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An Index *to the*
Chemical Action *of* Microorganisms
on the Non-Nitrogenous
Organic Compounds

AN INDEX
TO THE CHEMICAL ACTION
OF MICROORGANISMS ON THE
NON-NITROGENOUS
ORGANIC COMPOUNDS

by

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Chemical Action *of* Microorganisms
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Organic Compounds



PREFACE

The material presented in this volume is a summary of information in the process of organization for several years, being maintained both in card index and tabular form. These data have been consulted on numerous occasions by various workers in the field of zymology. At the urgent request of these workers, who have found our files and tables useful, we are making this information more generally available in the present form. It is our hope that this index will be of definite value in the rapidly developing field of zymology.

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January 24, 1930

CONTENTS

PREFACE.....	vii
INTRODUCTION.....	xi
I TABLE ONE: INDEX TO MICROORGANISMS.....	3
II TABLE TWO: INDEX TO ORGANIC (NON-NITROGENOUS) SUBSTRATES.....	59
III TABLE THREE: INDEX TO PRODUCTS.....	109
IV REFERENCES.....	167

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INTRODUCTION

In the course of studies on the production of chemicals from agricultural wastes by the action of microorganisms it seemed advisable to obtain a comprehensive view of the chemicals which have been reported as produced by the action of bacteria, yeasts, and molds on various substrates. A survey was made with reference to non-nitrogenous compounds since such compounds furnish the important sources of energy for the organisms and for the zymotechnical production of chemicals on a large scale. This study was further limited to those instances in which a named organism acted on a named substrate to produce a named compound.

To cover the literature completely even with the above limitations would involve so much material as to become unwieldy. *The purpose of this survey* is to cite references involving a variety of organisms, substrates, products, and authorities; that is, to give a cross section of the field complete enough to introduce the reader to the subject. Hence the authors have purposely omitted much material on the more common types of fermentation with only typical references, while for more uncommon types the treatment has been practically complete. Since the purpose is not primarily historical many of the older references have been omitted and later work cited.

A survey was likewise made of the media and analytical methods for each reference listed. This information will be reserved for a further communication. However, a few general remarks may be pertinent. For example, it is an open question whether in some instances succinic acid is produced from the non-nitrogenous substrate or is a secondary product resulting from the breakdown of the cell or is due to the action upon glutaminic acid. Oxidation and reduction (dehydrogenation and hydrogenation) may in some instances be due to conditions in the medium rather than to direct action of the living organisms. The recent work of Conant and Aston (1928), for example, has shown the production of acetone, carbon dioxide,

complex crystalline bodies, and gummy substances, by the oxidation of isobutyraldehyde by potassium permanganate or potassium dichromate under the given conditions of temperature and relative concentrations of the reagents. The material at hand likewise shows that one of the immediate needs in the field of zymology is the development and consistent use of adequate analytical methods for the fermentation products.

The names ascribed to the microorganisms by the various investigators have been listed as they are given in the original communication. In case the generic or specific designation has been changed since that time the later name has been cross-indexed. The use of an author's name for an organism has been given to identify it. When the statement is made that a certain organism was used to produce definite products, no attempt was made by the authors of this index to judge the purity of the culture. The technique in many instances has not been such as to warrant the conclusions which have been drawn with regard to the ability of the organism to bring about the action reported. It is unfortunate that occasionally investigators will execute a very careful piece of research from a chemical point of view and fail to describe the organism with which the work was done, merely referring to it as a "bacillus." Reference to a number of publications has been omitted for this reason. Frequently a description of an organism has been given which may be adequate for purposes of classification but no name has been attached. The authors wish to emphasize the importance of a proper use of bacterial taxonomy in chemical studies of fermentation.

The results of the literature survey made with the limitations above outlined are presented in three Tables involving the four items: *organism*, *substrate*, *product* and *authority*. In *Table 1* they are shown in the order named above. This compilation enables the reader to gain an idea of the general chemical actions of a given organism and to compare them with others. In *Table 2* the order is *substrate*, *product*, *organism*, *authority*, enabling the reader at a glance to gain an idea of the various products elaborated from a given substrate by the organism involved. It is of interest to note that the products

from the pentoses are of the same types as those produced from the hexoses. The order in *Table 3* is *product, substrate, organism, authority*, enabling the reader to find the types of substrate from which a given chemical has been reported as produced by the named organisms. At the end of the paper is given the list of references cited. It is the hope of the authors that this treatment, limited as it is, may be of value in giving an adequate key to the literature on the chemical changes produced by microorganisms acting on non-nitrogenous organic compounds.

