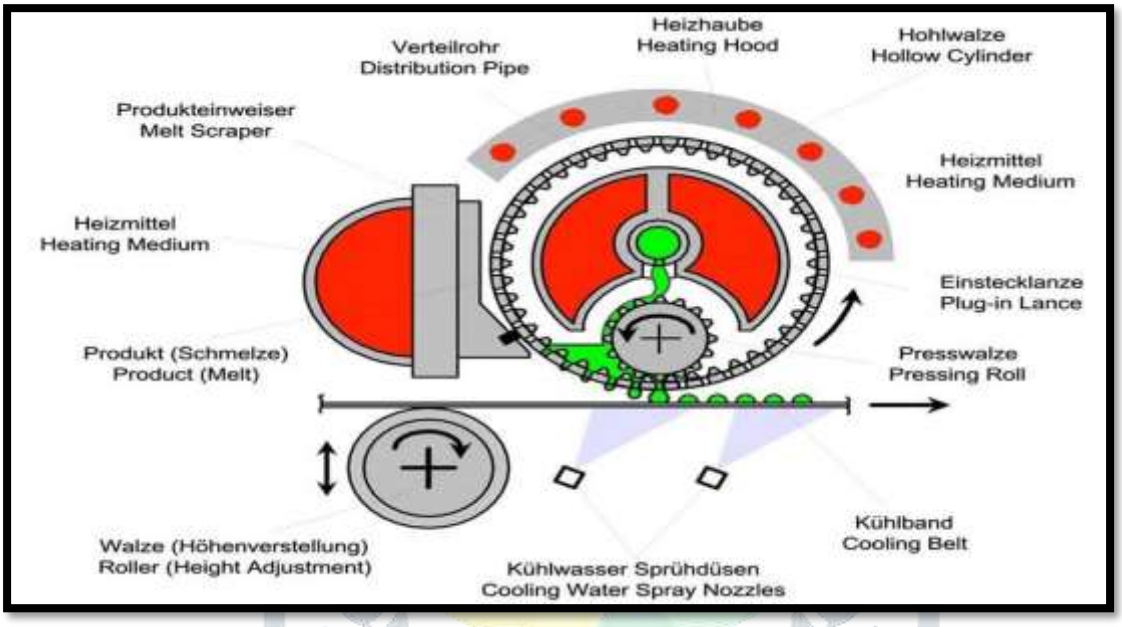
The Rollomat system was covers the widest viscosity of all rotating pastillators. The Rollomat rotary depositor has an operating principle similar to a gear pump. The heart of this system is an inner-greater, hollow cylinder a pressing roll engages with the teeth of the hollow cylinder and the product is fed at the designated rate-through the plug-in lance. From there is flow onto the rotating pressing roll and becomes sandwiched between the outer cylinder and inner pressing roll. Each time the teeth of the hollow cylinder engage with the teeth of the pressing roll, product is pushed through the nozzle and to the cooling belt. The Rollomat has a heated product scraper ensuring that the outer surface of the cylinder is clean when reaching the drop-off point.



❖ Advantages of Rollomat

- Ideal for running product with higher melting point.
- Lower operating temperature.
- Wide range product application.

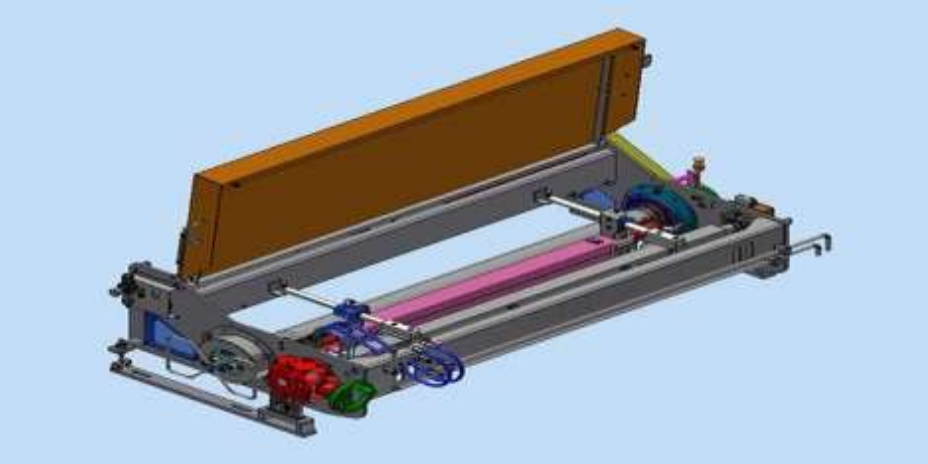
❖ Operating principle:



4:ROLLOSIZER[10]

The rotating pastillation process rollosizer is our most recent development, and is complementing our other pastillation systems, when it comes to achieve high capacities on one unit with low viscosity product. For the Design of the KEISER-Rollosizer, where used some of the various advantageous features of the KEISER-Rollomat, which is successfully in used since many years at various operation.

