

in reaction mixture as other reaction conditions were fixed. It was also demonstrated that the limiting factor for the activity of the immobilized glucose oxidase was the oxygen diffusion resistance which increases proportionally to the glucose concentration.

## 8. Effect of Environmental pH on End Products, Fermentation Balances and Bioenergetic Aspects of *Lactobacillus bulgaricus* in a Glucose-limited "pH Stat" Continuous Culture.

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A glucose-limited "pH-stat" continuous culture study of *Lactobacillus bulgaricus* NLS-4 in an anaerobic condition showed the marked effects of environmental pH on end products, fermentation balances and bioenergetic aspects of the organism. Lactic acid was the major end product of fermentation with minor products, such as acetic acid, formic acid and ethanol throughout the pH range tested. In acidic conditions below pH 6.5, a typical pattern of homofermentation was revealed whereas in alkaline conditions, the metabolic pattern was changed from homofermentation to heterofermentation and led to acquire much energy. This metabolic change was likely due to the pH-dependent lactate dehydrogenase activity.

Molar growth yields ( $Y_{glc}=35.5-44.4$ ) and YATP,  $18.5 \pm 2.5$  in average which was 80% higher than the value ever postulated seemed to be accounted for less requirement of maintenance energy of the organism in the culture conditions.

## 9. The release of cellular constituents of *Lactobacillus lactis* by freezing and freeze-drying

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*Lactobacillus lactis* cell was markedly damaged when shocked by freezing and freeze-drying. The supernatant of shocked cells in 1% phosphate buffer (pH7.3) showed a maximum u.v. absorption spectra at 260nm after further incubation for 90min at 37°C.

The leakage of cellular constituents by shocking could be prevented by dimethyl sulfoxide, glycerol, dextrose and  $MgCl_2$ . Among them,  $MgCl_2$  showed the preventing effect before and after freezing whereas the rests, only before the treatment. This leakage was proved not to be related to the cellular repairing mechanism.

## 10. 醱酵乳製品에 있어서 乳酸菌과 酵母의 相互作用

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우유를 원료로하여 만든 치즈나 醱酵乳에는 *Streptococcus*나 *Lactobacillus*와 같은 유산균이 주로 사용되는데 이러한 제품에 酵母가 많이 존재한다는 것이 보고되어 있으나, 그 존재의의에 대해서는 아직 불명한 점이 많다. 따라서 본 실험에서는 醱酵乳에 존재하는 酵母의 역할을 검토하기 위하여, 醱酵乳製品的의 starter로 사용되는 *Lactobacillus*와 酵母 *Saccharomyces fragilis* 그리고 *Debaryomyces hansenii* 사이에 어떠한 相互作用이 있는지를 알아보았다.

본 실험에 사용한 유산균수는 *L. casei*와 *L. bu-*