ASPECTS REGARDING HYGIENE AND TECHNOLOGY IN WRAPPING BEEF HINDQUARTERS IN PVC-FILM.

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Introduction.

The weight loss during conditioning and chilling, storage and distribution of whole carcasses should be kept as low as possible. By wrapping in the same type of packaging film which is commonly used for packing small portion cuts, it is possible to keep the total weight loss of carcasses and larger cuts relatively small. At the same time the wrapping also offers sanitary protection from contamination.

The literature tells little about the hygienic aspects concerning wrapping of whole carcasses and quarters in relatively permeable packaging materials. On the other hand, from the producers of packaging film, booklets are available which tell about the great advantages of such packaging for preventing weight loss and discoloration.

Before we started our tests we thought that wrapping of whole carcasses would increase to a great extent the bacteriological problems due to the increased relative humidity in the air under the film, near the surface of the carcasses.

These bacteriological problems turned out to be of less importance than expected.

Materials and methods.

Different packaging tests were carried out with the PVC packaging film CW-65 from Borden Chemical . This film has a relatively high oxygen permeability:3300 cc and is relatively water vapor proof. The water vapor transmission rate for this film is stated to be: 26.1 g/100 in 2 /24 h. 100°F, 90% R.H. The thickness is 0.0008 inches and ultimate elongation 250 - 350 %.
The CW-65 film need not to be heatsealed. Due to its built-in cling properties it gives a good protection when properly used by trained wrappers. Broad film rolls are put vertically into a dispenser device which is equipped with a hot cut-off wire.

Hindquarters and whole carcasses of Norwegian cattle were wrapped 24 hours after slaughtering and stored for 1 - 2 weeks in refrigerated rooms.
(Please see graphs at the back of this report.)
The bacteriological counts on the surface of the carcasses were investigated as well as the weight loss in the same period of time.
In this paper the results from three of our tests carried out with the CW-65 packaging film are reported.
One test was carried out in a storage room with 93% relative humidity, and another test was run in a storage room with a relative humidity of 83%. The temperature was during the storage period +5 - +7°C at 93% R.H. and +4°C at 83% R.H.

A third storage test was carried out at +4 - +5°C and 85 - 90% R.H.

In the first test at +5 - +7°C and 93% relative humidity only the agar sausage method was used as a sampling method to investigate the bacteriological contamination and growth on the surface of the meat. The agar sausages were pressed

to the carcass surface on eight different places.
In the second test this method was used together with the swab method and in a third test the "cutting out" method was used as the only one.

Measurements of the carcass muscle or fat color were not carried out in our tests.

RESULTS.

Wrapping and storage at 93% R.H. and +5 - +7°C.

Bacteriological tests:

From figure 1 it may be seen that the hindquarters No. 1 and No. 2 which were not wrapped in film had the most rapid bacteriological growth during a storage period of 6 to 7 days. The agar sausage method is not useful for bacteriological counts above 10.000 bacteria per square centimeter. This limit was reached on the unwrapped surfaces after 6 - 7 days. The hindquarters numbered 3, 4, 5 and 6 which were all wrapped in CW-65 film had a lower bacteriological growth speed, and the 10.000 bacteria per square centimeter limit was reached approximately 3 days later.

It should be mentioned that the storage room in the same period of time as the wrapping tests were carried out, was used for distribution work in the slaughterhouse. Workers carried out splitting and weighing of other carcasses as well as floorwashing in the same room. This must be part of the reason for the difference in bacteriological counts for the CW-65 wrapped hindquarters and the unwrapped.

Weight loss registrations.

From figure 2 it may be seen that the weight loss is greater on hindquarters No. 1 and No. 2 which were not wrapped in film.

The tests lasted for a period of about two weeks and it may be seen that the weight loss after one week is about 1.5% for the unwrapped hindquarters and about 0.3% for the wrapped hindquarters.

As mentioned before the relative humidity was relatively high - 93% R.H.
The difference in weight loss was relatively greater in the following test run at a lower relative humidity.

Wrapping and storage at 83% R.H. and +4°C.
Bacteriological tests.

When another test was run at +4°C and a relative humidity of 83% the swab method was also used to investigate bacteriological contamination and growth rate during the storage.

