[CONTRIBUTION FROM THE DEPARTMENT OF CHEMISTRY OF COLUMBIA UNIVERSITY, No. 300.]

A NOTEWORTHY EFFECT OF BROMIDES UPON THE ACTION OF MALT AMYLASE.

BY ARTHUR W. THOMAS.

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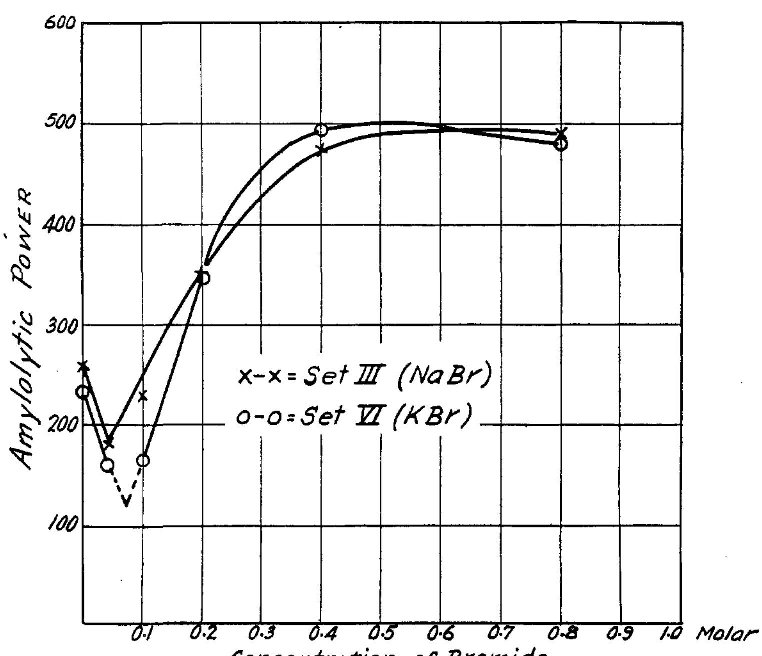
In connection with investigations upon the activation of malt amylase by acids and salts, a peculiar effect in the relation of bromides to the amylolytic activity of purified malt amylase preparations has been observed.

The chlorides, nitrates, sulfates and phosphates of sodium and of potassium activate malt amylase proportionately to the concentration of salt present.[1] The bromides, on the contrary, show an inhibitory effect when present in small amounts and upon increasing the concentration of the salt, an activating action is obtained.

Repetition of experiments with different samples of thrice recrystallized sodium bromide and with thrice recrystallized potassium bromide, using two different purified soluble starch samples and two purified malt amylase preparations[2] demonstrate that the effect cannot be accidental.



[1] Sherman and Thomas, THIS JOURNAL, 37, 623–43 (1915).

[2] Prepared by Sherman and Schlesinger and described by them in *Ibid.*, **35**, 1617–22 (1913).

The method for determination of the amylolytic activity was that used in this laboratory[1] In brief, a solution of neutralized and highly purified Lintner soluble starch, after addition of the salt whose effect is desired, is diluted to 100 cc. with the purest obtainable redistilled water, adjusted to 40°, and added to a flask containing the enzyme. The reaction mixture of substrate, salt and enzyme is kept at 40° in a thermostat for exactly 30 minutes, when Fehling's solution is added and the reduction determined.

The results of our experiments follow.

SET I.—0.07 MG. OF MALT AMYLASE NO. 118 AND 100 CC. OF NEUTRAL 2% SOLUTION OF STARCH NO. 6 USED IN EACH CASE.

Amount of sodium bromide added.	Concentration of sodium bromide.	Reduction in mg. of Cu_2O.	Power.[2]
None	....	61.5	272
1 cc. of 4 Molar	0.04 Molar	28.0	121
2.5 cc. of 4 Molar	0.10 Molar	37.0	161
5.0 cc. of 4 Molar	0.20 Molar	60.5	267
10.0 cc. of 4 Molar	0.40 Molar	99.2	441
14.0 cc. of 4 Molar	0.56 Molar	98.5	440

SET II.—ENZYME AND STARCH SAME AS SET I.