CHAPTER I

INDEX TO MICROORGANISMS

CHAPTER I
TABLE ONE
INDEX TO MICROORGANISMS

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Acetobacter acetum</i> (See <i>Mycoderma acetii</i>) (See <i>Bact. acetii</i>)	
<i>Acetobacter ascendens</i> (See <i>Bact. ascendens</i>)	
<i>Acetobacter melanogenum</i> butyl alc.	butyric ac. Visser't Hooft, 1925
isobutyl alc.	isobutyric ac. Visser't Hooft, 1925
isopropyl alc.	acetone Visser't Hooft, 1925
lactic ac.	acetic ac. Visser't Hooft, 1925
propyl alc.	propionic ac. Visser't Hooft, 1925
<i>Acetobacter sorbose</i> (See also sorbose bacterium) xylose	CO ₂ Fred, Peterson and Anderson 1923
<i>Acetobacter suboxydans</i> adonitol	d-adoninulose Visser't Hooft, 1925
2, 3-butylene glycol	acetone Visser't Hooft, 1925
ethyl alc., lactic ac.	acetic ac. Visser't Hooft, 1925
erythritol	erythrose Kluyver and deLeeuw, 1924

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Acetobacter suboxydans</i> (cont.) gluconic ac. glycerol glycerol isopropyl alc. mannitol sorbitol	hydroxygluconic ac. Kluyver and deLeeuw, 1924 dihydroxy-acetone Kluyver and deLeeuw, 1924 dihydroxy-acetone Brit. patent, 269,950 acetone Visser't Hooft, 1925 levulose Kluyver and deLeeuw, 1924 sorbitol Kluyver and deLeeuw, 1924
<i>Acetobacter</i> sp.? ethyl alc. ethyl alc. ethyl alc. ethyl alc. gluconic ac. glucose propyl alc.	acetic ac. Knieriem and Mayer, 1872 acetic ac. Buchner and Gaunt, 1906 acetic ac. Day and Baker, 1913 acetic ac. Söhngen, 1913 dihydroxyacetone, ethyl alc. Söhngen, 1914, 1915 acetic ac., CO ₂ , ethyl alc., gluconic ac. Söhngen, 1914, 1915 propionic ac. Buchner and Gaunt, 1906
<i>Acetobacter xylinum</i> (See also <i>Bact. xylinum</i>) (See also <i>B. xylinum</i>) (See also sorbose bacterium) 2, 3-butylene glycol	acetone Visser't Hooft, 1925

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Acetobacter xylinum</i> (cont.) isopropyl alc. lactic ac. d-propylene glycol xylose	acetone Visser't Hooft, 1925 acetic ac. Visser't Hooft, 1925 acetol Visser't Hooft, 1925 acetone, CO ₂ , ethyl alc. Fred, Peterson and Anderson, 1923
<i>Actinomyces sp.?</i> xylan	pentose (xylose?) Patrick, Werkman and Hixon, 1930
<i>Aerobacillus acetoethylicus</i> (See <i>B. acetoethylicus</i>)	
<i>Aerobacillus asterosporus</i> (See <i>B. polymyxa</i>)	
<i>Aerobacillus macerans</i> (See <i>B. macerans</i>)	
<i>Aerobacillus polymyxa</i> (See <i>B. polymyxa</i>)	
<i>Aerobacter aerogenes</i> (See <i>B. lactis aerogenes</i>) (See <i>Bact. lactis aerogenes</i>)	
<i>Aerobacter cloacae</i> (See <i>B. cloacae</i>)	
<i>Aerobacter faeni</i> sucrose, xylose	acetic ac., acetylmethyl carbinol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Breden, Fulmer, Werkman and Hixon, 1930

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Amylobacter butylicus</i> (See also <i>B. amylobacter</i>) glycerol, lactic ac.	acetic ac., butyl alc., butyric ac. Duclaux, 1895
lactose, maltose, mannitol, starch, sucrose	acetic ac., butyl alc., butyric ac., CO ₂ , ethyl alc., H ₂ , lactic ac. Duclaux, 1895
<i>Amylobacter ethylicus</i> sucrose	acetic ac., acetaldehyde, ethyl alc., lactic ac. Duclaux, 1895
<i>Amylomyces Rouxii</i> lactic ac.	pyruvic ac. Mazé, 1916
<i>Aspergillus cellulosa</i> dextrose	acetaldehyde Cohen, 1920
<i>Asp. cinnamomeus</i> dextrose	citric ac., gluconic ac. Falek and Kapur, 1924
<i>Asp. fumaricus</i> arabinose	fumaric ac., citric ac. Schreyer, 1928
dextrose, gluconic ac., glyceric ac., glycerol, lactic ac., mannitol	citric ac. Schreyer, 1928
galactose	fumaric ac., citric ac. Schreyer, 1928
gluconic ac.	citric ac. Schreyer, 1925, 1928
glyceric ac.	citric ac. Schreyer, 1928
sucrose	fumaric ac. Wehmer, 1918
sucrose	citric ac., fumaric ac., gluconic ac., malic ac. Wehmer, 1928