From figure 3 it may be seen that the agar sausage counts on the surfaces of five left hindquarters unwrapped did not increase so rapidly as on five opposite right hindquarters which were wrapped in CW-65 packaging film. After one week the bacteriological counts were about 1.000 for the unwrapped hindquarters and about 2.000 bacteria per square centimeter for the PVC wrapped hindquarters.

When looking at figure 4 which shows the bacteriological results of the swab method tests, it will appear that the counts on the surfaces after one week is approximately 400.000 bacteria per square centimeter on the unwrapped hindquarters and approximately 70.000.000 bacteria per square centimeter on the wrapped hindquarters.

Weight loss registrations.

From figure 5 it may be seen that the weight loss difference at this relatively low storage humidity, 83% is relatively great. For the packed hindquarters the weight loss after ten days is on average 0.5% and the unwrapped hindquarters have a weight loss of about 3.9 - 4.0%. This great difference is due to the very low relative humidity which gave the unwrapped hindquarters a very dry discolored surface.
It is interesting to see the weight loss for wrapped hindquarters stored at 93% R.H. and +5 - +7°C for 14 days is lower: 0.3%. This shows the great importance of the relative humidity. For unwrapped hindquarters the weight loss difference for the two humidities and temperatures is much greater.
The average weight of the hindquarters in these tests was 54.5 kg. The carcass halves were cut between the sixth and seventh rib bone.

Wrapping and storage at +4 - +5°C and 85 - 90% R.H.

In a third test with ten whole carcasses which were cut into two halves the results were about the same. Immediately after slaughtering the carcasses were brought into a shock cooler at a temperature of +1 to +2°C and 80% relative humidity. The air velocity was 5 meter per second. Afterwards the carcasses were brought into a cooler at a temperature of +2 to +4°C and 80% relative humidity with an air velocity less than 0.5 meter per second. Then the carcass halves were wrapped and stored in a cooler at +4 - +5°C., 85% - 90% relative humidity and an air velocity less than 0.5 meter per second.
The average weight of the wrapped halves was 118.1 kg and for the unwrapped 116.4 kg.

Bacteria counts.

The results showed that the carcass halves wrapped in CW-65 film had an average bacteria count of 2.63 log per square

centimeter and the unwrapped carcass halves had an average bacteria count of 2.9 - 3.0 log per square centimeter after 5 days storage. The bacteria counts were found by cutting out 10 square centimeters of the carcass surfases.

Weight loss measurements.

In the same five-day period the weight loss for the unwrapped carcass halves was 0.42% and for the wrapped the average weight loss was 0.16%.

Discussion.

The PVC wrapping protects effectively from sanitary contamination during storage and distribution. When wrapped carcasses are going to be transported hanging in cooled trucks, the wrapping should be done properly in order to prevent the film from falling off.
When considering only weight loss the most effective procedure would be to wrap immediately after slaughtering, but this would probably require a very excellent slaughter hygiene in order to obtain a necessary very low initial bacteria count on the carcass surfaces.

Usually the surface-bacteria growth rate is controlled by the temperature, air velocity and air humidity.
By using the PVC wrapping material it seems to be possible to store the meat in a more uncontrolled atmosphere and at the same time reduce weight loss.

As the film used has a 'cling' effect it is not necessary to use heat-sealing, but some packaging know-how is necessary if wrapped carcasses are going to be shipped by truck over long, bumpy distances.

It is an advantage that when wrapped in film the meat need no further wrapping or packaging if it is shipped separately

in small vehicles which are not espesially constructed for carcass transportation.

The weight loss may be reduced to a great extent by wrapping carcasses which are going to be stored at a relatively very low relative humidity.

It is obvious that the surface of carcasses which have a great moisture loss and therefore are very dry, have a longer storage possibility than wrapped surfaces with almost no water loss.

Summary.

The same type of PVC packaging film which is commonly used for wrapping red meat portion cuts, was used for wrapping whole beef carcass halves and hindquarters in order to reduce weight loss and microbiological contamination.

Altogether sixteen hindquarters and carcass halves were used for the packaging experiments. Nine hindquarters were wrapped in RESINITE CW-65 from Borden Chemical. The wrapping took place 24 hours after slaughtering. The results show that when the wrapped hindquarters were stored in 93% relative humidity, the weight loss was 0.3% after seven days storage at +5 to +7°C.
The unwrapped hindquarters, the control group, had a weight loss of 1.45% during the same period.
The total bacteria counts on the surfaces of the hindquarters were lower on the wrapped meat than on the control hindquarters.