None	....	56.8	250
1.0 cc. of 4 Molar	0.04 Molar	31.0	134
2.5 cc. of 4 Molar	0.10 Molar	34.7	152
5.0 cc. of 4 Molar	0.20 Molar	74.7	331
10.0 cc. of 4 Molar	0.40 Molar	115.3	514
20.0 cc. of 4 Molar	0.80 Molar	106.3	473

SET III.—ENZYME AND STARCH SAME AS SETS I AND II BUT DIFFERENT SAMPLE OF SODIUM BROMIDE.

None	....	59.1	258
1.0 cc. of 4 Molar	0.04 Molar	42.4	183
2.5 cc. of 4 Molar	0.10 Molar	52.1	227
5.0 cc. of 4 Molar	0.20 Molar	79.5	354
10.0 cc. of 4 Molar	0.40 Molar	106.8	477
20.0 cc. of 4 Molar	0.80 Molar	108.6	487

SET IV.—0.07 MG. OF MALT AMYLASE NO. 118 AND 100 CC. OF NEUTRAL 2% SOLUTION OF STARCH NO. 2*a* USED IN EACH CASE.

None	....	84.2	373
1.0 cc. of 4 Molar	0.04 Molar	25.1	108
2.5 cc. of 4 Molar	0.10 Molar	37.2	161
5.0 cc. of 4 Molar	0.20 Molar	73.1	322
10.0 cc. of 4 Molar	0.40 Molar	111.1	496
20.0 cc. of 4 Molar	0.80 Molar	105.5	473

[1] Sherman and Thomas, THIS JOURNAL, **37**, 623–43 (1915).

[2] Scale of Sherman, Kendall and Clark, *Ibid.*, **32**, 1073–1086 (1910).

SET V.—0.07 MG. OF MALT AMYLASE NO. 111*a* AND 100 CC. OF NEUTRAL 2% SOLUTION OF STARCH NO. 6 USED IN EACH CASE.

Amount of sodium bromide added.	Concentration of sodium bromide.	Reduction in mg. of Cu_2O.	Power.
None	....	54.5	242
1.0 cc. of 4 Molar	0.04 Molar	33.6	148
2.5 cc. of 4 Molar	0.10 Molar	32.5	143
5.0 cc. of 4 Molar	0.20 Molar	60.1	263
10.0 cc. of 4 Molar	0.40 Molar	75.9	341
20.0 cc. of 4 Molar	0.80 Molar	60.0	263

SET VI.—EFFECT OF POTASSIUM BROMIDE. SAME ENZYME AND STARCH AS SET V. KBr USED INSTEAD OF NaBr.

None	....	54.0	236
1.0 cc. of 4 Molar	0.04 Molar	35.6	161
2.5 cc. of 4 Molar	0.10 Molar	37.5	165
5.0 cc. of 4 Molar	0.20 Molar	78.7	350
10.0 cc. of 4 Molar	0.40 Molar	111.1	496
20.0 cc. of 4 Molar	0.80 Molar	107.6	482

Note the initial drop in activity (from 0–0.1 Molar concentration of the bromide) in each case preceding the activation. The subjoined curves bring out the effect more strikingly.

An explanation for the above results is now being sought by further experiments with various salts, including the bromates and iodates.

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[CONTRIBUTION FROM THE DEPARTMENT OF BIOCHEMISTRY, UNIVERSITY OF CALIFORNIA.]

THE INFLUENCE OF AVAILABLE CARBOHYDRATES UPON AMMONIA ACCUMULATION BY MICROÖRGANISMS.

BY SELMAN A. WAKSMAN.

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It is a well-established fact that in human metabolism the energy is derived from the fats and carbohydrates of the diet or from those accumulated in the body as reserve materials. In the absence of available carbohydrates the organism will utilize the proteins available as a source of energy; but in this case there will be a waste of materials that cannot be utilized by the organism and are thrown off as waste products.

A similar case has been observed in the metabolism of microörganisms. Kendall and his associates[1] have shown in a number of experiments that fermentation takes precedence over putrefaction; when bacteria are grown in media containing both carbohydrates and proteins, they derive their energy from utilizable carbohydrates in preference to the proteins, even

[1] A. J. Kendall, *J. Med. Res.*, **20**, 117 (1911); "Bacteriology, General, Pathological and Intestinal," Philadelphia, 1916; Kendall and Farmer, *J. Biol. Chem.*, **12**, 13, 19, 215, 219, 465, 469; **13**, 63 (1912); Kendall, Day and Walker, THIS JOURNAL, **35**, 1201 (1913).