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Asp. fuscus</i> dextrose	citric ac., gluconic ac. Falck and Kapur, 1924
<i>Asp. glaucus</i> glycerol	hydro-oxymaltol Traetta-Mosca and Preti, 1921
<i>Asp. niger</i> acetic ac.	glycollic ac., glyoxylic ac., oxalic ac. Challenger, Subramaniam and Walker, 1927
acetic ac., dextrose, starch, tartaric ac. acetonedicarboxylic ac.	oxalic ac. Wehmer, 1891 oxalic ac. Walker, Subramaniam and Challenger, 1927
arabinose, dextrose, galactose, glycerose, levulose, maltose, mannose, sucrose, xylose	citric ac. Amelung, 1927
arabinose, gluconic ac., glycerol, mannitol, quinic ac., saccharic ac. sucrose	citric ac., oxalic ac. Butkewitsch, 1923
arabinose, dextrose, glycerol, levulose, mannitol, sucrose butyric ac.	gluconic ac. Bernhauer, 1928 β -hydroxybutyric ac., acetoacetic ac., acetone Koppock, Subramaniam and Walker, 1928
cinnamic ac.	styrol Herzog and Ripke, 1908
citric ac.	acetone, glyoxylic ac., malonic ac., oxalic ac. Challenger, Subramaniam and Walker, 1927
citric ac.	acetonedicarboxylic ac. Walker, Subramaniam and Challenger, 1927

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Asp. niger</i> (cont.)	
citric ac.	glycollic ac. Challenger, Subramaniam and Walker, 1927
citric ac.	oxalic ac. Challenger, Subramaniam and Walker, 1927
dextrin, dextrose, glycerol, inulin, lactose, mannitol, sucrose	citric ac., oxalic ac. Elfving, 1919
dextrose	acetic ac., oxalic ac. Heinze, 1903
dextrose, sucrose	citric ac. Bernhauer, 1928
dextrose	citric ac., gluconic ac. Falek and Kapur, 1924
dextrose	citric ac., oxalic ac. Wehmer, 1924
dextrose	ethyl alc., CO ₂ Kostytschew, 1907
dextrose	gluconic ac. Müller, 1925
dextrose	oxalic ac. Wehmer, 1897
fumaric ac.	l-malic ac. Challenger and Klein, 1929
gluconic ac.	citric ac., saccharic ac. Walker, Subramaniam and Challenger, 1927
gluconic ac.	citric ac., oxalic ac. Wehmer, 1925
oxalic ac.	glycollic ac. Challenger, Subramaniam and Walker, 1927
phloridzin	phloroglucinol, dextrose Boas, 1916

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Asp. niger</i> (cont.)	
raffinose	oxalic ac. Gillot, 1899
saccharic ac.	citric ac. Walker, Challenger and Su- bramaniam, 1927
succinic ac., fumaric ac., malic ac., tartaric ac., acetic ac.	oxalic ac. Raistrick and Clark, 1919
sucrose	citric ac. Currie, 1917
sucrose	citric ac., gluconic ac., oxalic ac. Bernhauer, 1924
sucrose	citric ac., gluconic ac., oxalic ac. Butkewitsch, 1924
sucrose	citric ac., gluconic ac., oxalic ac. Bernhauer, 1926
sucrose	kojic ac. Kinoshita, 1927
sucrose	oxalic ac. Currie, 1919
tartaric ac., lactic ac., quinic ac., glycerol, mannitol, sucrose	ethyl alc. Kostytschew and Afanassjewa, 1922
<i>Asp. niger-mutante</i>	
pyruvic ac.	acetaldehyde Nagayama, 1921
<i>Asp. oryzae</i>	
quinic ac.	protocatechuic ac., pyrocatechol Butkewitsch, 1924
sucrose	kojic ac. Kinoshita, 1927
<i>Bacillus acetobutylicus</i> (See <i>Cl. acetobutylicum</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B.* aceti</i> arabinose, dextrose, erythritol ethyleneglycol, glycerol, glycollic ac., isobutyric ac., isolichenin, levulose, malonic ac., rhamnose, sucrose	oxalic ac. Banning, 1902 .
<i>B. aceti</i> (Hansen) ethyl alc. propyl alc.	acetic ac. Buchner and Gaunt, 1906 propionic ac. Buchner and Gaunt, 1906
<i>B. aceti viscosum</i> dextrose ethyl alc.	gluconic ac. Day and Baker, 1913 acetic ac. Day and Baker, 1913
<i>B. acetigenum</i> arabinose, dextrose, glycollic ac. dextrose	oxalic ac. Banning, 1902 gluconic ac. Henneberg, 1898
<i>B. acetoethylicum</i> arabinose, dextrose, galactose, glycerol, lactic ac., levu- lose, maltose, mannose, raffinose, starch, sucrose, xylose dextrose, maltose	acetone, ethyl alc., formic ac. Northrop, Ashe and Morgan, 1919 acetone, ethyl alc., pyruvic ac. Speakman, 1925

* While *B.* usually designates *Bacillus*, this symbol is used occasionally for *Bacterium*, and leads to confusion. The authors have used the designation of the authorities cited.