When hindquarters were wrapped and stored at a lower humidity, 83% R.H., the difference in weight loss was greater: 0.3% for the wrapped and 2.9% on the unwrapped hindquarters.

The surface bacteria counts were then no longer lower on the wrapped meat, but an increase was found in relation to counts on the unwrapped.

In another test, 20 carcass halves were wrapped 24 hours after slaughter and stored for 5 days in 85 - 90% R.H. at +5°C. The weight loss was 0.14% for the wrapped and 0.36% for the unwrapped carcass halves. The bacteria counts in this last storage test found by the "cutting out" method, were lower on the wrapped than on the unwrapped carcass surfaces.

Literature:

Coretti, K: The value of some methods for bacteriological control of factory hygiene. 11 th Meeting of European Meat Research Workers. Beograd 1965.

Nilsson, Roy, Swedish Meat Research Institute: Personal communication 1972.

Tiernan, John J: Film cuts product weight loss, helps prevent discoloration. Package Engineering, January 1971.

Zeuthen, Peter, Danish Meat Resarch Institute: Personal communication 1972.

Fig. 1:

Bacteria per square centimeter (agar sausage method) on unwrapped No. 1 and No. 2, and on wrapped hindquarters stored at 93% R.H. +5 - +7°C.

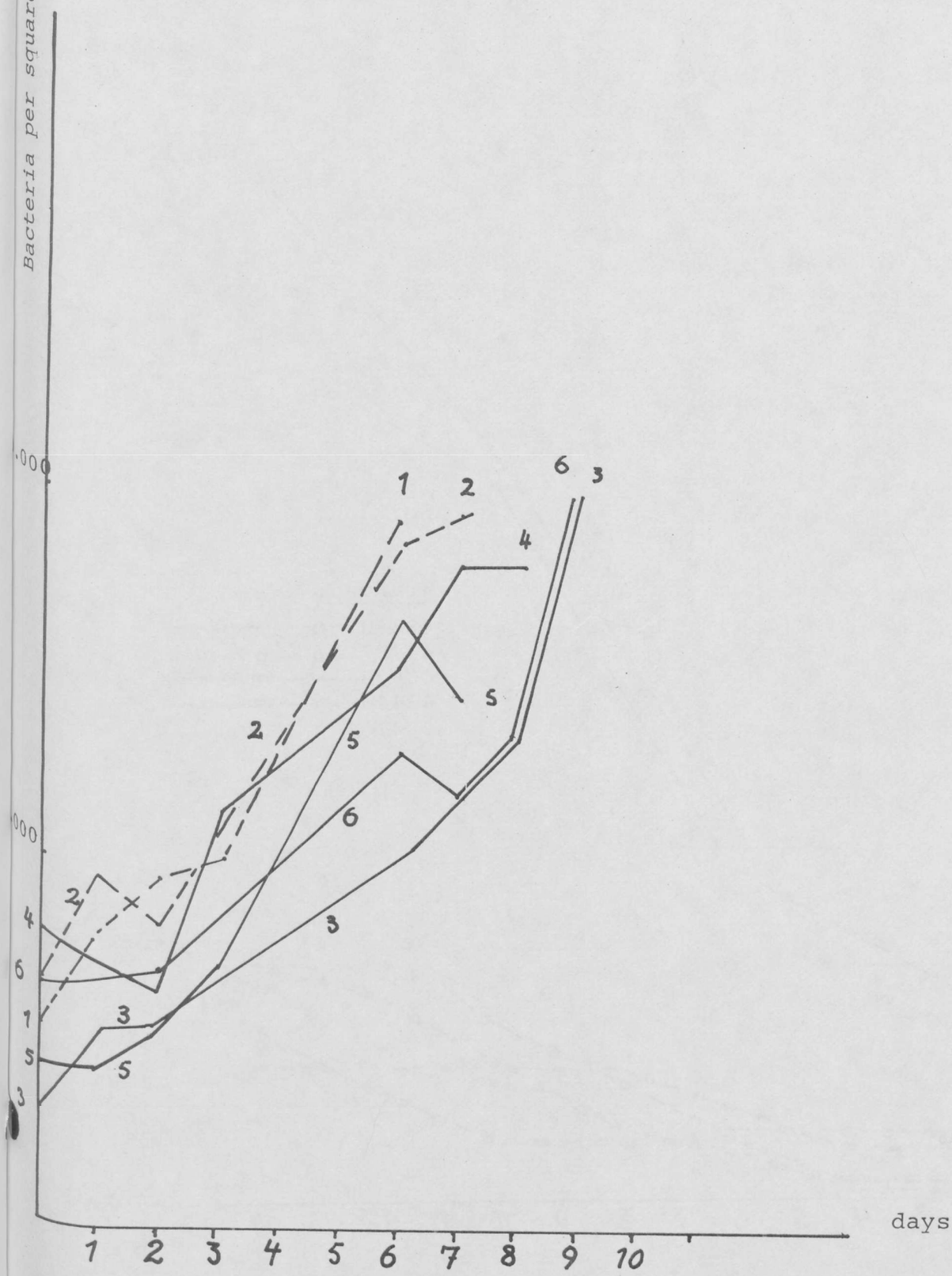


Fig. 2:

Weight loss for unwrapped No. 1 and No. 2 and PVC wrapped hindquarters stored at 93% R.H. + 5 - + 7°C.

