OXIDATIONS BY ACETOBACTER SUBOXYDANS

Sirs:

Acetobacter suboxydans is known to bring about oxidation of polyhydroxy compounds. The action of the bacterial enzyme is limited, however, to substances with specific configurations. According to the generalization of Bertrand,¹ only those hydroxyl groups are oxidized which are situated between a primary hydroxyl group and a secondary one in a cis position. Hann, Tilden, and Hudson,² in a comparative study of D and L sugar alcohols, demonstrated that only the D form is oxidized readily. In the case of inositol isomers, even a greater stereochmical specificity is required; as was shown in a recent study by Magasanik and Chargaff,³ only hydroxyl groups in a polar position are attacked by Acetobacter suboxydans. We wish to report our findings on the action of Acetobacter suboxydans upon D-glucose dimethylacetal,⁴ which has a configuration favorable for oxidation according to the Bertrand-Hudson rule.

A comparison of the oxidation rates of various substrates reveals (see the table) that meso-inositol, D-sorbitol, calcium D-gluconate, and glycerol are oxidized rapidly, whereas D-glucose dimethylacetal consumes only an insignificant amount of oxygen. A variation of the concentration of glucose dimethylacetal between 10 and 100 micromoles per Warburg vessel did not change this result. In this connection it is interesting to note that D-mannose diethylmercaptal is also resistant to the action of Acetobacter suboxydans.²

Glucose dimethylacetal or glucose diethylmercaptal, when added in concentrations varying from 20 to 100 micromoles to Warburg vessels containing 20 micromoles of inositol, did not influence the rate at which inositol was oxidized. Thus, neither of these substances has an inhibitory effect on the action of the bacterial enzyme.

Attempts to adapt Acetobacter suboxydans to the oxidation of glucose dimethylacetal by growing the bacteria on this substrate failed. After a series of seven transfers on media containing decreasing amounts of D-sorbitol (1 to 0.05 per cent) and increasing amounts of glucose dimethylacetal (0.1 to 1 per cent), the bacteria were not able to bring about an oxidation of the latter substance.

¹ Bertrand, G., Compt. rend. Acad., 126, 762 (1898).
The inability of *Acetobacter* to attack D-glucose dimethylacetal demonstrates that, besides the steric requirements expressed by the Bertrand and Rate of Oxidation by *Acetobacter suboxydans*

The Warburg vessels in each experiment contained 0.5 cc. of the suspension of resting bacteria (about 10 mg. dry weight), 0.5 cc. of solution containing 20 micromoles of substrate, and 2 cc. of 1/15 M phosphate buffer of pH 6. The experiments were carried out at 38° in the presence of air. Calculated oxygen consumption, 224 c.mm.

<table>
<thead>
<tr>
<th>Time (min.)</th>
<th>meso-Inositol</th>
<th>d-Sorbitol</th>
<th>Calcium d-gluconate</th>
<th>D-Glucose dimethylacetal</th>
<th>Glycerol</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>131</td>
<td>18</td>
<td>32</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>15</td>
<td>220</td>
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<tr>
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<td>228</td>
<td>95</td>
<td>99</td>
<td>4</td>
<td>81</td>
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<tr>
<td>45</td>
<td>230</td>
<td>158</td>
<td>148</td>
<td>6</td>
<td>111</td>
</tr>
<tr>
<td>60</td>
<td>235</td>
<td>221</td>
<td>202</td>
<td>7</td>
<td>136</td>
</tr>
</tbody>
</table>

Hudson generalizations, additional factors are decisive for the oxidation of open chain polyhydroxy compounds.

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