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. acetoethylicum</i> (cont.) dextrose, starch, sucrose, xylose starch	acetic ac., acetone, ethyl alc., formic ac., lactic ac. Arzberger, Peterson and Fred, 1920 acetaldehyde Peterson and Fred, 1920
<i>B. acetoethylicus</i> dextrose starch, sucrose	acetic ac., acetylmethyl carbinol, acetone, 2, 3-butylene gly- col, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac. Donker, 1926 acetone, ethyl alc. Bakonyi, 1926
<i>B. acetosum</i> arabinose, dextrin, dextrose, erythritol, ethyleneglycol, glycollic ac., malonic ac. dextrose	oxalic ac. Banning, 1902 gluconic ac. Henneberg, 1898
<i>B. acidi-laevolactici</i> sucrose	l-lactic ac. Schardinger, 1890
<i>B. acidi propionici</i> (See <i>Propionibacterium pen- tosaceum</i>)	
<i>B. acidi propionici</i> lactic ac.	acetic ac., CO ₂ , propionic ac. von Fruedenreich and Jensen, 1906
<i>Bacillus aerogenes</i> (See <i>B. lactis aerogenes</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. aerogenes</i> dextrose	acetic ac., acetylmethyl carbinol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Scheffer, 1928
<i>B. amaracrylus</i> glycerol	acrylaldehyde Voisenet, 1918
<i>B. amarificans</i> (See <i>B. lactis</i>)	
<i>B. amylobacter</i> (See <i>Clostridium butyricum</i>) (See <i>Granulobacter butylicum</i>)	
<i>B. anthracis</i> maltose, sucrose starch	acetylmethyl carbinol Lemoigne, 1919 dextrose Maumus, 1893
<i>B. ascendens</i> (See also <i>Acetobacter ascendens</i>) (See also <i>Bart. ascendens</i>)	
<i>B. ascendens</i> acetaldol arabinose, dextrose, ethylene glycol, glycerol, glycollic ac., malonic ac., rhamnose methylethyl-acetaldehyde	β -butylene glycol, β -hydroxybu- tyric ac. Binder-Kotrba, 1926 oxalic ac. Banning, 1902 l-amyl alc., valeric ac. Neuberg and Simon, 1926

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<p><i>B. butylicus</i> (See also <i>B. amylobacter</i>) dextrose, glycerol</p> <p>dextrose, glycerol, lactic ac., propionic ac.</p> <p>glycerol</p> <p>glycerol, mannitol</p> <p>glycerol, mannitol, sucrose</p>	<p>acetic ac., n-butyl alc., n-butyric ac., formic ac., lactic ac. Buchner and Meisenheimer, 1908</p> <p>butyric ac., butyl alc., caproic ac., caprylic ac. Neuberg and Arinstein, 1921</p> <p>n-amyl alc., n-butyl alc., n-propyl alc. Morin, 1887</p> <p>butyl alc. Emmerling, 1897</p> <p>butyl alc., butyric ac., lactic ac. Fitz, 1882</p>
<p><i>B. butyricus</i> (See <i>B. amylobacter</i>)</p>	
<p><i>B. casei</i> dextrose</p>	<p>lactic ac. Virtanen and Karström, 1928</p>
<p><i>B. casei</i> lactic ac., succinic ac.</p>	<p>acetic ac., propionic ac. Orla-Jensen, 1904</p>
<p><i>B. casei E.</i> sucrose</p>	<p>i-lactic ac. Virtanen, Wichmann and Lind- ström, 1927</p>
<p><i>B. caucasicus</i> (See <i>Bact. caucasicum</i>)</p>	
<p><i>B. cellulosa dissolvens</i> cellulose</p>	<p>acetic ac., butyric ac., CO₂, ethyl alc., H₂ Khouvine, 1923</p>

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<p><i>B. cloacae</i> arabinose, galactose, isodulcitate, levulose, mannose dextrose, mannitol</p> <p>dextrose</p> <p>dextrose, mannitol</p>	<p>acetylmethyl carbinol Harden and Norris, 1912</p> <p>acetylmethyl carbinol, 2, 3-butylene glycol Thompson, 1912</p> <p>acetylmethyl carbinol, 2, 3-butylene glycol, CO₂, ethyl alc., formic ac., H₂, lactic ac. Scheffer, 1928</p> <p>acetic ac., ethyl alc., CO₂, formic ac., lactic ac., succinic ac. Thompson, 1912</p>
<p><i>B. coli</i> (See also <i>Bact. coli</i>) (See also <i>Bact. coli communis</i>) dextrose</p> <p>dextrose</p> <p>dextrose</p> <p>dextrose, galactose, lactose, mannitol, mannose, sucrose dextrose, mannitol</p> <p>dextrose</p> <p>dextrose</p>	<p>pyruvic ac. Aubel, 1926</p> <p>acetic ac., ethyl alc., l-lactic ac., succinic ac. Grimbert, 1896</p> <p>acetic ac., CO₂, ethyl alc., formic ac., H₂, lactic ac., succinic ac. Scheffer, 1928</p> <p>lactic ac. Péré, 1898</p> <p>acetic ac., ethyl alc., formic ac., lactic ac., succinic ac. Thompson, 1912</p> <p>acetic ac., CO₂, ethyl alc., formic ac., H₂, lactic ac., succinic ac. Virtanen and Simola, 1927</p> <p>lactic ac. Neuberg and Gorr, 1926</p>

