

Parameters Affecting Heat Sealing in Wet Tissue Packaging

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Abstract- Today, packaging has become the important factor for marketing and good economical benefits. Packaging is as important as designing for proper utilization of product especially in case of wet tissue. As wet tissue needs to be properly wet before utilization, it is important to seal the pouch properly and avoid contact with atmospheric air. In this paper we have discussed some parameters that affect sealing in wet tissue packaging.

Keywords- Wet tissue packaging, Pressure Dwell Time, Temperature.

I. INTRODUCTION

Sealing is very important thing in packaging of product. We can find various types of sealing like in earlier days sealing used to be done manually by using candle as source of heat. Now a days we find different sealers like hot bar sealer, impulse sealers, and hot wire sealers for more efficient packaging and also it increases packaging speed. Hot bar sealer (also known as Direct Contact Thermal Sealing) has heated tool kept at a constant temperature. They use one or more heated bars, irons, or different dies which comes in contact with material to heat the interface and form a bond. Impulse sealer has heating elements as Nichrome placed between synthetic rubber and surface of film or fabric. The heating elements are heated only when material is in contact thus heat is generated by passing current flow. When the materials are placed in the heat sealer, external pressure needs to be applied. Electric current heats the heating element for a specified time also called as dwell time and creates the required temperature.

Hot wire sealing involves a heated wire which cuts the surface and also joins them with a molten edge bead. This is not usually used when sealing properties are critical. These sealing types have some common parameters which must be studied for good quality sealing of products some of them are explained in this paper.

We see that pressure, temperature, dwell time means time for which heat is provided come into consideration for quality sealing. For packaging of wet tissue the other important factor comes into consideration is the heat required to vaporize the liquid alcohol which may come in contact

where sealing takes place thus the heat needed to seal the packet is increased slightly and may affect the sealing if adequate heat is not supplied.

II. LITERATURE REVIEW

Ruben J. Hernandez explains different types of sealing methods which can be used for polyethylene sealing such as hot bar sealing, impulse sealing, and solvent sealing [4].

Hurnanen explains the types of heat sealing used for packing with various parameters affecting sealing such as sealing time, pressure, temperature angle of contact [1]. Some part of peeling of packet is also covered in paper. Different sealing parameters (time, temperature and pressure) affects the seal strength and this has been given some consideration in theory part as well. Adhesion theories have been introduced and that gives information about laminate adhesion.

Zahra Najarzadeh explains different angles at which sealing can be done their strength and peeling effect. It also gives information on pressure and temperature which affects sealing strength [2].

Takashi Inomata in her paper tells about statistical processes to maintain product quality based on the sensor technology such as small thermometers and displacement sensors, which can give us information on production parameters. In this paper, heat-seal time parameter is considered as one of the most important characteristics. As heat-seal time cannot be found directly, they measured other variables that may be used to estimate heat-seal time [3]. They measured the displacements of seal-bars and constructed the statistical model for estimating heat seal time from that displacement data.

III. PARAMETERS AFFECTING HEAT SEALING

A. Sealing Time

Seal time is the period of time that the two films are brought into intimate contact by the heated bars. The heated bars are in direct contact with films so heat could be transferred to the surface. More is the heat flow rate, less is the dwell time required. Thus, the heat flow rate affects the dwell time of the process. Generally, the seal time in modern flexible packaging industry is few milliseconds, or in some cases 1-2 seconds. The optimum seal time ensures no excessive time is wasted, to achieve required production speed.

Table 1. Temperature Sealing Time and Pressure Required

Temperature (° C)	Sealing Time(sec)	Pressure applied(MPa)
130	1	0.5
160	1.5	0.5
160	0.5	0.5
180	3	0.7

B. Temperature

Sealing time and temperature for sealing are interrelated if the seal time is more less temperature difference is sufficient for adequate heat flow. Above graph explains the seal time and temperature required for quality sealing. Higher is the production rate more is the temperature of sealing surface. Sealing requires the polythene to be melted to some extent for fusing both sides of packet.