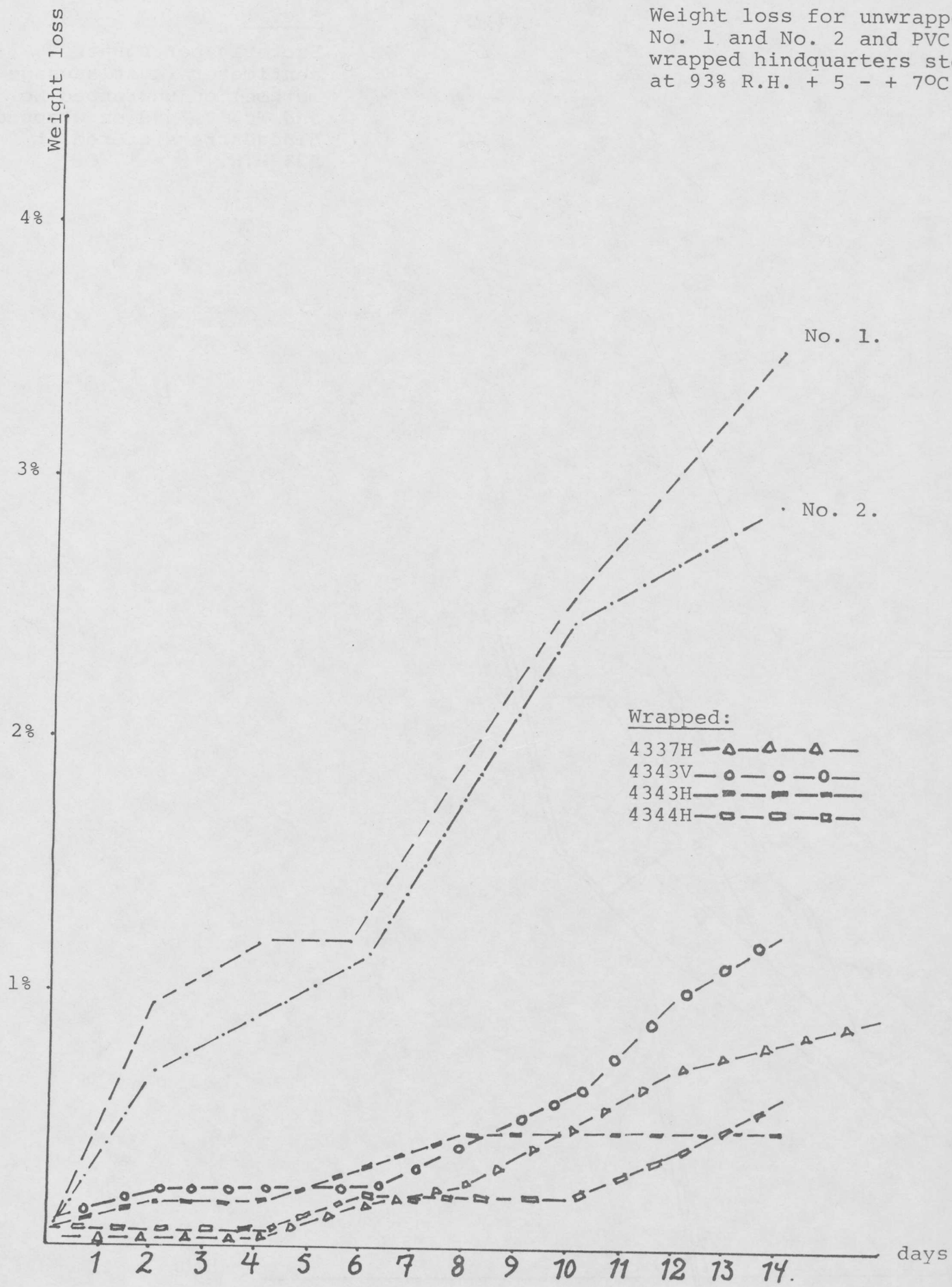
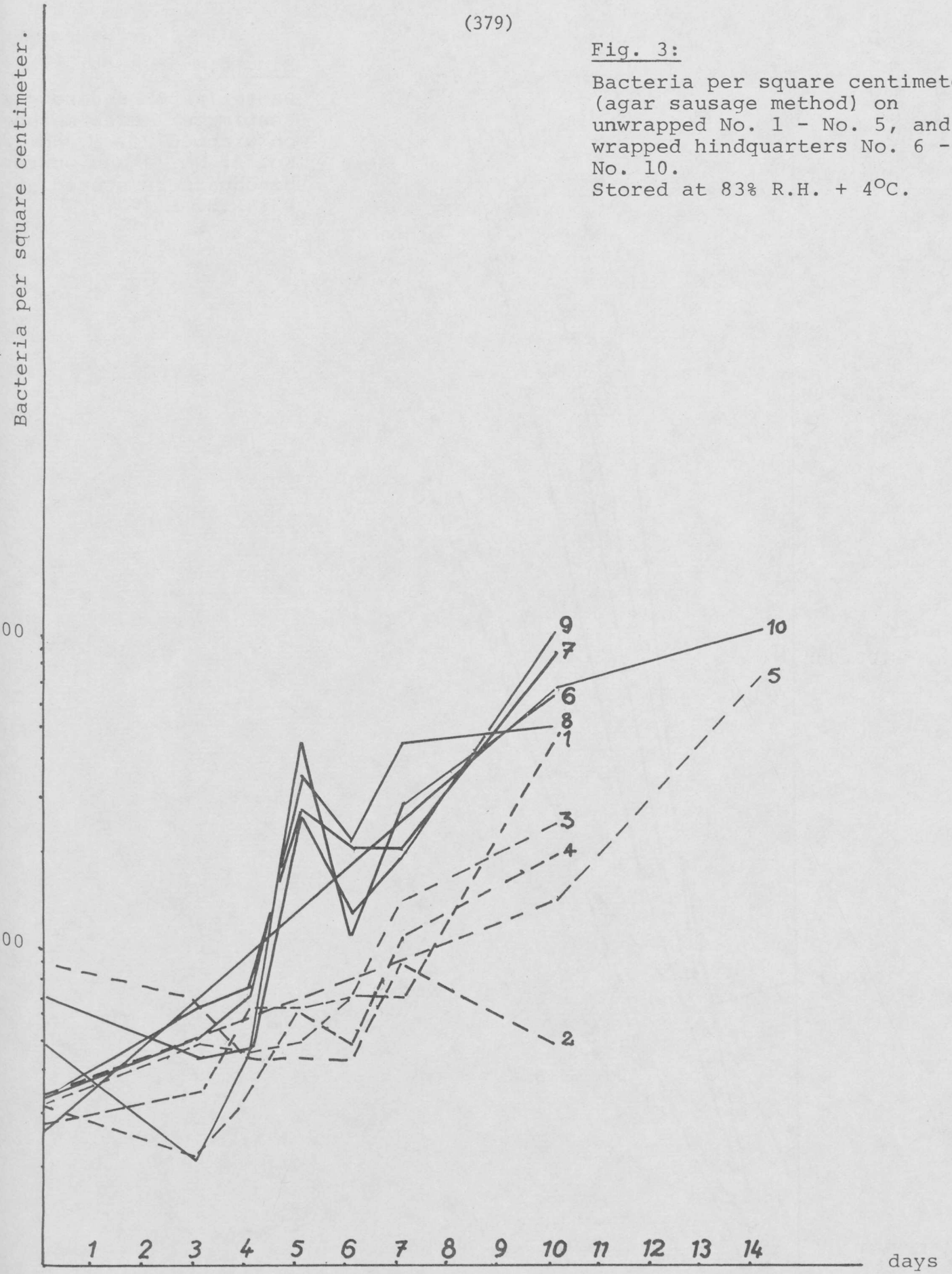


Fig. 3:

Bacteria per square centimeter (agar sausage method) on unwrapped No. 1 - No. 5, and wrapped hindquarters No. 6 - No. 10.
Stored at 83% R.H. + 4°C.



