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CATALYTIC OXIDATION OF THE CARBOHYDRATES
AND RELATED COMPOUNDS BY OXYGEN
IN THE PRESENCE OF IRON
PYROPHOSPHATES

III. Ethyl Alcohol, Acetaldehyde, Acetic Acid, and
Sodium Acetate

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Since ethyl alcohol, acetaldehyde, and acetic acid all represent products of carbohydrate degradation under certain specific conditions, it was thought advisable to determine the stability of these compounds under the conditions of this series of experiments (1). The amounts of these substances indicated in the table were subjected to the action of oxygen in the presence of iron pyrophosphate solution at a temperature of 50° C. for a period of one to sixteen days.

In each set of experiments four control tubes were used, and the average change in weight of the control tubes was used as a correction factor. Hence the values given in the tables represent the average net change in the weight of the experimental tubes. In general, the procedure was the same as that reported in the previous papers (1 and 2).

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(1) J. Biol. Chem. 94:423 (1931); 95:409 (1932).

The data obtained for carbon dioxide formation in this set of determinations appear in the following table:

CO₂ PRODUCTION FROM ETHYL ALCOHOL, ACETALDEHYDE, ACETIC ACID, AND SODIUM ACETATE

Time in days		1	2	5	8	12	16
3.84 gm. Ethyl alcohol (Theoretical for CO ₂ is 7.35 gms).	CO ₂ obtained, gms. . . .	-.0004	-.0004	-.0007	-.0011	-.0021	-.0022
	C returned as CO ₂ , % . . .	-.006	-.006	-.009	-.015	-.028	-.028
	Determinations made . . .	18	15	12	9	6	3
3.67 gm. Acetaldehyde (Theoretical for CO ₂ is 7.35 gms).	CO ₂ obtained, gms. . . .	-.0006	-.0009	+ .0025	+ .0232	+ .0603	+ .1366
	C returned as CO ₂ , % . . .	-.008	-.012	+ .034	+ .316	+ .822	+ 1.863
	Determinations made . . .	18	15	12	9	6	3
5.01 gm. Acetic Acid (Theoretical for CO ₂ is 7.35 gms).	CO ₂ obtained, gms. . . .	-.0044	-.0050	-.0087	-.0096	-.0034	-.0019
	C returned as CO ₂ , % . . .	-.060	-.109	-.119	-.131	-.046	-.026
	Determinations made . . .	18	15	12	9	6	3
11.36 gm. Sodium Acetate (Theoretical for CO ₂ is 7.35 gms).	CO ₂ obtained, gms.0000	.0000	-.0014	-.0008	-.0013	+ .0018
	C returned as CO ₂ , %000	.000	-.018	-.010	-.018	+ .024
	Determinations made . . .	18	15	12	9	6	3

From a study of the data given in the above table it is apparent that ethyl alcohol, acetic acid, and sodium acetate do not yield carbon dioxide under the conditions of these experiments. Titrations for total acid production and for volatile acid constituents likewise indicated the absence of oxidation. This is in agreement with the general behavior of these compounds and also agrees with the results obtained for the corresponding members of the one carbon series previously reported (2).

The experiments on acetaldehyde showed production of carbon dioxide, which definitely indicates oxidation. Titrations for total acid production led to the same conclusion. The study of the end products of this oxidation and the mechanism involved is reserved for a later paper. It is of interest to note, however, that acetaldehyde (supposedly present in the metabolic processes of the animal organism) is oxidized under the conditions of these experiments, whereas formaldehyde (which is poisonous to the animal organism) is not oxidized.

In conclusion it appears from the data obtained in this set of experiments that (1) ethyl alcohol, acetic acid, and sodium acetate are not oxidized by oxygen in the presence of iron pyrophosphates at 50° C., and (2) that acetaldehyde is oxidized under the conditions of these experiments, carbon dioxide being one of the end products.

(2) J. Biol. Chem. 95:409 (1932).