The gluconic acid-producing enzyme of acinetobacters

B. J. van Schie, J. P. van Dijken and J. G. Kuenen

Delft University of Technology, Laboratory of Microbiology,
Julianaan 67A, 2628 BC Delft, The Netherlands

The capacity to produce an aldonic acid from aldose sugars is widespread among acinetobacters. The enzyme responsible for this reaction is a membrane-bound, pyrrolo-quinoline quinone (PQQ)-dependent aldose dehydrogenase (E.C. 1.1.99.17). Fermentor studies with Acinetobacter calcoaceticus strain LMD 79.41 showed that the aldose dehydrogenase is synthesized constitutively. Preliminary results obtained with carbon-limited chemostat cultures of this organism revealed that the cell yield on mixtures of acetate and glucose was significantly higher than on acetate alone (molar growth yield (g.mole \(^{-1}\)) for acetate 14.6 versus 21.3 for acetate plus glucose). Since glucose is almost quantitatively oxidized to gluconic acid it follows that the aldose dehydrogenase may play a role in energy metabolism of acinetobacters.

The activity of the enzyme and the rate of acid production from aldose sugars by whole cells show large differences in various Acinetobacter strains, cultivated under the same conditions. However, a low activity of aldose dehydrogenase is not necessarily due to a low level of apo-enzyme. In various strains the addition of PQQ to cell suspensions resulted in an instantaneous enhancement of the rate of glucose oxidation. Efficient recombination of apo-enzyme and PQQ in such strains was also observed in vitro. It is concluded therefore that the apo-enzyme and coenzyme are not always synchronously synthesized in acinetobacters. Preliminary results show that this may also be true for a number of other genera including Pseudomonas and Rhodopseudomonas.

Peptide degradation in Streptococcus cremoris

Aart van Boven, Roel Otto and Wil N. Konings

Department of Microbiology, University of Groningen,
Kerklaan 30, 9751 NN Haren, The Netherlands

Streptococcus sp. are strictly dependent on the milk-protein casein for their nitrogen source. The casein is hydrolyzed by cell-wall bound proteases and the resulting peptides are hydrolyzed by peptidases. In this work we study the localization and properties of the peptide-hydrolysing enzymes.

The leucyl-leucine peptidase has been isolated and partially purified from S. cremoris Wg2. The enzyme has been injected into rabbits to induce the synthesis of specific antibodies. These antibodies have been used in immuno-adsorption experiments to localize the dipeptidase with respect to the cytoplasmic membrane. These experiments demonstrate that this peptidase is located at the outer side of the cytoplasmic membrane.

Experiments with whole cells of S. cremoris Wg2 showed that hydrolysis of leucyl-leucine takes place only if the energy source lactose is available. In the absence of lactose the rate of peptide hydrolysis is very low.

The addition of the uncouplers SF 6847 and CCCP (which dissipate the proton motive force) to whole cells supplied with lactose also decreases the rate of peptide hydrolysis. The addition of the ionophores nigericin (which dissipates the \(\Delta \Psi \) component of the proton motive force) and valinomycin (which dissipates the \(\Delta \Psi \) component) also affects the rate of hydrolysis.

These results strongly suggest that the generation of a proton motive force has an influence on the rate of peptide hydrolysis in whole cells of S. cremoris Wg2.