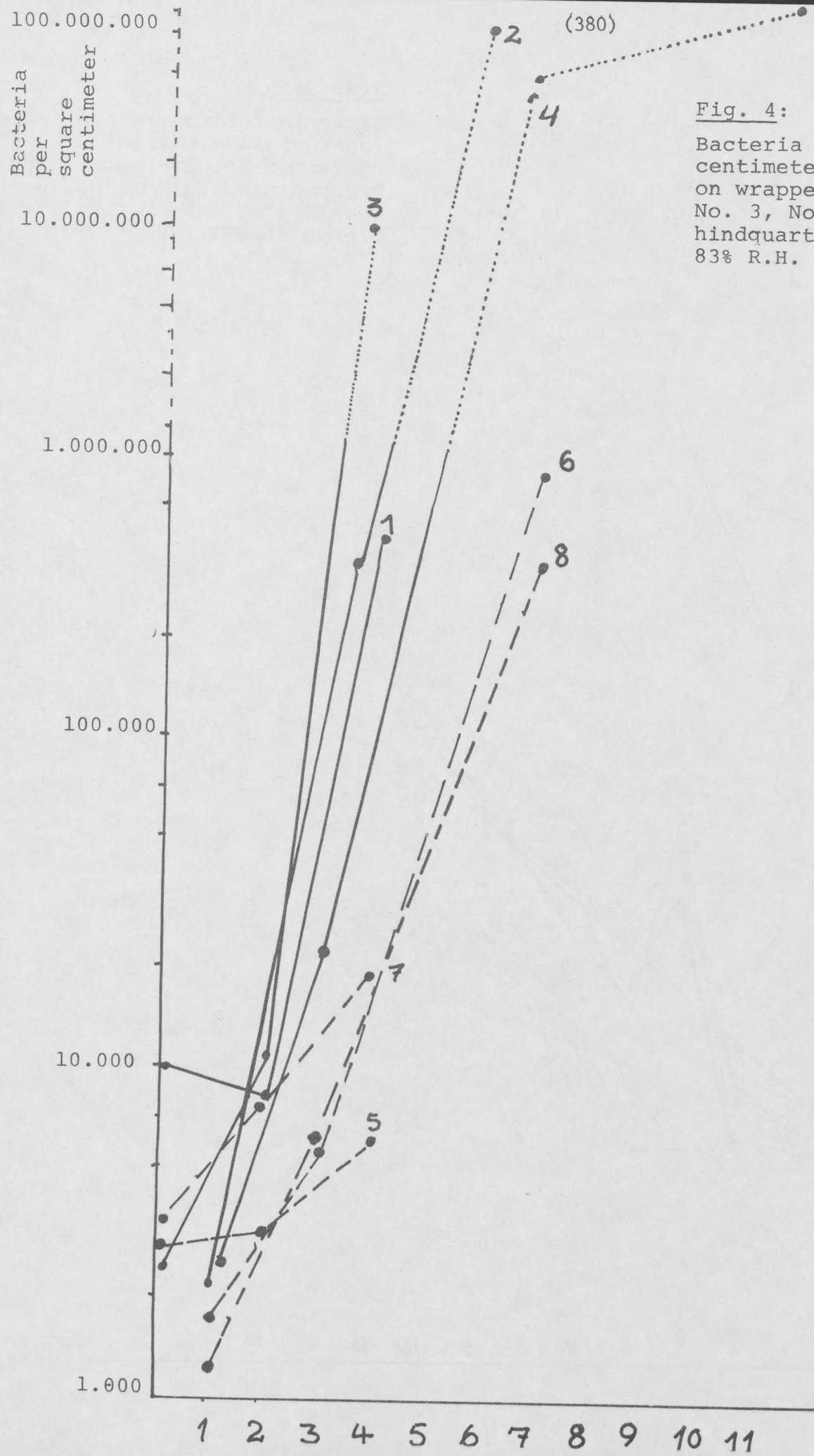


Fig. 4:

Bacteria per square centimeter (swab method) on wrapped No. 1, No. 2, No. 3, No. 4 and unwrapped hindquarters stored at 83% R.H. + 4°C.

