EFFECTS OF FOOD-PRESERVATIVES ON THE ACTION OF DIASTASE.

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THE use of antiseptics in perishable articles of food has become quite general in recent years, and has been, to a certain extent, the subject of legislation. Salicylic acid has been, probably, the most used, and while sanitary authorities of different countries have, as a rule, opposed its use, there has been no positive evidence of its injurious action, even when continued for some time. Lehmann published in Pettenkofer's "Archives of Hygiene" several instances in which healthy male adults had taken for many days considerable doses of this acid without apparent injury. While there may be a legitimate field for the use of the agents in articles of food of a highly perishable character, and especially where the addition is made known, there can be no question that their indiscriminate use is dangerous. Independently of any directly injurious action, it is important to inquire how far they may interfere with the nutritive or medicinal value of any articles with which they may be associated. The matter has been brought prominently to our notice in consequence of some analyses made by us for the State Board of Health of Pennsylvania, in which the free use of salicylic acid in beers and malt extracts was detected. Similar results in regard to beers were found by other State Boards and the Department of Agriculture of the United States Government. It becomes important, then, to inquire how far the presence of these substances may interfere with the diastasic action ascribed to preparations of malt. It must be noted that with a number of the malt extracts now on the market the addition of a preservative has very little significance, because, as prepared, these articles are merely weak beers, and possess no diastasic power. Thus, of eleven samples tested, including all the extracts widely known in this market, only four had any appreciable effect, and but one of these was strikingly efficient.

We have undertaken a few experiments to determine what retarding effect the common food-preservatives may possess. The method of operating was that indicated by Drs. Duggan and Coale in papers in the *American Chemical Journal* and elsewhere, based on the estimation of the sugar formed in presence of a large excess of starch. Arrow-root starch was selected for reasons given by these observers. To avoid error due to varying action of the dilute solutions of malt which are required for the experiments, a blank experiment was made in each set, and from this the diastasic value of the pure malt extract was determined. In the first observations maltine was employed, it having been shown by our previous tests to be by far the most active of the commercial extracts, but later Schuchardt's diastase was used. The Fehling's solution was prepared as directed by Allen, and the determinations were made volumetrically. Many of the experiments

were duplicated, with concordant results. In addition, a number of tests were made by the method given by Allen for valuing malt-extracts. The results obtained were similar to those given below, but, not being capable of quantitative comparison, are not detailed here.

The antiseptics selected were salicylic acid, boric acid, sodium acid sulphite, saccharin, beta-naphthol, and alcohol. The sample of beta-naphthol was of the form now sold under the name hydronaphthol. In all the experiments the temperature, time of action, strength of starch solution (30 grammes to litre) were the same.

In the following table the effect is represented produced by 0.5 c.c. of maltine diluted to 5 c.c., and added to 100 c.c. of starch solution. The figures give the proportion of antiseptic used to the whole volume of solution, and the amount of sugar formed from the starch—that contained in the maltine being deducted:—

Antiseptic used.	Proportion.	Fehling's Solution required.
None		245 c.c.
Salicylic acid	1 to 500	No sugar formed.
" "	1 " 1,000	" " "
" "	1 " 20,000	" 245 c.c.
Boric acid	1 " 1,000	245 "
Sodium acid sulphite	1 " 1,000	245 "
Saccharin	1 " 1,000	18.5 "
" "	1 " 500	5.6 "
Beta-naphthol	1 " 1,000	204 "
" "	1 " 500	174 "
Alcohol	1 " 25	245 "

In the above experiments the antiseptics were added to the starch and the maltine allowed to act at once. In the following, very small quantities of salicylic acid and alcohol were first mixed with *maltine* and allowed to stand four days before addition to the starch.

Antiseptic used.	Proportion.	Fehling's Solution required.
None		245 c.c.
Salicylic acid	1 to 20,000	174 "
Alcohol	1 " 500	221 "
Salicylic acid	1 " 20,000 }	174 "
Alcohol	1 " 500 }	

As before, the proportion of antiseptic is given to the whole volume of solution, after addition of the starch.

EXPERIMENTS WITH DIASTASE.

Proportion of Diastase.	Antiseptic.	Proportion of Antiseptic.	Fehling's Solution required.
1 to 500	None		300.5 c.c.
1 " 500	Salicylic acid	1 to 3,000	286 "
1 " 500	" "	1 " 1,500	16 "
1 " 500	" "	1 " 1,000	No sugar
1 " 1,000	None		263 c.c.
1 " 1,000	Salicylic acid	1 " 1,000	No sugar
1 " 2,000	None		238 c.c.
1 " 2,000	Salicylic acid	1 " 5,000	82 "
1 " 2,000	" "	1 " 3,000	No sugar
1 " 1,000	Boric acid	1 " 1,000	250 c.c.
1 " 1,000	Sodium acid sulphite	1 " 1,000	263 "
1 " 500	Saccharin	1 " 1,000	86.3 "
1 " 1,000	" "	1 " 1,000	No sugar
1 " 1,000	Betanaphthol	1 " 1,000	238 c.c.
1 " 1,000	Alcohol	1 " 25	250 "

Saccharin was included in the above experiments on account of statements made recently in medical journals that it has decidedly antiseptic powers, and that it may be used liberally for internal administration. Such an opinion would be likely soon to lead to its use as far as its taste would permit.

The inferences from the above observations are that salicylic acid is especially objectionable in a malt extract, and that saccharin is also unsuitable. Alcohol in the extract is also objectionable. Betanaphthol has some retarding action, but not very considerable. Boric acid and sodium acid sulphite seem to have but little retarding effect. Their effect, however, by long-continued action on the malt extract before adding it to the starch has not been tested. It is obvious that these conclusions apply to the use of preservatives in prepared articles of food.

With a view of adding further to this point, a sample of Fairchild's pancreatic extract was examined as to its action on starch, with and without addition of salicylic acid. 0.3 grm. pancreatic extract in 100 c.c. starch solution formed sugar equal to 161.3 Fehling's solution; in presence of one-thousandth part of salicylic acid, no sugar was formed.

The President said that the paper just read was a very important one in many respects, and he was glad to think that members of the Society so far distant as Philadelphia had made such a valuable contribution to the proceedings.