Design & Fabrication of Tablet Defoiling Machine

Dr. RavindraNavthar[1] , Ganesh Khedkar[2], Amol Kharche[3], Rushikesh Nawale[4], Mohammad Subhan[5]
[1]Assistant Professor, Dept of Mechanical Engineering
[2, 3, 4, 5]Dept of Mechanical Engineering
[1, 2, 3, 4, 5] DVVP Engineering College, Ahmednagar, India

Abstract- *In medicine industries, variety of medicine are produced daily. Being related to health directly these medicine are to be packed very carefully and properly .Also storage of these medicines is done very carefully. Different packaging styles are adopted by various companies, most of the tablet are packed in blister package .provide very nice performance. but these tablet have the expiry period. If these are not consumed in specific period, these area to be exposed properly. The blister pack are not destroyed naturally; hence the separation of blister pack and the tablet is to be done.The manualseparation is time taking and consuming.*

Here we are developing a machine which will be very benefecing and efficient. The motorized machine with slotted pulley and v belt or DC motor rotation mechanism.

It consist of conveyor belt for carrying the tablet strip to be destroyed. after pass in over a pulley, the tablet and pack is dropped in a tray in separate manner.

I. INTRODUCTION

Different product having different size and shape, according to that the pack size of blister is varying. When the batch start it is necessary to check the set the packaging machine according to pack size. While setting this machine many strips are carried out as the rejected strips. Some strip are rejected while printing mistake and packaging mistake. So this strips are not through it must defoiled and come to back in line. For this defoiling purpose the manual defoiling is not a correct solution. So defoiling machine is used for defoiling the tablets and capsules from the blister.Blister packages for pharmaceuticals consist of two basic packaging. Component lidding materials and forming films. The lidding materials consist of a supporting materials, e.g. aluminum That has a heat seal lacquer on own sides to act as a sealing agent, and on the other side an assortment of other layers depending on the end requirements of the blister package (tamper-evident, child resistance, or simple unit does delivery).

The side coated with the sealing agent faces products and forming films. The forming film can be a monolayer sheet of PVC or a composite of other materials or coating to increase the water vapor barrier effect. The forming film of composite is the packaging component that receives the dosage form in deep-dram pockets. Plastic forming film such as PVC, polypropylene (PP)and polyester (PTE) can be Thermoformed, but other formable structure containing aluminum and cold light resistance is required, light-protective or opaque forming films can be employed.

Rigid PVC is currently the most widely used forming film because of its ideal thermoforming characteristics. A typical thickness before thermoforming is 250 micrometer (10mil).PVC does not provide a good barrier for moisture-sensitive product.

When better barrier properties are required in a thermoform able blister. PVC is laminated or coated with other materials. Because of environmental issues, other materials such as PP completely for blister usage with PVC. In the medical device industry it has been completely replaced by materials such as PET.

There has been a considerable effort to replace PVC with PP as a support material for blister packaging its moisture barrier properties are comparable to PVDC-coated PVC in some cases. However, the processing properties of PP pose a problem. The narrow temperature range required for thermoforming PP and the temperature of the subsequent cooling process must be precisely controlled. PP packages are not as rigid as those made from PVC and PVC composites is not as problematic.PET competes effectively with PVC medical packaging because of its strength and superior resistance to sterilizing effect. However, it is poor moisture – vapor barrier and its enhancement by PVDC are not viable because Of environmental concerns about plastics that contain chlorine. Replacing PVC with PP allows compliance with environmental standards in some pharmaceuticals markets. This material is cold from instead of being thermoformed. Such packages required more packaging materials than thermoplastic films for the packaging of the same number and same size of tablets or capsules. These coating must precisely match chemically the respective forming film (PVC, PP, or PET), a permanent sealing strength of the blister must fall within predetermined tolerances for the package to the functional.

Package access can be varied through selection of various lidding structure. The use of simple hard of soft tempered foils permits the classical push through feature of blister packages. When paper is laminated on t the aluminum, the product is accessed by peeling of the lidding materials. For child resistance, PTE is added to the paper-foil lamination.

Key Words: Polypropylene (PP), Polyester Thermoformed (PET), Polyvinyl Chloride (PVC), Polyvinylidine Chloride (PVDC).