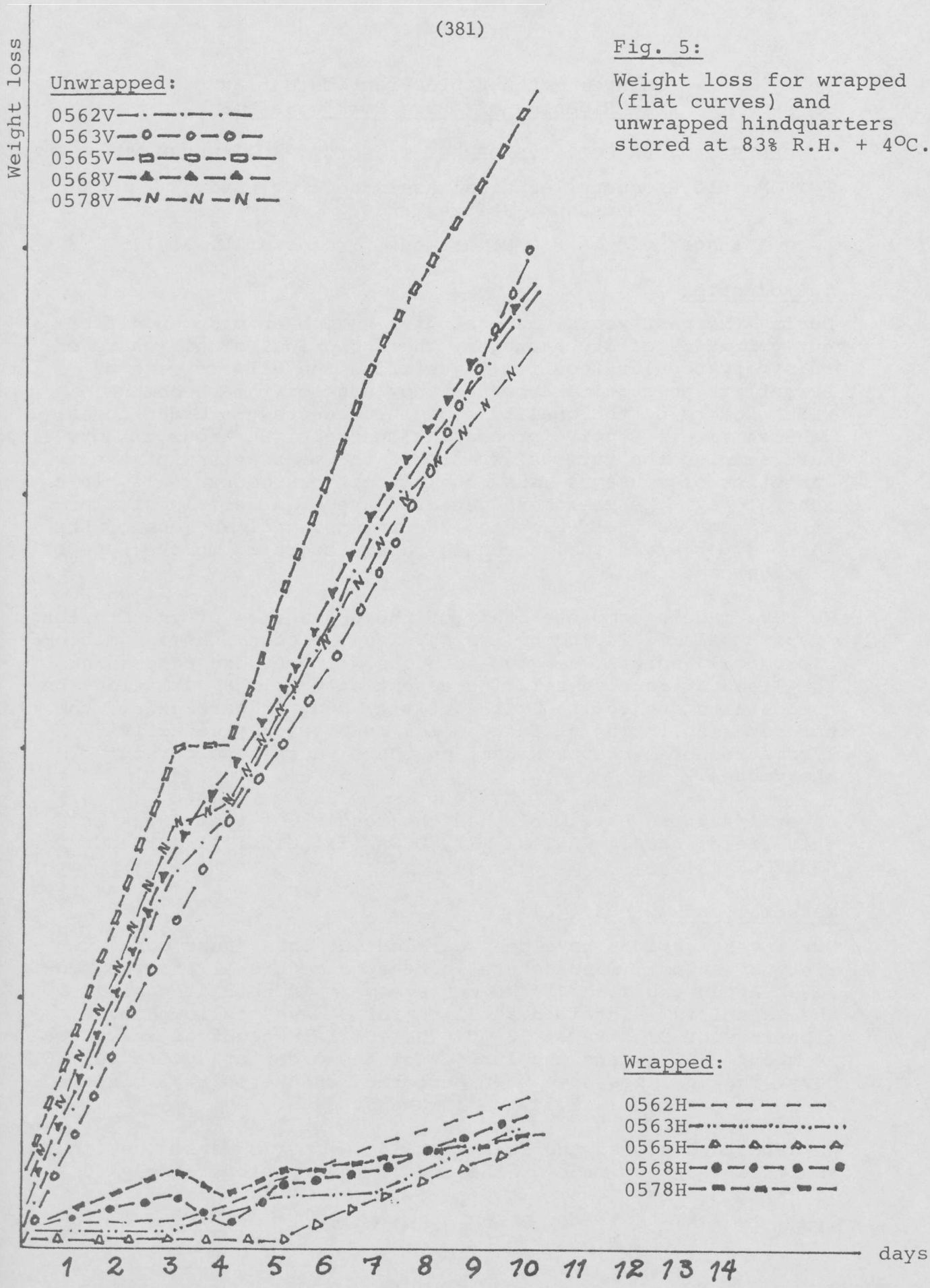


Fig. 5:

Weight loss for wrapped (flat curves) and unwrapped hindquarters stored at 83% R.H. + 4°C.