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. coli</i> (cont.)	
lactose	acetic ac., ethyl alc., l-lactic ac., succinic ac. Grimbert, 1896
malic ac.	fumaric ac. Quastel and Whetham, 1924
methylglyoxal	lactic ac. Neuberg and Gorr, 1926
pyruvic ac.	acetic ac., formic ac., glycollic ac., lactic ac. Cambier and Aubel, 1922
succinic ac.	fumaric ac. Quastel and Whetham, 1924
sucrose	lactic ac., methylglyoxal Virtanen and Simola, 1927
<i>B. coli communis</i>	
(See also <i>B. coli</i>)	
(See also <i>Bact. coli</i>)	
(See also <i>Bact. coli communis</i>)	
arabinose, dextrose, d-galac- tose, levulose, mannitol	acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac. Harden, 1901
citric ac.	acetic ac., CO ₂ , ethyl alc., succinic ac. Grey, 1923
dextrose	acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Grey, 1918
dextrose	acetaldehyde Grey, 1913
dextrose	acetic ac., CO ₂ , H ₂ , ethyl alc., lactic ac. Harden, 1899
dextrose	acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Grey, 1920

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. coli communis</i> (cont.)	
dextrose	acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Grey and Young, 1921
dextrose	acetic ac., lactic ac., succinic ac. Young, 1924
dextrose, mannitol	acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac. Grey, 1918
dextrose	formic ac. Franzen and Kahlenberg, 1916
dextrose	l-lactic ac. Kimura, 1928
dextrose	CO ₂ , lactic ac. Goto, 1925
dextrose, gluconic ac., mannitol, saccharic ac.	acetic ac., formic ac., succinic ac. Kay, 1926
formic ac.	CO ₂ , H ₂ Franzen and Kahlenberg, 1916
fumaric ac.	succinic ac. Quastel, Stephenson and Whetham, 1925
glucosamine	d-lactic ac. Kimura, 1928
glycerol	acetic ac., CO ₂ , ethyl alc., formic ac., lactic ac., succinic ac. Grey, 1923
lactic ac.	pyruvic ac. Quastel, Stephenson and Whetham, 1925
malic ac.	succinic ac., fumaric ac. Quastel and Whetham, 1924
malic ac.	acetic ac., ethyl alc., succinic ac. Grey, 1923
malonic ac.	acetic ac. Grey, 1923

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. coli communis</i> (cont.) succinic ac. tartaric ac.	acetic ac., formic ac., H ₂ Grey, 1923 acetic ac., ethyl alc., succinic ac. Grey, 1923
<i>B. cylindrosporus</i> (See <i>B. lactis</i>)	
<i>B. Delbrücki</i> dextrin, dextrose, maltose, sucrose methylglyoxal phenylglyoxal	l-lactic ac. Henneberg, 1903 d,l-lactic ac. Henneberg, 1903 d-mandelic ac. Henneberg, 1903
<i>B. dioxyaceticum</i> glycerol	dihydroxyacetone Virtanen and Barlund, 1926
<i>B. dysenteriae</i> , Shiga-Kruse dextrose dextrose	acetic ac., ethyl alc., formic ac., lactic ac., succinic ac. Scheffer, 1928 acetic ac., acetaldehyde, ethyl alc., formic ac., succinic ac. Bergh, 1928
<i>B. ethaceticus</i> arabinose dextrose, mannitol glycerol, mannitol mannitol	acetic ac., ethyl alc., formic ac., succinic ac. Frankland and MacGregor, 1892 acetic ac., CO ₂ , ethyl alc., H ₂ Frankland and Lumsden, 1892 acetic ac., ethyl alc., formic ac., succinic ac. Frankland and Fox, 1889 acetic ac., ethyl alc. Frankland, Stanley and Frew, 1891

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. ethacetosuccinicus</i> lactic ac. dulcitol, mannitol	acetic ac., ethyl alc., formic ac. Mazé, 1913 acetic ac., CO ₂ , ethyl alc., H ₂ , succinic ac. Frankland and Frew, 1892
<i>B. fluorescens</i> malic ac.	pyruvic ac. Beijerinck and Folpmers, 1916
<i>B. Freundii</i> (See also <i>Bact. Freundii</i>) dextrose	acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Scheffer, 1923
<i>B. globigii</i> (See <i>B. mesentericus ruber</i> as a possible synonym)	
<i>B. granulobacter pectinovorum</i> (See also <i>B. amylobacter</i>) (See also <i>B. butylicus</i>) (See also <i>B. butyricum</i>) (See also <i>Cl. pastorianum</i>)	
<i>B. granulobacter pectinovorum</i> arabinose, dextrose galactose, mannitol, starch, xylose arabinose, xylose	acetic ac., acetone, butyl alc., butyric ac., lactic ac. Speakman, 1923 acetone, butyl alc., CO ₂ Peterson, Fred and Schmidt, 1924
<i>B. granulobacter pectinovorum</i> Weizmann dextrose	acetic ac., acetylmethyl carbinol, acetone, butyl alc., butyric ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac. Donker, 1926

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. graveolens</i> (See <i>B. mesentericus-culgatus</i> as a possible synonym)	
<i>B. güntneri</i> dextrose	acetic ac., lactic ac. Hucker, 1928
<i>B. herbicola aurem</i> arabinose, xylose	CO ₂ Fred, Peterson and Anderson, 1923
<i>B. industrium</i> acetic ac., dextrose, ery- thritol, ethylene glycol, isolichenin, mannitol	oxalic ac. Banning, 1902
<i>B. invertenti-acetici</i> sucrose	acetic ac., acetone, ethyl alc., lactic ac. Mezzadrolì, 1917
<i>B. invertenti-lattici</i> sucrose	acetic ac., lactic ac. Mezzadrolì, 1917
<i>B. Kützingianum</i> arabinose, dextrin, dextrose, ethylene glycol, galactose, glycollic ac., isobutyric ac., isolichenin, lactic ac., malonic ac.	oxalic ac. Banning, 1902
acetic ac.	CO ₂ , Seifert, 1897
acetic ac.	CO ₂ , Mayer, 1898
butyl alc.	butyric ac. Seifert, 1897

