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COMPARATIVE ANALYSIS BETWEEN DIFFERENT PROPERTIES OF VARIOUS MATERIALS USED IN CONVENTIONAL AND BLISTER PACKAGING

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ABSTRACT

In this modern era both conventional and blister paperboardare in vogue for blister packaging as each one haveits own pros and cons. Heat sealing process is used commonly for blister as well as sometimes for conventional paperboard. Stability of blister packaging depends on the final selection of material and efficiently carrying out the sealing process. Hence a comparison was drawnbetween various properties of different materials used in conventional andblister packaging. This analysis elucidates the comparison in the behavior of both paperboards i.e. conventional and blister paperboard when variation occurred in sealing parameters during the heat sealing process.

Keywords: - *Conventional board, Blister packaging, heat sealing process, sealing parameters.*

I. INTRODUCTION

Blister packaging is used for physical and barrier protection of the packed product. The packed product must require protection from mishandling, shock, water vapour, dust and variation in temperature during transportation. Stability and strength of the blister package depend upon the various factors which include types of board, forming film, inkand adhesive coating. Blister packaging is carried out by heat sealing process. Heat sealing is a method used for bonding by the application of heat and pressure.

Both conventional and blister paperboard are used for packaging applications. The difference between the blister and conventional paperboard used in packaging applications is that two layers of coating (10GSM+9GSM) are applied to make a smooth and glossy surface of the board for normal board,but only a single coat of 10GSM is applied on the paperboard in case of blister board which provides a rough surface as compared to a conventional board. In blister packaging, mostly recycled paperboard is used for packaging purpose because recycled paperboard has loosely fibers bonding as compared to conventional paperboard.

Paper properties: Various types of paper properties that are taken into consideration while selecting during blister packaging are enlisted as below:-

1. **Thickness:** Thickness of paper or board is generally measured in microns or micrometres. In blister packaging applications more thick paper is required as compared to conventional packaging applications because blister sealing requires deep cavities on lidding materials surface to penetrate the liquid adhesive coating properly.
2. **Grammage:** It is measured in grams per square meter (g/m^2) of the paper or board. Grammage and thickness both are the different properties it is not always necessary that a more thick substrate has more gsm as compared to a low thick substrate, its depends upon the bonding strength offibres. In most applications of blister packaging, a low gsm paperboard is used with more thickness as compared to conventional packaging applications which required a good bonding strength paperboard.
3. **Paper Surface Characteristics:**It includes surface gloss, smoothness and finish as essential characteristics. The blister paperboard surface finish should be free from gloss coating. The smoothness of the lidding board describes the irregularities on the lidding surfaceunder visual conditions of the board.While gloss and

finish are the general properties of the board. So blister board should contain enough rough surface which helps to adhere heat seal coating on the upper surface a single layer of upper clay coat is applied on the blister lidding board which provide it moderate surface for printing with a good finish.

4. **Heat Sealing Properties:**In blister packaging process heat sealing is a method of bonding between polymer to polymer and polymer to the paper substrate by applying heat and pressure from different sources. Sealing temperature, pressure and dwell time are the crucial factors that determine the quality and efficiency of any heat sealing process.

Objectives of Study

The research was carried out to accomplish the following objectives during the heat sealing process: -

i. Comparative analysisof Heat sealing properties of Conventional and Blister Paperboard
ii. Comparison between Conventional and Blister Coating
iii. Comparison between Inks used for Conventional and Blister paperboard

II. RESEARCH METHODOLOGY

The research work was carried out at Edelmann Packaging India Pvt. Ltd., carton packaging industry situated at Himachal Pradesh (Baddi) in order to analyze and compare the different properties of materials i.e. paperboard, ink and coating used in conventional and blister packaging. During the research, a study was done on heat sealing properties of conventional and blister packaging board. Thedata was collected and analyzed.

III. DATA ANALYSIS

The data was collected in order to analyze for the aforesaid objectives during research. The findings of the research are as below:-

1. **Comparative analysis of Heat sealing properties of Conventional and Blister Paperboard:-** Generally sealing temperature, pressure and dwell time are the crucial factors that decide the efficiency of any heat sealing process.The sealing temperature causes bond formation between lidding base material and forming film after activating the sealant. Acommon range of sealing temperature is 130°C to 160°C.The sealing pressure ensures that both the film surface and lidding material are in contact for interfacial penetration. The time when lidding base material and forming films are brought in contact by heating bars is known as Dwell time.The effect of these variables on Conventional and Blister Paperboard is shown as below: -

   a. **Effect of Temperature on Conventional Gray back Paperboard (CGB) and Blister Gray back Paperboard (GB) during Heat Sealing Process: -**Inorder to study the effect of temperature on Conventional Gray back (CGB) and Blister Gray back Paperboard (GB), values of two parameters i.e. sealing pressure (7dB) and dwell time (3seconds) were kept constant during heat sealing process while temperature was gradually increased from 130°C to 160°C with a difference of 5°C. So obtained results are explicated in Table 1.