The drop-forming principal is a static heated cylinder with the inner product channel andthe tubes for the heating medium. by means of a special product distribution bar, the product enters the cooling belt through the holes in the perforated cylinder. The pastilles are generated by the overlapping of the holes in the product distribution bar with the holesin the rotating cylinder.



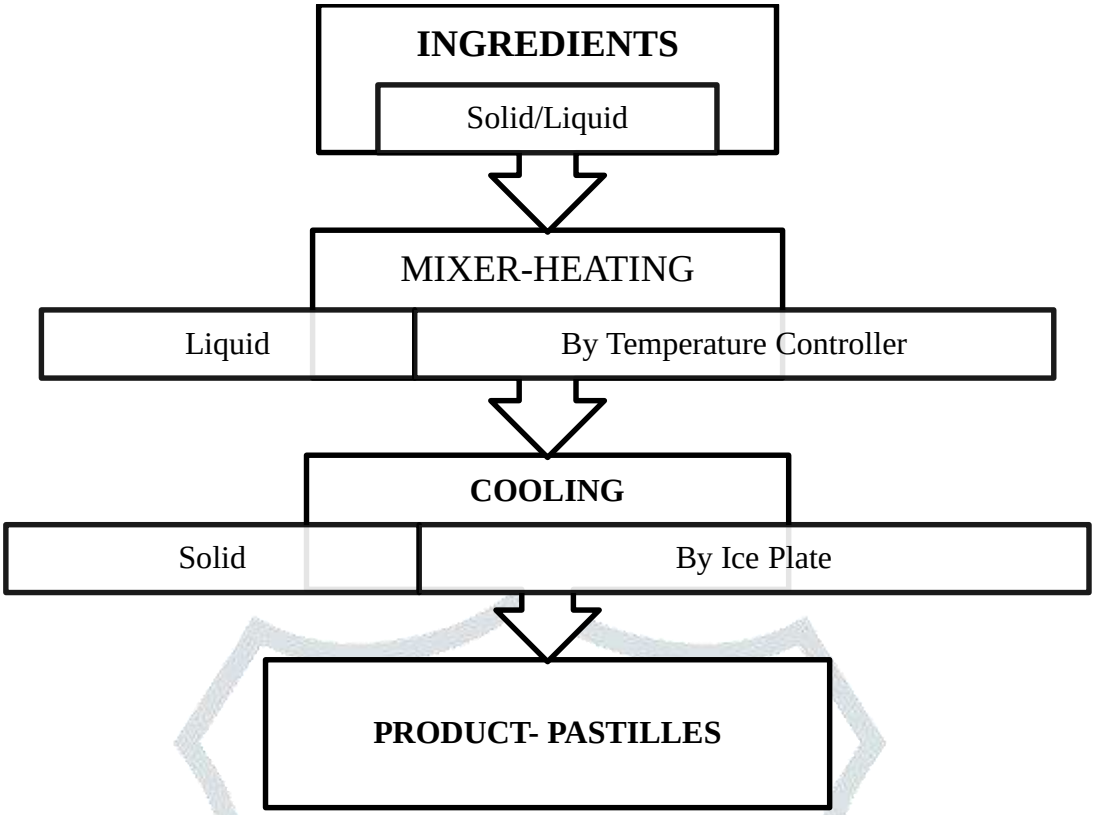
Rollosizer

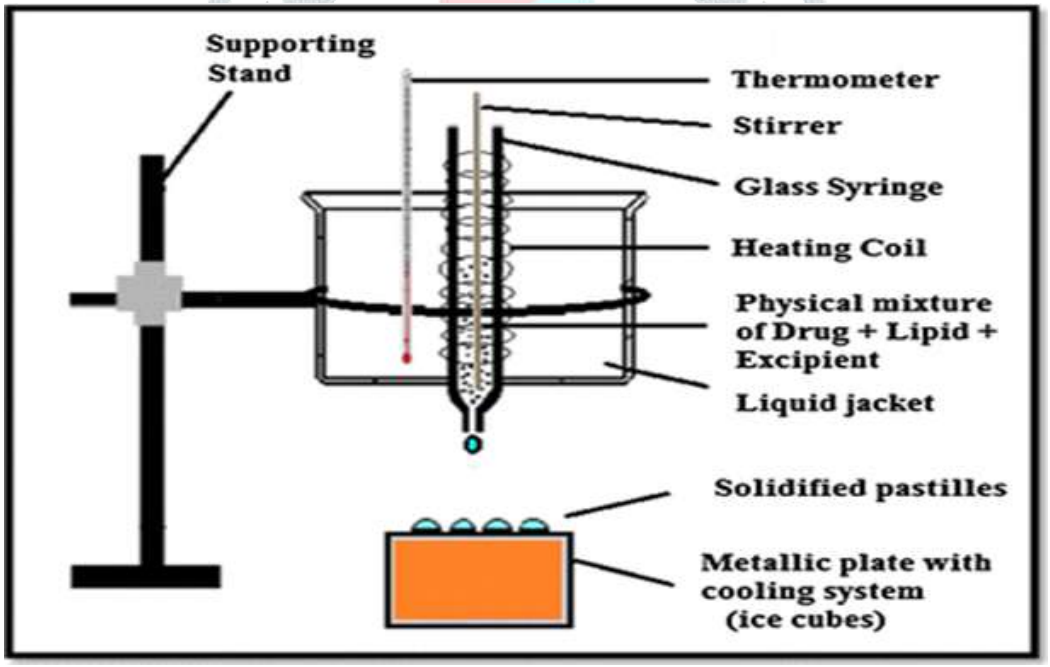
❖ Advantages of Rollosizer

- Direct solidification from the melt, eliminating the energy and equipment costassociate with subsequent crushing, and breaking or grinding process.
- Pastilles of the highly uniform shape and the stability for dust – free production.
- Free flowing pastilles, ideal for handling, blending , storage and further processing.
- Higher bulk density and batter packing properties than bulky flakes.

PROCESS OF PASTILLATION

The crystallization and deformation of drops on a cooled substrate is examined to achieve the desired size and shape of the product and to predict the required crystallization time. As example a bisacodyl melt is chosen. The crystallization occurs immediately after the deformation. The rule of the contact angle of the drop on a substrate is investigate by different experimental variables. The static contact angle is increased with increasing degree of surface roughness. It is, however, decreased with increasing Reynolds numberand degree of subcooling. The phenomenon of spreading and rebounding of drops isobserved and used to discuss the deformation process. Madejski's model predict the degree of deformation. It is increased with increasing Reynolds number. Using a simple drop solidification model allows to numerically study the degree of deformation based on the achieved experimental data. To estimate the normalized deformation and crystallization times, which are found to be proportional to the Reynolds number to the power of 1.23 the numerical study can also be used. On basis of the crystallization time the solidification equipment can be designed.[8]