Effect of sealing time

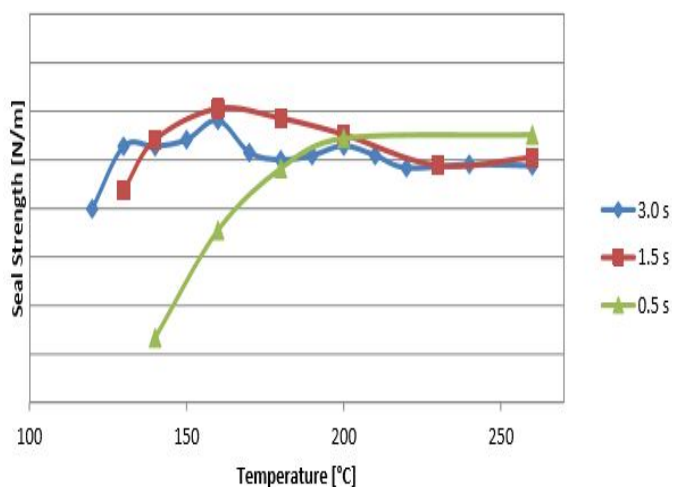


Fig 1. Effect of sealing time on temperature

In above graph we can see different temperatures and seal time which affects the sealing strength. It is seen that seal time of 1.5 sec and temperature around 160 ° C is desirable for high strength. According to product and production rate it can be varied from 120 ° C to 200 ° C the idea behind graph is by hurnanen [1].

C. Pressure

Pressure is required for proper contacting the film surfaces and for interfacial penetration. Excessive pressure, may result in the squeezing the molten film from the seal area. In most sealing pressure is less important than either temperature or dwell time. However in industrial production lines, higher pressure may be required if the pressure control is not precise, the film thickness is non-uniform, if the heated bars are poorly aligned.

D. Sealing Angle

In bar sealing, the design of jaw surface also affects the seal strength. Even if the simple and ideal seal jaw might be flat, in practical there is a risk of damage in sealing area if there are folds or tucks in the films. In some applications, the flat type seal bar can be used, but other different types are also common. If the jaws are Patterned, serrated, crimp or embossed then it gives the seals extra strength. In the case of non-uniform film thickness, flat bars cause weaker seal. Also serrated jaws can improve seal appearance from aesthetic point. They generally ensure that the two films are adequately stretched to have intimate contact. Figure below illustrates the vertical and horizontal serrations in the jaw surface. The flat form of jaw was used for simplicity and it can prevent the complications in seal cross section and seal surface in jaw pattern.

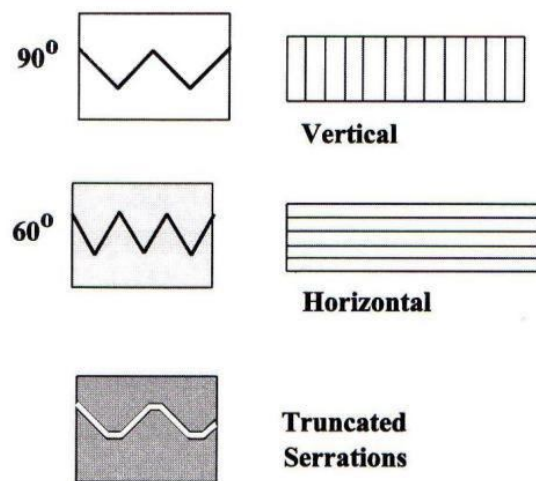


Fig 2. Different Textures in Sealing

E. Liquid coming in contact with sealing area

Liquid which gets adhered during insertion of wet tissue in the area where sealing takes place should be considered for calculating heat required to seal the packet. As it takes the latent heat and vaporizes; heat required for sealing gets increased.

F. Use of Teflon

To prevent sticking, the molten seal material between the jaws, seal bars are coated by a layer of poly tetrafluoroethylene (Teflon®) or other types of non-stick coatings. It thus prevents damage of the seal and jaws. This it can be important factor in heat sealing process.

IV.CONCLUSION

It can be seen that parameters varies according to the production rate. Higher the production rate higher is the temperature required to seal as heat transfer needs to be at faster rate and thus dwell time would be less. For dwell time of 1.5 sec it is desirable to have 120o C surface temperature of polythene Pressure may not be more important parameter 0.5 to 0.7 Mpa pressure would be sufficient for efficient packaging. Sealing angle are set according to material to be packed if its heavy material then angle should be 60o otherwise 90o is desirable for fast production rate. Teflon should be used at the contact of sealing plate and polythene to avoid stickiness of paper to plate.

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