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. Kützingianum</i> (cont.) butyl alc. dextrose dextrose ethyl alc. ethylene glycol ethylene glycol propyl alc.	butyric ac. Mayer, 1898 gluconic ac. Seifert, 1897 gluconic ac. Mayer, 1898 acetic ac. Mayer, 1898 glycollic ac. Seifert, 1897 glycollic ac. Mayer, 1898 propionic ac. Mayer, 1898
<i>B. lactis</i> i-inositol	acetic ac., ethyl alc., CO ₂ , succinic ac. Hewitt and Steabben, 1921
<i>B. lactis acidi</i> dextrin, dextrose, maltose, sucrose lactose	l-lactic ac. Henneberg, 1903 d-lactic ac. Henneberg, 1903
<i>B. lactis aerogenes</i> acetaldehyde adonitol, mannitol arabinose, dextrose, galactose, isodulcitol, mannose dextrose	acetic ac., 2, 3-butylene glycol, succinic ac. Harden and Norris, 1912 acetylmethyl carbinol, 2, 3-butylene glycol Harden and Norris, 1912 acetylmethyl carbinol, 2, 3-butylene glycol Harden and Norris, 1912 acetaldehyde Kumagawa, 1922

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. lactis aerogenes</i> (cont.) dextrose	acetaldehyde, acetylmethyl carbinol, 2, 3-butylene glycol Neuberg, Nord and Wolff, 1920
dextrose	acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Virtanen and Simola, 1927
dextrose, gluconic ac., mannitol, saccharic ac.,	acetic ac., acetylmethyl carbinol, ethyl alc., formic ac., succinic ac. Kay, 1926
dextrose, mannitol	acetic ac., ethyl alc., formic ac., succinic ac. Thompson, 1912
dextrose	acetylmethyl carbinol, 2, 3-butylene glycol Neuberg, Nord and Wolff, 1920
dextrose, levulose	acetylmethyl carbinol, 2, 3-butylene glycol Walpole, 1911
dextrose, mannitol	acetic ac., acetylmethyl carbinol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Harden and Walpole, 1906
ethylene glycol, glycerol	2, 3-butylene glycol Harden and Norris, 1912
galactose, gluconic ac., glyceric ac., lactic ac., lactose, levulose, maltose, sucrose glycerol	acetaldehyde Nagai, 1923 acetic ac., 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Harden and Norris, 1912

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. lactic aerogens</i> (cont.) glycerol inositol lactose malic ac. xylose	acetaldehyde Kumagawa, 1922 acetaldehyde, lactic ac., CO ₂ , succinic ac. Kumagawa, 1922 acetic ac., succinic ac. Emmerling, 1900 acetic ac., succinic ac. Emmerling, 1899 acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac. Fred and Peterson, 1920
<i>B. macerans</i> starch, sucrose	acetone, ethyl alc. Bakonyi, 1926
<i>B.</i> of malignant oedema dextrose	i-lactic ac., ethyl alc. Kerry and Frankel, 1890
<i>B. mesentericus-ruber</i> lactic ac.	2, 3-butylene glycol Lemoigne, 1913
<i>B. mesentericus vulgatus</i> dextrose mannitol	acetylmethyl carbinol Harden and Norris, 1912 acetylmethyl carbinol Harden and Norris, 1912
<i>B. mobilis</i> lactic ac.	acetic ac., propionic ac. Jensen, 1904
<i>B. orthobutylicus</i> (Grimbert) (See <i>Cl. butyricum</i>) (See <i>B. Granulobacter butyricum</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. oxydans</i> acetic ac., dextrose, erythritol, ethylene glycol, glycerol, levulose	oxalic ac. Banning, 1902
<i>B. paratyphoid B</i> xylose	acetic ac., butyric ac., CO ₂ , ethyl alc., formic ac., lactic ac., succinic ac. Fred and Peterson, 1920
<i>B. paratyphosus B</i> (See <i>B. paratyphoid B</i>)	
<i>B. pasteurianum</i> acetic ac.	CO ₂ Seifert, 1897
acetic ac.	CO ₂ Mayer, 1898
butyl alc.	butyric ac. Seifert, 1897
dextrin, dextrose, ethylene glycol, glycerol, glycollic ac., isobutyric ac., malonic ac., sucrose	oxalic ac. Banning, 1902
dextrose	gluconic ac. Mayer, 1898
dextrose	gluconic ac. Seifert, 1897
ethyl alc.	acetic ac. Mayer, 1898
ethylene glycol	glycollic ac. Seifert, 1897
ethylene glycol	glycollic ac. Mayer, 1898
propyl alc.	propionic ac. Mayer, 1898