INGREDIENTS
Solid/Liquid
MIXER-HEATING
Liquid
By Temperature Controller
COOLING
Solid
By Ice Plate
PRODUCT- PASTILLES


Supporting Stand
Thermometer
Stirrer
Glass Syringe
Heating Coil
Physical mixture of Drug + Lipid + Excipient
Liquid jacket
Solidified pastilles
Metallic plate with cooling system (ice cubes)

EXAMPLES OF PASTILLES

1. PARACETAMOL [5]

Producing the Paracetamol – containing Pastilles for paediatric and eutectic of two sugar alcohol (sorbitol, xylitol) in one step. This type of melt-technology is more cost-efficient and similar than the conventional tableting technologies, whereby the formation of the pastilles and their coating occurs upon the same fabrication step. We managed to produce pastilles having a softer core and a harder, resistant shell in one cooling step. Adding polyethylene glycol(PEG) 2000 and or 6000 to the Paracetamol containing eutectic, the dissolution rate of Paracetamol could be considerably increased, especially when using PEG 2000, reaching equal dissolution characteristic both under mouth-and gastric-specific conditions. Distribution of the component within the Pastilles has been determined by X- ray scattering and Raman spectroscopy. Physic-chemical parameters of the xylitol-sorbitol eutectic and their changes upon adding Paracetamol and PEGs have been determined, and ithas been reveal that xylitol and sorbitol from a new entity with a distinguished crystal structure. The significant changes in viscosity were explained and the interaction in the eutectic mixture was investigate using fourier transport infrared spectroscopy (FT-IR). The uniformity of the physical parameters of the pastilles also demonstrates the feasibility of using the cost-efficient and simple one-step eutectic-cooling technology for manufacturing pastilles.

