

Free Amino Acids in Brewing Materials

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The free amino acids occurring in barley, malt, wort, beer and bottom yeast (*Saccharomyces Carlsbergensis*) have been determined by means of paper partition chromatography¹. Finely ground, six row barley (Stella) was extracted with an 8 per cent solution of trichloroacetic acid and the same extraction fluid was used on malt and yeast. The trichloroacetic acid extracts were washed with ether and purified by precipitation with 80 per cent ethyl alcohol. After filtration, the filtrate was concentrated on a boiling water bath and the concentrate used for the chromatographic separation. Wort and beer were treated with alcohol and filtered in the same way as the trichloroacetic acid extracts. The beer was fermented a second time after the evaporation of alcohol and

Table 1.

	Barley	Malt	Unboiled wort	Boiled wort	Beer	Beer 2nd ferm.	Yeast
Alanine	+	+	+	+	+	+	+
γ -Amino-butyric acid	+	+	+	+	+	+	+
Arginine	+	+	+	+	+	—	+
Asparagine	+	+	+	+	—	—	+
Aspartic acid	+	+	+	+	—	—	+
Cystine	+	+	?	?	?	?	+
Glutamic acid	+	+	+	+	+	+	+
Glutamine	+	+	+	+	+	+	+
Glycine	+	+	+	+	+	+	+
Histidine	+	+	+	+	+	—	+
Isoleucine	+	+	+	+	+	—	+
Leucine	+	+	+	+	+	—	+
Lysine	+	+	+	+	+	—	+
Phenylalanine	+	+	+	+	+	—	+
Proline	+	+	+	+	+	+	+
Serine	+	+	+	+	+	—	+
Threonine	+	+	+	+	—	—	+
Tyrosine	+	+	+	+	—	—	+
Valine	+	+	+	+	+	+	+
Unknown (peptides)	—	1	3	2	—	—	9

the addition of dextrose. The amino acids found are given in Table 1.

The occurrence of γ -amino-butyric acid, which has not earlier been found in brewing

The protective action of acetylcholine, physostigmine, and choline against TEPP action (acetylcholine as substrate) lets us assume that TEPP reacts with at least one of the two active centres of the enzyme molecule. It has now been demonstrated that triacetin also protects the enzyme against TEPP action. Triacetin is attracted to centre II and, consequently, the inactivation of the enzyme by TEPP is a destruction of that centre. Furthermore, it was demonstrated that choline, reacting only with centre I, does not protect the enzyme when it is actively splitting triacetin. These results support the recent proposal⁶ that the alkyl phosphates combine with the "ester-grouping" of the enzyme.

A full report will be published elsewhere in due course.

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Received September 23, 1950.