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. polymyxa</i> dextrose	acetic ac., acetylmethyl carbinol, acetone, butyl alc., 2, 3- butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac. Donker, 1926
<i>B. prodigiosus</i> dextrose	l-lactic ac. Kimura, 1928
dextrose	formic ac. Franzen and Egger, 1912
glucosamine	l-lactic ac. Kimura, 1928
<i>B. propionicus</i> dextrose	lactic ac. Neuberg and Gorr, 1926
methylglyoxal	lactic ac. Neuberg and Gorr, 1926
<i>B. proteus</i> dextrose	acetylmethyl carbinol, 2, 3-buty- lene glycol Lemoigne, 1923
<i>B. proteus vulgatus</i> pyruvic ac.	acetic ac., lactic ac., glycollic ac. Cambier and Aubel, 1922
<i>B. pyocyaneus</i> (See also <i>Bact. pyocyaneus</i>) acetaldehyde	acetic ac. Supniewski, 1923
acetic ac.	formaldehyde, formic ac. Supniewski, 1923
acetone	acetic ac., formic ac. Supniewski, 1923
ethyl alc.	acetaldehyde, acetic ac. Supniewski, 1923

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. pyocyaneus</i> (cont.)	
fumaric ac.	acetic ac., pyruvic ac. Quastel, 1924
fumaric ac.	pyruvic ac. Quastel, Stephenson and Whetham, 1925
glycerol	CO ₂ , glyceric ac., lactic ac. Supniewski, 1923
lactic ac.	acetaldehyde, acetic ac., pyruvic ac. Supniewski, 1923
lactic ac.	pyruvic ac. Quastel, Stephenson and Whetham, 1925
methyl alc.	formic ac. Supniewski, 1923
pyruvic ac.	acetic ac., formic ac. Cambier and Aubel, 1922
pyruvic ac.	lactic ac. Aubel, 1924
succinic ac.	propionic ac. Quastel, 1924
<i>B. spongiosus</i> raffinose, sucrose	arabin Ruhland, 1906
<i>B. suaveolens</i> starch	acetaldehyde, acetic ac., butyric ac., ethyl alc., formic ac. Selavo and Gosio, 1891
succinic ac.	fumaric ac. Quastel and Whetham, 1924
<i>B. subtilis</i> dextrose	acetylmethyl carbinol Harden and Norris, 1912
dextrose	d- or dl-lactic ac. Kimura, 1928

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. subtilis</i> (cont.) dextrose	butyric ac., CO ₂ , lactic ac., H ₂ , mannitol Vandevelde, 1884
glucosamine	l-lactic ac. Kimura, 1928
glycerol	butyric ac., lactic ac., succinic ac. Vandevelde, 1884
glycerol	pyruvic ac. Aubel, 1921
lactic ac.	acetylmethyl carbinol, 2, 3-buty- lene glycol Lemoigne, 1923
mannitol	acetylmethyl carbinol Harden and Norris, 1912
starch	acetic ac., butyric ac., ethyl alc., succinic ac. Fitz, 1878
sucrose	acetylmethyl carbinol, 2, 3-buty- lene glycol Lemoigne, 1912
<i>B. tarbellicus</i> (See <i>Thermobacillus tarbellicus</i>)	
<i>B. tartricus</i> dextrose, lactose, maltose, mannitol, sucrose	acetic ac., acetylmethyl carbinol, CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac. Grimbert, 1901
tartaric ac.	acetic ac., CO ₂ , H ₂ , succinic ac. Grimbert, 1898
<i>B. thermoamylolyticus</i> starch	maltose Coolhaas, 1928
<i>B. thermobutyricus</i> dextrose	butyric ac. Coolhaas, 1928

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. typhosum</i> dextrose	acetic ac., ethyl alc., formic ac., lactic ac., succinic ac. Scheffer, 1928
<i>B. typhosus</i> dextrose xylose	acetic ac., formic ac., ethyl alc., lactic ac., succinic ac. Harden, 1901 acetic ac., butyric ac., ethyl alc., formic ac., lactic ac., succinic ac. Fred and Peterson, 1920
<i>B. vulgatus</i> sucrose xylose	gum levan Owen, 1923 acetone, CO ₂ Fred, Peterson and Anderson, 1923
<i>B. welchii</i> glycerol	acrolein Humphreys, 1924
<i>B. xylinum</i> (See <i>Acetobacter xylinum</i>) (See also <i>Bact. xylinum</i>) arabinose, dextrose, glycerol, levulose, rhamnose dextrose glycerol glycerol glycerol glycerol	oxalic ac. Banning, 1902 gluconic ac., ketogluconic ac. Bernhauer and Schön, 1929 dihydroxyacetone Bertrand and Sazerac, 1901 dihydroxyacetone Brit. patent 269,950 dihydroxyacetone Virtanen and Barlund, 1926 dihydroxyacetone Bernhauer and Schön, 1928