2. Diclofenac sodium [2]

The diclofenac sodium is BCS class II drug which comes under the antipyretic class drug, and has a wide range of use. But due to its low solubility it has low dissolution rate and hence reduced bioavailability. There are several methods for the enhancement of solubility and dissolution rate. Pastillation techniques are widely employed in chemical industry for solidification and better handling. Pastilles are solidified discrete units, acquired directly from the melt mass. However, this method of pastillation has not been explored for the drugdelivery system yet. Literature revels that it can be used as a novel, effective and easiest method for the enhancement of solubility and dissolution rate. The selection of polymer was done by the solubility studies and kolliphor HS 15 was used to make the pastilles of Diclofenac sodium. Formation of pastilles were confirmed by FT-IR and further evaluate for % yield, drug contents, solubility of Diclofenac sodium was increased by pastillation method by 2-fold and dissolution rate was also enhanced by double than that of the drug, thus,

pastillation can be effective and easiest method to enhance the solubility, dissolution rate and bioavailability of poorly water-soluble drugs having good permeability.

CASE STUDY[3]

NICOTINE- CONTAININGS SOFT GELATIN PASTILLES:

The present invention relates to soft pastilles for nicotine therapy.

Nicotine is an alkaloid found in the plants belonging to family *Solanaceae*. Nicotine is a hygroscopic, oily liquid which is miscible with water in its base form. As nicotine enters the body, it is distributed quickly through the bloodstream and can cross the blood - brain barrier. On an average it takes about ten second for the substance to reach the brain when the inhaled. The half-life (t ½) of nicotine in the body is around two hours.

PROCESS: PREPARATION OF SOFT PASTILLES

- Accurately weighed Glycerin and Water in a reactor. To this accurately weighed gelatin and lecithin are added to form a first mixture.
- To this mixture nicotine active is added and the resulted mixture is mixed for about 30 to 45 minutes at 1500 rpm to form a second mixture.
- In next step, adequate quantities of sweetener, flavor, colour and preservatives are incorporated into the second mixture to obtain a mass. The obtained mass is then collected in a container followed by cooling and solidification of the mass. The solidified mass is transferred into a melter to obtain a melted mass.
- Finally, the melted mass is passed the through and injector into the perform cavities followed by cooling and blister packing.

NICOTINE PASTILLES: NIClonz

No	Ingredients	Role	Amount (**mass of the pastilles**)
1.	Nicotine poracrilex	API	0.05% to 1%
2.	Gelatin and caragreenan.	Gelling agent	5% to 40%
3.	Glycerin and sorbitol.	Plasticizer	30% to 70%

4.	Saccharin, sucrose	Sweetener agent	0.05% to 10 %
5.	Lecithin	Releasing agent	0.5% to 30%
6.	Methyl paraben,propyl paraben	Preservative agent	0.05% to 2%
7.	Menthol, lemon, mint	Flavorings agent	0.01% to 5%
8.	Water	Aqueous	5% to 20%

Examples of Pastilles:

