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Acceleration of Cheese Ripening

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1 INTRODUCTION

Cheese ripening is a complex process of concerted biochemical changes, during which a bland curd is converted into a mature cheese having the flavour, texture and aroma characteristics of the intended variety.1-3 The gradual breakdown of carbohydrates, lipids and proteins during ripening is mediated by several agents, including: (a) residual coagulant, (b) starter bacteria and their enzymes, (c) non-starter bacteria and their enzymes, (d) indigenous milk enzymes, especially proteinases, and (e) secondary inocula with their enzymes.1-4 Ripening is an expensive and time-consuming process, depending on the variety, e.g. Cheddar cheese is typically ripened for 6–9 months while Parmesan is usually ripened for two years. Owing to the cost of ripening cheese, there are obvious economic advantages to be gained by accelerating the process.

Greater control of ripening may also be gained by manipulating the process whereby end product quality may be predicted with greater certainty.1 Acceleration of cheese ripening is, therefore, of benefit to the producer from both the economic and technological points of view, provided, of course, that the final product has the same flavour profile and rheological attributes as conventional cheese.1-7

The principal biochemical events involved in cheese ripening are: (a) glycolysis of residual sugars, (b) lipolysis, and (c) proteolysis involving the degradation of the caseins to lower molecular weight peptides and free amino acids. Acceleration of glycolysis, which occurs rapidly, is considered to be of no benefit in most or all cheese varieties. Acceleration of lipolysis may be of benefit in Blue or some Italian types where lipolysis plays a major role in the generation of characteristic flavour. The contribution of lipolysis to the flavour of Cheddar or Dutch cheeses is unclear, and acceleration of lipolysis in these types is not usually undertaken as a means of enhancing flavour development.

Proteolysis occurs in all cheese varieties and is considered to be a prerequisite for good flavour development. It is effected by a number of agents, including
### Table I

**Principal Methods for Accelerating Cheese Ripening**

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated temperature</td>
<td>No legal barriers, technically simple, possible cost saving</td>
<td>Non-specific action; potential for microbial spoilage increased</td>
</tr>
<tr>
<td>Exogenous enzyme</td>
<td>Low cost, specific action, choice of flavour options</td>
<td>Limited choice of useful enzymes; over-ripening; difficult to incorporate uniformly; possible legal barriers</td>
</tr>
<tr>
<td>Modified starters</td>
<td>Easy to incorporate, natural enzyme balance retained</td>
<td>Technically complex</td>
</tr>
<tr>
<td>Slurries</td>
<td>Very rapid flavour development</td>
<td>High risk of microbial spoilage; final product requires processing</td>
</tr>
</tbody>
</table>

(1) residual coagulant, (2) indigenous milk proteinase, and (3) the proteinases and peptidases of starter and non-starter bacteria.

Ripening involves the production, via various pathways, of a pool of sapid compounds which give the flavour typical of the intended variety. The aim of accelerating the various biochemical pathways is to reduce the ripening time without adversely affecting flavour or texture. The biochemistry of cheese ripening and the important contribution by proteolysis to flavour development are reviewed in Chapter 10 of this book; in this chapter, the means by which maturation can be accelerated will be discussed.

# 2 Methods for Accelerating Cheese Ripening

The principal methods used to accelerate the ripening of cheese are summarized in Table I, and are discussed in Sections 3–6.

# 3 Elevated Ripening Temperature

Enzymatic, as well as chemical, reactions generally occur at faster rates as the reaction temperature is increased. Therefore, it can be reasonably assumed that the biochemical reactions which generate flavour compounds or flavour precursors in cheese will be accelerated by increasing the temperature at which the cheese is matured.

Many cheese varieties are now ripened at low temperatures, e.g. 6–8°C for Cheddar. In a study on the influence of various factors, such as starter type,