II. LITERATURE SURVEY

Saurabh Sanapet..al (1) has claimed that different product having different size and shape , according to that the pack size of blister is varying . When the batch start it is necessary to check the set up the packing machine according to pack size. While setting this machine many strips are carried out as the rejected strips .Some strips are rejected while printing mistake and packing mistake . So this stripe are not through it must defoiled and come to back in line for this defoiling purpose the manual defoiling is blister.[01]

J.D.Chowguleet..al (2) has also claimed that it is observed that the cam shaft fails due fatigue loading into two pieces during operation visual examination of the fracture surface clearly shows cracks initiated from the roots of shaft state and the no. of cycle till failure is shown on the machine PLC screen. To find out the cause of failure, a finite element analysis is carried out .Result of stress analysis reveal that the highest stressed area coincides with the fracture regions of the failure of the shaft is due to weak section at the step provided for cam shaft mount .To enhance service durability of the transmission system of blister packing machine few suggestions are presented.[02]

Pratik Swarup Daset..al (3) has claimed packaging is designed to contain a product so that ot is unable to interact with the environment. Packaging must provide the protection, identification, information against the physical damage, loss of content or ingredients and intrusion of unwanted component of the environment such as water vapour, oxygen and light. An important role of pharmaceutical packaging is to transform the formulation into an attractive and marketable product. So many issues regarding the pharmaceutical product like stability, sale, patient compliances, etc are related with the packing and in regard to this; present review is done on the various advancement in the packaging techniques and selection of packaging materials, machinery and labeling. The present article review the various packaging material, types of packaging in pharmaceutical industries.[03]

DebjitBhowmiket..al (4) has also claimed that tablet is defined as solid pharmaceutical dosage form containing drug substance generally with suitable diluents and prepared by either compression or molding method. Tablet remain popular as a dosage form because of the advantages afforded,both to the manufacture(e.g.simplicity and economy of the preparation, stability,and convenience in packing ,shipping and dispensing) and the patient. Because of their composition method of manufacture or intended use, tablets present a variety of characteristics and consequently there are several categories of tablet.Tablet formulation and design may be describe as the process whereby the formulator ensure that the correct amount of the drug in the right form is delivered at or over the proper time at the proper rate in the desired location,while having its chemical integrity protected to that point. Latest concepts and regulation focus on bioavailability, bioequivalence andvalidation, etc. impact formulation designing and manufacture. [04]

III. CONSTRUCTION OF DEFOILING MACHINE

A blister defoiling machine consists of two roller shafts on which two sprockets are mounted at ends of both shafts. A single strand chain is used to transmit the power from driving shaft to driven shaft. A DC wiper motor which runs on DC current with 12volts is used as the prime mover. The pedestral bearings are used to support the shafts with the roller. A roller with the grooves made on it of thickness 11.5 mm are made on which the actual part of the aim carried out. The bearings are clamped with the nuts and bolts. The conveyor is mounted on two roller shafts. The defoiling machine can be consists of following components given below,

1. Pedestal bearing
2. Rubber roller
3. Wiper motor
4. Transformer
5. Sprocket
6. Groove shaft roller
7. Chain & Frame

Fig :- Component of defoiling machine

IV. WORKING OF DEFOILING

The blister defoiling machine works as follows:-

The AC power is supplied to the transformer of 12volt by which the ac current is converted into dc12 volt. this motion of the motor is transmitted to the driving roller shaft.Then the Power is transmitted to the driven member with the help of conveyor belt.When blister of tablets are placed on the conveyor, they are carried to groove pulley in which the pressure is applied form top shaft so that the capsules/tablets comes down and the blister thrown toward due to revolution of shaft and we get capsules/tablets at bottom sides in tray.

Fig .Tablet Remover Machine (Catia software used)

V. DESIGN OF COMPONENT OF TABLET DEFOILING MACHINE

5.1.DESIGN:-

Metallurgical specification the machine is basically made up of mild steel then reasons for mild steel is readily available in market, it is economical to use, it is available in standard sizes, it has good mechanical properties i.e. it is easily machinable,it has moderate factor of safety, because of safety result in unnecessary wastage of material and heavy selection, low factor safety result in unnecessary risks of failure.

5.2.MOTOR SELECTION

Thus selecting a motor of the following specifications

Single phase DC motor, Power = 1/15hp=50 watt,Speed= 80 rpm

Motor Torque

$$P = \frac{2\,\Pi\,N\,T}{60}$$

$$T = \frac{60 \times 50}{2\,\Pi \times 80}$$

T = 5.96 N-m.

Power is transmitted from the motor shaft to the input shaft by means of chain drive reduction ratio =1

5.3.GEOMETRY OF CHAIN

A. Pitch of Circle = 10.41mm
B. No. of teeth on sprocket (z) = 18
C. Motor speed (n) = 80r.p.m

1.Pitch of chain (p) = 10.41mm

2.Pitch angle (γ) :-

$$\gamma = \frac{360}{z} = \frac{360}{18} = 20^\circ$$

3.Pitch diameter of sprocket (D) :-

$$D = \frac{p}{\sin\left(\frac{360}{2*z}\right)} = \frac{10.41}{\sin\left(\frac{360}{2*18}\right)} = 60\text{mm}$$