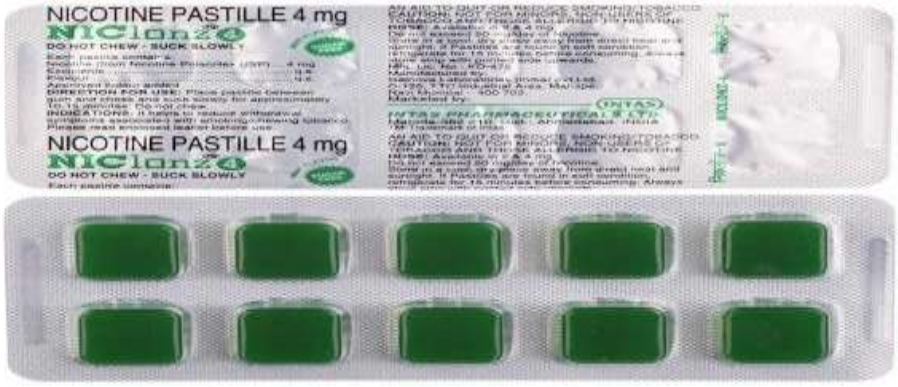
Pastilles 1500mg

Sr. no.	**Ingredients**	**Amount**
1.	Nicotine- Nicotine poliacrilex	5mg
2.	Gelatin	299mg
3.	Glycerin	971.7mg
4.	Water	170mg
5.	Lecithin	37.3mg
6.	Flavor	3.8mg
7.	Sucralose	1.4mg
8.	Colour	4mg
9.	Methyl paraben	2.4mg
10.	Propyl paraben	1.2mg

➢ USE OF SOFT PASTILLES

- Nicotine pastilles are used to help peoples stop smoking. Nicotine pastilles are in a class of medication called smoking cessation. They work by providing nicotine to your body to decrease the withdrawal symptoms experienced when smoking is stopped and to reduce the urge to smoke.
- Nicotine is treating Parkinson's disease

- Alzheimer's



EVALUATION OF PASTILLATION[1]

1: Selection of excipient

The excipients were selected based on the type of dosage form to be developed for immediate release formulation.

- ❖ PEG was selected as the matrix former due to its water soluble nature, for controlled release formulation. It has been used as performer and drug release rate modifier for the controlled release batches.
- ❖ Stearic acid was a solid – lipid was selected as the matrix base due to its hydrophobic nature.
- ❖ Colloidal silicon dioxide was employed in some batches to improve the viscosity of the melt.

2: Effect of operating variables on contact angle

Contact angle of pastilles is a measure to evaluate the spreading of a drop of melt on the plate surface before it gets solidified. The effect of various operating variables like needle size, height of needle from plate and temperature of the plate on the contact angle was studied.

2.1 : Needle size:

Reduction of size beyond above range would result in difficulty in passage of melt from theneedle and increase from this range can form Pastilles with bigger size which cannot be filled in capsule.

2.2 Dropping height

The height of needle was reduce the extent of spreading of the drop which immediately solidified by transfer of its heat to the cold plate. The dropping height of < 1.5 cm would be ideal for fabrication of pastilles with higher contact angles, further decrease or increase in dropping height may not be possible.

2.3 Temperature of plate

At low plate temperature, sudden cooling of the drop takes place that hinders its spreading on the plate and the pastilles is formed instantaneously with high contact angle. At higher

plate temperature, the drop takes time to cool and solidify that provides sufficient time to drop before its spreading is stopped by solidification. Maintenance of low temperature (4ºC) is essential for generating pastilles of high contact angle.

3: Drug content uniformity

The drug content uniformity values show that the drug is uniformly distributed in the matrix. In addition, it also indicates that the drug does not undergo any possible degradationdue to its exposure to high temperature during fabrication and is therefore, thermo stable.

4. Drug release study

The solubility studies for the drug carried out in our laboratory indicate the maintenance of sink condition of the selected dissolution medium. Two different types of matrix forming agents were used in the preparation of the pastilles. PEG based pastilles show the immediate drug release within 45 minutes due to its highly hydrophilic.

4.1 Effect of drug load

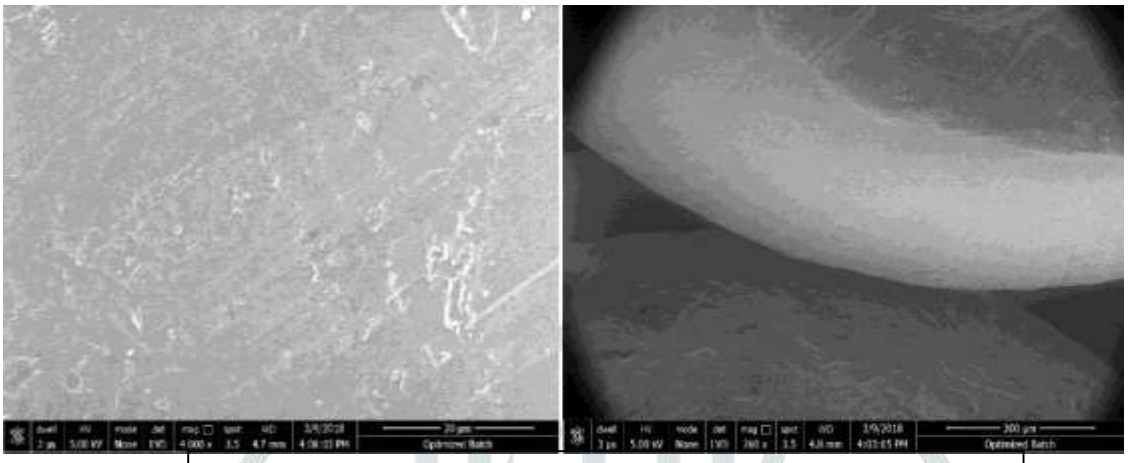
The drug release rate increase with increase in the drug load. As lipid/drug ratio, amount of lipid available to control the release of drug decrease, resulting in faster drug release from the matrix.

