



Grey Fat

Fat can develop a grey discoloration during retail display. This Bulletin describes the problem, outlines some work done by MIRINZ to determine what is causing this greying of fat, and suggests ways of overcoming the problem.

THE PROBLEM

There have been reports that, after chilled storage, fat on beef cuts can become noticeably grey during retail display. The discoloration appears before meat browning occurs, and can be so unattractive that it, rather than meat browning or microbial spoilage, limits the display life. MIRINZ scientists have been examining this problem; in particular, how it occurs and ways to limit or eliminate it.

THE INVESTIGATION

To investigate the kinetics of fat greying, we packed beef striploins in various types of packaging and stored them for up to 4 months (17 weeks).

The packagings and storage regimes used were:

- Frozen storage in oxygen-permeable packs.
- Chilled storage in oxygen-impermeable packs. For chilled storage, the meat was either vacuum-packed, carbon dioxide-packed, or packed in the presence of an oxygen scavenger.

Both before and after storage, steaks and pieces of surface fat were cut from the striploins, packaged in conventional retail display packs and displayed under light in a retail display cabinet at 4°C.

In trying to quantify the colour change, we found that none of the usual parameters measured by colour meters (i.e., CIELAB L^* , a^* , b^* values, hue angle, chroma values) were directly related to the visual greyness of the fat. The best measure of greyness was sensory scores from a colour panel, who scored fat colour against a grey colour standard. Some of their results are given in graphs in this Bulletin.

A surprising outcome was that even with fresh (unstored) striploins the fat turned grey during simulated retail display. For these fresh samples, the grey discoloration took 7 days to develop during display. With stored cuts, the display time before discoloration appeared shortened as the storage

period increased, so that by the end of the trial (17 weeks storage), the grey colour developed after less than a day on display.

In general, the discoloration appeared more quickly in steaks from striploins that had been held frozen or held chilled in vacuum packs, compared to steaks from loins held in carbon dioxide packs or in packs containing an oxygen scavenger.

Chemical analysis of the samples showed that the grey discoloration was not linked with microbiological spoilage, or with vitamin E or β -carotene content.

MIRINZ scientists concluded that the grey discoloration was caused by meat drip, which first penetrates and stains the fatty tissue during display and/or storage, and then changes in colour from reddish to grey.

The colour change in the fat tended to occur just before the meat lean also changed in colour, from red to brown. This well-known colour change is due to the oxidation of muscle myoglobin.

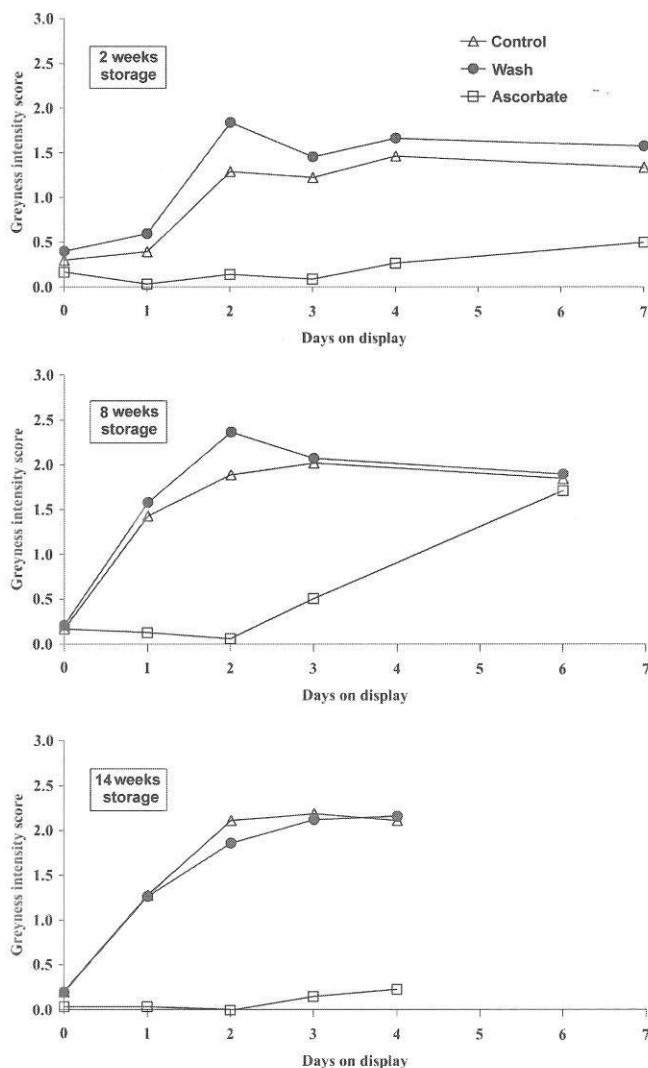
Colour spectra were studied, and the results showed that a similar oxidation reaction was occurring in the drip in or on the fat. Haemoglobin in the drip was being oxidised to methaemoglobin.

Even when drip was excluded from the fat, if the fat had been stained with blood during carcass dressing, enough



Scores by MIRINZ sensory panellists were a better measure of fat greyness than instrumental readings.





Average colour panel scores for intensity of greyness in fat on beef steaks during simulated retail display after various periods of chilled storage. The steaks were cut from striploins whose surface fat was either washed with water (Wash), treated with a dilute sodium ascorbate solution (Ascorbate), or received no treatment (Control) before storage. Greytness intensity was scored from 0 (absent) to 3 (extreme).

haemoglobin was present for the grey discoloration to develop. Samples stained with blood developed the characteristic grey discoloration, and the greater the staining, the greater the discoloration.

THE SOLUTION

Since the colour change was due to the oxidation of haemoglobin, we applied a dilute solution of sodium ascorbate (vitamin C), a naturally occurring antioxidant, to the surface of the striploins before storage. This delayed the development of the grey discoloration, giving steaks cut from the striploins an adequate display life (for example, display life was 3 days after 14 weeks storage). However, if the ascorbate-treated fat was stained with blood (from dressing procedures) or with drip during storage or display, it looked pink. Customers might object to pink fat almost as much as they object to grey fat.

We also tried to eliminate the problem by washing the fat surface with water before packaging. Such washing did not get rid of the greying problem; if anything it made it worse, as shown by the sensory panel results (left).

We found that once the fat had turned grey, applying ascorbate reversed the colour defect to some extent, although the results were not as good as for samples treated before storage.

In some countries, such as the U.S.A, New Zealand and the U.K., it is not legal to treat meat with strong antioxidants. This is because these chemicals can reverse the oxidation of myoglobin, and can therefore bring back the red "fresh meat" colour.

Although these chemicals are not harmful in themselves, legislators fear that preventing the natural meat browning that occurs during retail display can mask microbiological spoilage. This belief is in error, as chilled meat browning occurs long before microbiological spoilage, and in any event, microbiological spoilage announces itself through the presence of off odours and flavours, or by the presence of visible slime at the meat surface.

For markets that do not allow antioxidant treatment, the best way to prevent the formation of grey fat is to minimise staining of the fat by blood or drip during meat preparation, storage and display.

FURTHER READING

The retail display life of steaks prepared from chill-stored vacuum and carbon dioxide packed sub-primal beef cuts. by R.G. Bell, N. Penny, and S.M. Moorhead, Meat Science, 42, 165-178 (1996).

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