

Tore B.Tjaberg and Anton Skulberg

In recent years clipped plastic casings have been introduced for marketing of different foods, particularly meat and fish products. To some extent this packaging method has also been applied for liquid products like soups. The products in question have in most cases been distributed in a refrigerated or frozen state. Lately, however, there seem to be a certain interest of applying this packaging method for sterilized food products. If this system is introduced a complete sealing of the casings is imperative in order to ensure a sufficient keeping quality during distribution without refrigeration.

Materials and Methods

Three different types of plastic casings, Supralon, Krehalon and Nylon 12, all extensively used on the Norwegian market were used. These casings may be autoclaved, and their main properties are given in table 1.

Table 1. Main properties of three types of plastic casings

Type	Thickness mm	Oxygen permeability ml/m ² - 24 hrs	Heat resistance °C
Supralon	0.04	12 - 15	110 (for 1 hr)
Krehalon	0.05	ca. 20	110 (soft point 145)
Nylon 12	0.05	ca. 60	130

The oxygen permeability was measured by means of a "Lussy"

test apparatus. The heat resistance figures were given by the producers of the casings.

The circumference of the Supralon and Krehalon casings was 10 cm (diameter approximately 3.2 cm) and corresponding figures for the nylon type were 12 cm and 3.8 cm.

Two types of clipping machines were included in the experiments, Tipper Clipper and Poly-Clip. The profiles of the clips after sealing are shown in fig. 1.

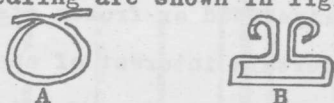


Fig. 1. Profiles of Tipper Clipper (A) and Poly-Clip (B) after sealing

The sealing pressure can be adjusted, and during these experiments maximal pressure was applied (i.e. maximal pressure which did not cut the casings).

The aspects of these experiments were to elucidate the tightness of the clipped casings by exposing them to different forms of bacterial invasion. The casings were filled with two different types of media, nutrient broth and semi-solid nutrient agar (0.4% agar content). The casings were filled by clipping one end of the casings, pouring medium into the casing and afterwards sealing in the clipping machine. Series of 5 sausages in each group were made.

Two forms of exposures to bacterial invasion were employed. In the first experiment the sausages were exposed by immersing them for 10 min. into a 48 hrs old culture of Serratia marscesens. The sausages were afterwards incubated at 30°C for 8 days. In the other experiment the sausages were immersed into a 48 hrs old culture of the same organisms and left there for 21 days at 23°C.

The reason for applying Serratia marscesens was that this organism is forming a red pigment at the temperatures used in these experiments. In this way an eventual invasion of the organism into the medium enclosed in the casings could easily be detected.

In order to test the tightness and other properties of the casings during heat sterilization (autoclaving) the casings were filled with coloured water and clipped with two clips leaving empty a certain area between the clips. Care was taken to remove all the coloured water from the areas between the sausages. The whole chain of sausages with empty intermittent areas was autoclaved at 110°C for 10 min. The pressure in the autoclave was varied with a maximal pressure of 1.5 kp per square cm.

Results

The results from the experiments are given in tables 2 and 3. In the tables "Leakage" means that liquid had leaked out through the ends sealed with clips. "Bacterial growth" means that growth of bacteria could be registered in the content of the casings.

Table 2. Results from experiments in which the casings were immersed in a culture of Serratia marscesens for 10 min. and afterwards incubated at 30°C for 8 days

Type of casing	Medium in the casing	Tipper Clipper		Poly-Clip	
		Leakage	Bact.growth	Leakage	Bact.growth
Krehalon	Broth	4/5	4/5	5/5	5/5
Krehalon	Agar	0/5	0/5	0/5	0/5
Supralon	Broth	3/5	5/5	2/5	3/5
Supralon	Agar	0/5	1/5	0/5	0/5
Nylon 12	Broth	5/5	5/5	5/5	5/5
Nylon 12	Agar	0/5	1/5	0/5	0/5

Table 3. Results from experiments in which the casings were immersed in a culture of *Serratia marcescens* for 3 weeks at 23°C

Type of casing	Medium in the casing	Tipper Clipper		Poly-Clip	
		Leakage	Bact.growth	Leakage	Bact.growth
Krehalon	Broth	2/5	3/5	2/5	4/5
Krehalon	Agar	0/5	1/5	0/5	0/5
Supralon	Broth	2/5	4/5	3/5	3/5
Supralon	Agar	0/5	0/5	0/5	0/5

Nylon 12 casings were not included in this experiments because disruptions occurred when hot medium was poured into the casings. The reason for this phenomenon can not yet be explained.

When the clipped casings were autoclaved with coloured water the penetration of water through the clipped seals were more pronounced than when the sausages were stored at room temperature only.

Supralon and Krehalon casings shrunk when filled with medium at 70°C and when autoclaved. This was not the case with nylon. Some of the clips had a tendency to slip from the ends when the filled casings were autoclaved.

Discussion

Most casings filled with broth started to leak immediately after clipping. It may be seen from the tables that microbial growth occurred in most of these casings. The results were similar for both clipping methods and all types of casings. These results

indicate that this packaging method is not suitable for sterile liquid products, in spite of the fact that it has been recommended by the producers of this packaging material. During the experiments it was tried to seal the ends with heat after clipping. This was, however, unsuccessful because the material crumbled.

The viscous consistency of the semi-solid agar gave much better results when the casings were filled with this medium. Leakage was very seldom a problem and bacterial growth occurred only in 3 out of 50 samples. There may be two main reasons for this fact. When viscous material is filled into the casings a better tension of the casing is obtained, and this might give a tighter seal after clipping. Moreover a viscous or solid material may give a certain barrier against intrusion of microorganisms.

The material in the 3 types of casings withstood autoclaving quite well. Autoclaving caused, however, leakage more frequently than when the samples were kept at room temperature only. In both cases there occurred some leakage from all types of casings included in the experiments.

Conclusion

3 types of casings (Krehalon, Supralon and Nylon 12) were sealed by means of clipping in Tipper Clipper and Poly-Clip and tested for tightness. Complete tightness was not obtained in any of the casings. After immersion in a culture of Serratia marsce-
sens intrusion of bacteria occurred in a few samples (3 out of 50) when the content in the casings had a viscous consistency. When liquid medium was filled into the casing bacterial invasion occurred regularly.

On the basis of these results application of this method is not recommended for sterilized products. This packaging method therefore seems most suitable for frozen or refrigerated products.