4.2 Types of lipid combination

Benefit is a mixture of triacylglycerol containing short chain (acetic, propionic, butyric acid) and long chain (stearic acid, canola, and soybean oil) fatty acid with stearic acid as the predominant long chain fatty acid. It is semi-solid at room temperature and melts to a clear liquid at body temperature. The drug release as expected due to the hydrophobicnature of benefit. At the same time, a reduction in

the pastilles strength was observed due tothe presence of excess amount of liquid lipid which interferes with their crystalline integrity.

5. Scanning electron microscopy



Smooth surface with hemispherical shape

STORAGE RECOMMENDATION [4]

These preparations should be stored away from heat and out of the reach of children. They should be protected from extreme of humidity. Depending on the storage requirement or refrigerated temperature is usually indicated.

SOCIAL AND INDUSTRIAL APPLICATION [1, 2, 4]

- Reduce process time, resource and money requirement.
- Increase industrial acceptability and scalability.
- The advantage of decreased cost may be passed on to the patients.
- Safe, efficacious and reduced doses frequency will gain patient compliance.

LIMITATION OFV THE PASTILLATION TECHNOLOGY[1]

This technology is particularly applicable to carries of low melting point which melt andare capable of re-solidification at room temperature i.e. lipids, waxes and macrogols. In addition, as the fabrication

process involves the use of temperature for melting the excipient, the drug being incorporated should not be degrade during processing, i.e. it must be thermo stable in the processing temperature range.

CONCLUSION

- Pastillation process is cheapest and its continuous manufacturing of solid dosageform without affecting quality of product.
- From the study it was concluded that prepared new dosage form and new releaseretardant were found to be cost effective.
- From the study it was concluded that as it gave continuous manufacturing so it hasindustrial applicability and scalability.

REFERENCES

1. Dali Shukla, Subhasis Chakraborty, Sanjay Singh, Powder technology, Pastillation: A novel technology for development of oral lipid based multiparticulate controlled release formulation, Research article, n may 2010
2. Pund sopan, Mahajan Nilesh,Gangane purushottam, Journal of Drug Delivery and Therapeutics, Enhancement of solubility of Declofenac Sodium by Pastillation method, Review Article, 05 Jun 2021
3. Thakkar, Jatin Vasant, Nicotine Containing soft gelatin pastilles, Patent , 25 August 2011
4. Renuka Pothu, Madhusudan rao Yamsani, International Journal of Advanced in Pharmaceutical Research,Lozenges formulation and evaluation, A review article, April 2014
5. Gabor Katona, Balazs szalontai, Maria budai-szucs, European Journal of Pharmaceutical Sciences, Formulation of Paracetamol containing pastilles with in situcoating technology, A research article, 12 February 2016
6. Suchitra Pundit, Abhay Maruri Lal Verma, Journal der Pharmazie Forchung, Review in Lozenges, Review Article, 01 October 2014
7. http://en.wikipedia.org/w/index.php?title=Pastille&oldid=1033744702
8. Prof. Dr.-Ing.habil. Joachim UIrich, prof. Dr. habil. Karsten Mader, Manufectured and Characteristics of Pastilles and their coating by crystallization process, Research, 15 December 2003
9. Frank Ridgway, Michael D. Ward, Antifungal pastilles formulation and method, Patent, 1f February 1998
10. http://kaiser-pbt.de/en/services/process-technologies/pastillation/
11. http://ipco.com/products/rotoform-granulation-systems/