

# **Factors affecting on the integrity and sealing of flexible packaging**

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## **Introduction**

In biscuit manufacturing, quality assurance plays a significant role in order to deliver a product that will attract the customers and profit gaining of the industry is closely related with the quality of packaging operations (Manly, 2002). There are various types of packaging materials that is being used for biscuit packaging but at present, flexible packaging materials are used prominently because of its good barrier properties, space saving, ease of operation and disposability etc. End product package integrity is important when assuring quality of the product throughout the shelf life (Robertson, 2012). At packaging, sealing defects may result damaged end products which will eventually absorb moisture and the biscuits may become stale and deteriorated along with shelf life. To prevent that, suitable machine settings of the packaging machine should be maintained and monitored. Objectives of this study are to find the best suitable machine setting range for two types of wrappers, metalized wrapper and laminated wrapper and to find the effect of Accelerated life testing on the package integrity, moisture absorbance and rancidity.

## **Methodology**

In this study, the integrity of end products belonged to two different types of flexible packaging materials (metalized and laminated wrapper), which was produced to different sets of temperature settings were monitored. From the selected wrappers, material combination of metalized wrapper (trade name Metalized BOPP/ CPP film) is 20 BOPP/ 25 MCPP and laminated wrapper (trade name BOPP/ CPP) consist 30 BOPP/ 25 CPP. Selected metalized wrapper is being using for Soft dough type 1(round) 75g product and laminated wrapper is being using for Soft dough type 2(rectangular) 100g product. The integrity of biscuit package is measured by subjecting the samples in to Leak tester. The sample packet was submerged in the water chamber of the leak tester and gradually the vacuum of the head space of the water chamber was created and was increased which resulted the expansion of the packet. The value of the vacuum pressure at which the package integrity gets terminated (either by bubble emission from the weakest point of seal or bursting of the package) was taken as the response measurement. Preliminary data base was created for five weeks by testing sixty biscuit packets of metalized and laminated wrapper each from morning and evening shift for its integrity by subjecting those to leak tester. The treatment was taken as the machine setting values (sealing temperature values) at which the biscuit packages were produced(RL1= roller 1, RL2= roller 2, UJ= upper jaw, LJ= lower jaw). The response variable was the vacuum pressure value at which the package integrity was terminated when subjected to leak tester. Those best treatments from each metalized wrapper and laminated wrappers were then subjected to accelerated life testing (ALT) by incubating under 45°C for eight weeks. Weekly the biscuit packet samples from each wrapper were tested for its integrity, moisture content, pH and rancidity.

## Results and Discussion

Table 01: Preliminary analysis results for metalized wrapper

Date	Shift	Treatments	RL1 (°C)	RL2 (°C)	U J (°C)	L J (°C)	Mean (kPa)	p value	Significance
4.6.14	1st	MS1	186	192	164	161	39.34	0.996	Not significant
		MS2	182	192	162	160	39.69		
		MS3	183	192	164	161	39.31		
	2nd	MS1	184	192	164	161	39.46	0.039	Significant MS2-MS1
		MS2	189	197	164	163	50.14		
		MS3	191	198	164	163	47.43		

There was significant effect from treatment in the second shift as the p value is 0.039 and difference between the treatments MS2 and MS1 in the second shift was significant.

Table 02: Preliminary analysis results for laminated wrapper

Date	Shift	Treatments	RL1 (°C)	RL2 (°C)	U J (°C)	L J (°C)	Mean (kPa)	p value	Significance
14.7.2014	1st	MS1	191	194	148	152	23.76	0.161	Not significant
		MS2	195	199	160	162	31.42		
		MS3	194	199	159	162	32.15		
		MS4	193	199	160	161	23.23		
15.7.2014	1st	MS1	192	196	160	163	37.48	0.719	Not significant
		MS2	192	196	162	163	37.74		
		MS3	193	196	164	162	40.97		

As obtained p values for the treatments, 0.161 and 1.719 there were no significant effect from the treatments. To prepare samples for accelerated life testing, MS3 treatment value in first shift of 15.7.2014 was taken as best treatment because it had the highest mean of response variable (RL1= 193°C, RL2= 196°C, UJ= 164°C, LJ= 162°C).

When the biscuit samples with metalized wrapper were subjected to accelerated life testing, for the best machine setting it showed low moisture absorbance and vacuum pressure values at the termination of package integrity were above 40 kPa. Mean vacuum pressure values increased from 43.64 kPa to 48.91 kPa up to fifth week and it was gradually decreased to 36.16 kPa on last and eighth week of accelerated life testing. Moisture absorbance was low up to sixth week from 2.66% to 2.91% then it was increased to 3.48% at the end of eighth week. pH variations of the sample were low which was between 7.07 and 7.55 for the tested eight weeks and it showed negative results when tested for rancidity.

There was no treatment effect from the laminated wrapper and samples for accelerated life testing were produced according to the machine setting which gave the highest mean vacuum pressure value when checked for the package integrity. In accelerated life testing, mean vacuum pressure values showed minimum variation unlike the data obtained for metalized wrapper and the mean vacuum pressure values were within the range of 40.57 – 41.54 kPa. Moisture content gradually increased from 2.36% to 2.69% but pH values decreased from 7.84 to 6.68. There was slight indication of rancidity on the last week of testing

### **Conclusions**

Best machine setting for metalized wrapper was MS2 with temperature values in °C, RL1= 189, RL2= 197, UJ= 164, LJ= 163 and best machine setting for laminated wrapper was RL1= 193°C, RL2= 196°C, UJ= 164°C and LJ= 162°C.

Weakest sealing point for metalized wrapper was middle of center seal and for laminated wrapper it was the serrated edge of cutter seal.

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