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>B. xylinum</i> (cont.) α -ketoglutaric ac.	succinic ac. Iwatsuru, 1925
mannitol	levulose Hoyer, 1898
methylethylacetaldehyde	i-amyl alc., i-valeric ac. Neuberg and Simon, 1926
sorbitol	sorbose Seifert, 1897
sorbitol	sorbose Hoyer, 1898
sorbitol	sorbose Mayer, 1898
<i>Bact. aceti</i>	
(See also <i>Mycoderma aceti</i>)	
dextrose	gluconic ac. Brown, 1886
ethyl alc.	acetic ac. Brown, 1886
propyl alc.	propionic ac. Brown, 1886
<i>Bact. acidi propionici</i> var. <i>fuscum</i>	
(See also <i>Propionibacterium</i>	
<i>Freudenreichii</i>)	
(See also <i>Bact. acidi propionici</i>	
a)	
<i>Bact. acidi propionici</i> a	
(See also <i>Bact. acidi propionici</i>	
var. <i>fuscum</i>)	
(See also <i>Propionibacterium</i>	
<i>Freudenreichii</i>)	
<i>Bact. acidi propionici</i> var. <i>fuscum</i>	
dextrose, lactic ac., lactose,	acetic ac., propionic ac., succinic ac.
pyruvic ac.	Virtanen, 1923

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Bact. acidi propionici a</i> lactic ac.	acetic ac., propionic ac., CO ₂ von Freudenreich and Jensen, 1906
<i>Bact. acidi propionici b</i> (See also <i>Propionibacterium</i> <i>Jensenii</i>)	
<i>Bact. acidi propionici b</i> lactic ac.	acetic ac., CO ₂ , propionic ac. von Freudenreich and Jensen, 1906
<i>Bact. acidi propionici c</i> (See <i>Propionibacterium</i> <i>Peterssonii</i>)	
<i>Bact. acidi propionici d</i> (See also <i>Propionibacterium</i> <i>Shermanii</i>)	
<i>Bact. acidi propionici d</i> lactose	acetic ac., propionic ac. Sherman and Shaw, 1923
<i>Bact. acidi propionici var. rubrum</i> (See <i>Propionibacterium rubrum</i>) (See <i>Propionibacterium Thonii</i>)	
<i>Bact. aerogenes</i> (See also <i>B. lactis aerogenes</i>)	
<i>Bact. aerogenes</i> glycerol	acetic ac., 2-3 butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Braak, 1928

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Bact. ascendens</i> acetaldol phenylglyoxal	β -butylene glycol, β -oxybutyric ac. Binder-Kotrba, 1926 d-mandelic ac. Mayer, 1926
<i>Bact. caucasicum</i> lactose	lactic ac., methyl glyoxal, pyruvic ac. Kostytschew and Soldatenkov, 1927
<i>Bact. cellaresolvens</i> cellulose	acetic ac., butyric ac., cellobiose lactic ac. Groenewege, 1923
<i>Bact. cloacae</i> (See <i>B. cloacae</i>)	
<i>Bact. coli</i> (See also <i>B. coli</i>) (See also <i>B. coli communis</i>) (See also <i>Bact. coli communis</i>)	
<i>Bact. coli</i> galactose, lactose, levulose, malic ac., maltose, sucrose, tartaric ac. glycerol methyl glyoxal pyruvic ac.	acetaldehyde Nagai, 1923 acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Braak, 1928 lactic ac. Neuberg and Gorr, 1925 acetic ac., CO ₂ , formic ac., glycollic ac., H ₂ , i-lactic ac., propionic ac. Aubel, 1924

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Bact. dysenteriae</i> Shiga-Kruse (See <i>B. dysenteriae</i>)	
<i>Bact. Freundii</i> glycerol	acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., tri- methylene glycol, succinic ac. Braak, 1928
<i>Bact. gluconium</i> dextrose	gluconic ac. Hermann, 1929
gluconic ac.	5-keto-gluconic ac. Hermann, 1929
levulose	5-keto-gluconic ac. Hermann, 1929
<i>Bact. lactis acidi</i> dextrose, lactose, maltose	i-lactic ac. Henneberg, 1903
<i>Bact. lactis aerogenes</i> (See also <i>B. lactis aerogenes</i>)	
<i>Bact. lactis aerogenes</i> methylglyoxal	d, l-lactic ac. Neuberg and Simon, 1927
phenylglyoxal	l-mandelic ac. Neuberg and Simon, 1927
<i>Bact. opalescens</i> cellulose	acetic ac., butyric ac., cellobiose, lactic ac. Groenewege, 1923
<i>Bact. pasteurianum</i> (See also under <i>Acetobacter</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Bact. pasteurianum</i> d-l-methyl-ethyl acetaldehyde methylglyoxal	d-amyl alc., valeric ac. Neuberg and Simon, 1926 d-l-lactic ac. Gorr and Perlmann, 1926
<i>Bact. pyocyaneum</i> (See <i>B. pyocyaneus</i>) (See <i>Bact. pyocyaneus</i>)	
<i>Bact. pyocyaneus</i> (See also <i>B. pyocyaneus</i>)	
<i>Bact. pyocyaneus</i> dextrose levulose	acetic ac., ethyl alc., formic ac. Aubel, 1921 acetic ac., ethyl alc., formic ac., lactic ac. Aubel, 1921
<i>Bact. suipestifer</i> citric ac.	acetic ac., CO ