

MEAT RESEARCH NEWS LETTER

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SPOILAGE OF FRESH MEAT

The Effects of Time and Temperature

Fresh meat is a perishable commodity which is subject to spoilage by bacteria even at refrigerator temperatures very close to freezing.

These bacteria are single celled organisms which are so small that it would take about 400 million to equal the size of a grain of sugar. Their growth may result in slime, sour odour, taint or changes in the wholesomeness of the meat.

Meat, freshly slaughtered under clean conditions, has only a few thousand bacteria per sq. inch (generally 1,000 to 10,000 per sq. inch).

When spoilage is advanced the bacterial colonies group together to give the appearance of slime. This occurs at about 1,000 million bacteria per sq. inch, or an increase of nearly 1,000,000 times.

As bacteria multiply by each cell dividing with two, an increase of 1,000,000 inevitably ensues when 20 divisions have occurred. The objective in fresh meat preservation is to choose storage conditions which will delay this 1,000,000 fold increase.

How many of these divisions do you wish to take place in your fresh meats prior to sale? If, for example, you permit 17 or 18 divisions to take place, only 2 or 3 remain before your customer notices the meat has spoiled. The meat is judged to have a poor keeping quality. If, on the other hand, you allow only 4 or 5 divisions, then 15 or 16 remain before the customer is likely to detect taints. The keeping quality is then judged to be excellent.

The rate at which bacteria grow on meat surfaces depends on the type of organism, nature of the storage atmosphere, the amount of water in or on the tissues and, above all, the temperature.

The accompanying graph summarises results obtained in various laboratories for effect of temperature on growth of spoilage bacteria on moist meat in air. It is under these conditions that spoilage develops most rapidly. Situations where the supply of moisture is adequate are quite commonly encountered, e.g., in chill rooms with high relative humidities of say 95 per cent or more, in insulated delivery vehicles, in packaged fresh meats and on equipment in meatworks or boning rooms where surfaces become covered with a film of meat juice.

In such circumstances, the time for one bacterial division depends on temperature. At 70°-80°F it may be an hour, or even less. At 50°F, the temperature of boning rooms, it is still not much above 2 hours, some 5 hours at 40°F and 10 or 12 hours at 30°-32°F. At each temperature there is a corresponding time required for one division. Consequently we can control bacterial growth by simply controlling time and temperature. Any additional time in storage or during transport will inevitably mean some additional growth of bacteria, the number of divisions in this period being determined by the temperature of the meat.

Low temperatures will delay the production of slime by slowing the growth of bacteria and increasing the time taken for the 20 divisions to occur. You can control the amount of bacterial growth in your products by measuring and controlling time and temperature.

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NEWS JOTTINGS

Next issue will be Estimation of Fat by the Refractometer Method.

Current work by the Laboratory, which we consider will be of importance to the Industry, concerns ageing of meat in permeable films under controlled atmosphere.

Relationship between Holding Temperature
and Rate of Growth of Spoilage Bacteria
on moist meat.

Division or Doubling Time (Hours)