4.Average velocity (v) :-

$$V = \frac{z*p*n}{60*1000} = \frac{18*10.41*80}{60*1000} = 0.2498\ \text{m/s}$$

5.Speed ratio (i) :-

$$i = \frac{z_2}{z_1} = \frac{n_1}{n_2} = \frac{80}{80} = \frac{18}{18} = 1$$

6.No. of links (M) :-

$$M = 2 * \left[\frac{c}{p}\right] + \left[\frac{z_2+z_1}{2}\right] + \left[\frac{z_2-z_1}{2*\pi}\right] * \frac{p}{c}$$

$$= 2 * \left[\frac{90}{10.41}\right] + \left[\frac{18+18}{2}\right] + \left[\frac{18-18}{2*\pi}\right] * \frac{10.41}{90}$$

$$= 35.29 = 36\text{mm}$$

7.Correctedcentre distance (C) :-

$$C = \frac{p}{4} * \left(M - \left[\frac{z_2+z_1}{2}\right]\right) + \sqrt{M - \left[\frac{z_2+z_1}{2}\right]^2 - 8\left[\frac{z_2-z_1}{2*\pi}\right]^2}$$

=

$$\frac{10.41}{4}*\left(36-\left[\frac{18+18}{2}\right]\right)+\sqrt{36-\left[\frac{18+18}{2}\right]^2-8\left[\frac{18-18}{2*\pi}\right]^2}$$

=70mm

8.Length of chain (L) :-

L = M * p= 36 * 10.41= 374mm

To find diameter of shaft by ASME code,**For commercial steel shaft, Actual shear stress**$\tau_{act = 55N/mm^2}$

T = Π/16 x τ_{act} xd^3

$\Rightarrow \tau_{act}=\frac{16xT}{\Pi x d^3}=5.96^3=\frac{16 \times 55}{\Pi \times d^3}=d^3=737.089$

d=9.033mm **select d=20mm**

VI. FABRICATIONPROCESSES

The fabrication is the process in which an item is made (fabricated) from raw material or semi-finished material instead of being assembled from ready component or part. There are different processes in the fabrication process such as cutting,folding,welding,machining,punching,shearing,stamping,casting and additional material fabrication process include broaching ,grinding and milling. Depending on the need of particular application , some metal facilitate even perform especially customized type of fabrication.

6.1FABRICATION OF FRAME

Square pipe of cast iron chosen as a raw material has been cut down with dimensions of width=400mm, height=750mm and length=1000mm.Then after to make it burr free grinding operation is carried out on it's edges. Further the parts of the frame are carried for drilling which avails the other parts to be get rigidly bolted on the frame. Then after the parts are arranged for arc welding process by which the frame gets completed.

6.2.FABRICATION OF ROLLAR

The roller is made up of aluminum by which the weight is minimized. The roller is turned and shaped on the lathe machine reduced the diameter to 128mm and the shaft of 20mm dia. Also the grooves of 11.5mm are made which are important part of our aim.

6.3.FABRICATION OF SPROCKETS

The sprockets Tare spot welded at the inner races so as to avoid the movement or rolling action of the inner races during the operation.

6.4.FABRICATION OF WHOLE MACHINE

After the above basic operations the parts such as bearings, rollers, wiper motor, conveyor belts, chain and the sprockets are mounted and the other parts are clamped using bolts according their respective functions. In this way the fabrication process has been carried out.

VII. EXPECTED OUTCOMES

In this project our aim to strips are rejected while printing mistake or packing mistake are defoiled and come to back in line for further used.

Minimize the manual effort because of the defoiling processes is automatically strips are defoiled

These machine work are effectively and low cost and minimum required time for defoiled the strips

REFERENCES

[1] Saurabh Sanap , SagarSanap ,Vishal Sanap ,Padol Satish –Design and manufacturing of Defoiling Machine, International journal of advance research in engineering, science & technology , e-ISSN :2393-9877,p-ISSN:2394-12444, volume 4,Issue 2, February-2017.

[2] J.D.CHOUGULE, R.G.TODKAR-Failure analysis of blister packaging machine cam shaft.(IOSR Journal of mechanical and civil engineering (IOSR-JMCE) ,ISSN-e :2278-1684, ISSN-p :2320-334X,PP:07-14) .

[3] Pratik SwarupDas,PoojaSaha,Rumpa Das-Pharamaceutical packaging technology:A brief outline,world journal of advance healthcare research,ISSN:2457-0400,volume to ,issue 1,year 2018

[4] DebjitBhowmik,S.Duraivel, Rajalakshmi.A.N and K.P.Sampathkumar-tablet manufacturing process and defect of tablet,ELIXIR PHARMACY-70(2014)

[5] V.B.Bhandari/"design of machine elements",TATA McGraw hill pub co.ltd,edition oct.2008

[6] www.pharamanet.com