Table 1: Effect of Temperature on Conventional Gray back Paperboard (CGB) and Blister Gray back Paperboard (GB)

Types of Board	Temperature (°C)	Pressure (Decibels)	Conventional Paperboard		Blister Paperboard	
			Dwell Time (Seconds)	Sealing Result (Fail/Pass)	Dwell Time (Seconds)	Sealing Result (Fail/Pass)
Conventional Gray back Paperboard (CGB) and Blister Gray back	130	7	3	F	3	F
	135	7	3	F	3	F
	140	7	3	F	3	P
	145	7	3	F	3	P
	150	7	3	F	3	P
	155	7	3	F	3	F
	160	7	3	F	3	F

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	165	*7*	*3*	*F*	*3*	*F*

In the case of double coated conventional Grayback Paperboard (CGB) sealing couldn't be achieved at any temperature range from initial value 130°C to last value 160°C. In contrast to it, good sealing strength was obtained at temperature 140°C in case of blister Grayback Paperboard (GB) as shown in table 1.

b. Effect of sealing temperature on Conventional White back Paperboard (CWB) and Blister White back Paperboard (WB) during Heat Sealing Process: -It is the most widely used paperboard in blister applications which provides loosely fibers bonding. Similar to previous case, values of two parameters were kept constant i.e. sealing pressure (7dB) and dwell time (3seconds) during heat sealing process to study the effect of temperature on conventional white back paperboard (CWB) and Blister white back Paperboard (WB) while temperature was gradually increased from 130°C to 160°C with a difference of 5°C.The results indicated that the sealing was successful in the temperature range of 145°C to 155°C for blister white back paperboard (WB) while sealing result was fail for conventional white back paperboardas shown in table 2.

Table2: Effect of sealing temperature on Conventional White back Paperboard (CWB) and Blister White back Paperboard (WB)

Types of Board	*Temperature (°C)*	*Pressure (Decibels)*	*Conventional Paperboard*		*Blister Paperboard*	
			Dwell Time (Seconds)	*Sealing Result (Fail/Pass)*	*Dwell Time (Seconds)*	*Sealing Result (Fail/Pass)*
Conventional White back Paperboard (CWB) and Blister White back Paperboard (WB)	*130*	*7*	*3*	*F*	*3*	*F*
	135	*7*	*3*	*F*	*3*	*F*
	140	*7*	*3*	*F*	*3*	*F*
	145	*7*	*3*	*F*	*3*	*P*
	150	*7*	*3*	*F*	*3*	*P*
	155	*7*	*3*	*F*	*3*	*P*
	160	*7*	*3*	*F*	*3*	*F*
	165	*7*	*3*	*F*	*3*	*F*

c. Effect of Dwell time and temperature on Conventional Gray back Paperboard (CGB) during Heat Sealing Process: -During the study it was foundthat when the values of two parameters sealing temperature and sealing dwell time were changed simultaneously while sealing pressure was kept constant then sealing result were achieved at different stages as indicated in Table 3.

Table3: Effect of temperature and dwell time on Conventional White back Paperboard (CWB)

Types of Board	*Temperature (°C)*	*Pressure (Decibels)*	*Dwell Time (Seconds)*	*Sealing Result (Fail/Pass)*
Conventional Grayback Paperboard (CGB)	*130*	*7*	*6*	*F*
	135	*7*	*6*	*P*
	140	*7*	*5*	*P*
	145	*7*	*5*	*P*
	150	*7*	*4*	*P*
	155	*7*	*4*	*P*
	160	*7*	*3*	*F*

2. Conventional and Blister Coating: - In normal printing applications basically aqua and UV coating is used to create glossy and texture effects on the surface after printing but in blister applications heat seal

adhesive coating is used to provide a bonding between the lidding base material and the blister forming film, after the printing of lidding substrate a thin layer of approximately 3-4 gsm heat seal coating is applied on the lidding base material which provides a bonding with blister cavities when heat and pressure are applied during the heat sealing process. Basically, two type of heat sealing coating is used in blister sealing application.

a. **Solvent Based Heat Seal Coating:-**The solvent-based coating is used in such applications where high bonding strength is required. In solvent based coating liquefying agents evaporate by a chemical reaction with oxygen, it provides a fast bonding as compared to water based coating because there is no big issue to change in environmental conditions or humidity level etc.
b. **Water Based Heat Seal Coating: -**The water based coating has no or fewer solvents, sometimes co-solvents are used in the water based coating which helps to evaporate the water as it dries, it reduces the chances of inflammable and others hazardous for workers.

3. **Conventional and Blister Inks: -** Blister inks have little different properties than the conventional ink. It doesn't contain any pigments and vehicles in excessive amount like greases, lubricants, and hydrocarbons etc. which present generally in conventional printing inks. These properties of blister inks help to reduce chances of blocking, rubbing and tackiness problems at high temperature and pressure during heat sealing process of blister packaging. Blister inks can be printed by the use of any printing process like letterpress, offset, gravure flexography and digital etc. In blister packaging mostly wax free ink is used for printing on lidding materials on single and both sides, blister inks have good thermal stability and can bear high pressure during the sealing process.

IV. RESULTS AND CONCLUSION

During the research, it was found that the various materials like ink, paperboard, the coatingused in blister packaging applications have different properties in contrast to conventional packaging. Generally,wax free ink is used for printing which helps to reduce the chances of tackiness and rubbing problemin blister packaging applications. During the study, it was found that the board used in blister packaging has rough and more water absorbent surface than conventional packaging board. The coating used for blister and conventional board both have totally different properties because in conventional applications UV and aqua coat is used to create texture and glossy effects on surface but in case of blister board a heat sealing solvent and water based adhesive coating is applied on the surface to provide a bonding between lidding and base materials.

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