The Characteristics of the Lactic Acid Bacteria Isolated from Moto, Yeast Mash for Saké Manufacture.

Part. I. The Fermentation Products From Koji Extract.

By

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The 39 strains of lactic acid bacteria were isolated in the year of 1933 from 38 kinds of moto and in 1934, 18 strains were isolated from 16 kinds of moto and a sample of koji, by plate cultures on chalked maltose yeast water agar.

The 57 strains thus obtained, were classified into two species according to their forms: 37 strains were found to be streptococcus ($0.7\ \mu$) and the others were short bacilli ($0.8 \times 1.5 \sim 3.0\ \mu$).

It will be seen in Table I that all the short bacilli produced almost theoretically lactic acid from koji extract, while koji extract was decomposed into not only lactic acid but also alcohol and CO_2 by the streptococci, without any exception, therefore the manner of decomposition of glucose was as follows:

by short bacilli..... $\text{C}_6\text{H}_{12}\text{O}_6 = 2\text{C}_3\text{H}_6\text{O}_3$(1)

by streptococci..... $\text{C}_6\text{H}_{12}\text{O}_6 = \text{C}_3\text{H}_6\text{O}_3 + \text{C}_2\text{H}_5\text{O} + \text{CO}_2$(2)

Table I. Fermentation products from koji extract.

Lactic acid bacteria	Average yield of products (%)				Number of strains producing				
	lactic acid	volatile acid	alcohol	CO_2	<i>l</i>	<i>d</i>	<i>dl</i>	<i>l+dl</i>	$\frac{d+dl}{\text{lactic acid}}$
short bacillus (20 strains)	101.4	2.3	0.7	0	0	7	7	0	6
streptococcus (37 strains)	47.3	2.4	21.7	23.3	36	0	0	1	0
calculated from equation (1)	100.0	0	0	0	—	—	—	—	—
" " " (2)	50.0	0	25.6	24.4	—	—	—	—	—

It is interesting to be pointed out that not only the manner of decomposition of glucose but also the optical rotation of lactic acid produced from koji extract was found to be different between the short bacilli and the streptococci. Table I shows that all the streptococci produced totally *l*-lactic acid excepting only one strain with which the lactic acid consisting of 70% of *l*- and 30% of *dl*-forms was obtained, while *l*-lactic acid was never found

in the products with the short bacilli, since *d*- or *dl*- lactic acid were obtained with each 7 strains and the other 6 strains produced the acid consisting of the above two forms.

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Part II. Observation of Fermentable Sugars and Some Cultural Conditions.

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All the 57 strains of lactic acid bacteria isolated from moto (see Part I) produced acid from pentose, sucrose and glucose, while acid production was hardly detected from glycerol, inulin and mannitol. It will be seen in Table I that arabinose, fructose and maltose were rapidly fermented by almost all the bacteria, galactose was also fermented by most of them although the degree of production of acid was inferior to the formers. Rhamnose, starch, dextrin and lactose were fermented by least number of strains, while fairly large number of bacteria produced acid from α -methyl glucoside and salicin.

It will be interesting to note that the fermentability of xylose was remarkably different between the streptococci and the short bacilli, since it was fermented rapidly by all the cocci, while the bacilli were found generally to have no fermenting power of xylose with the exception of three strains by which slight formation of acid was pointed out.

Table I. Kinds of fermentable sugars.

Lactic acid bacteria	Number of strains producing acid from															
	xylose	alabinose	rhamnose	glucose	fructose	galactose	sucrose	maltose	lactose	dextrin	starch	inulin	α -methyl glucose	salicin	glycerol	mannitol
Streptococcus (37 strains)	37	36	0	37	37	34	37	37	2	1	0	0	25	15	0	0
Short bacillus (20 strains)	3	20	3*	20	19	16	20	18	5	4	4*	0*	4*	5*	0	1

* represents the results of experiments on which 14 strains were under examination.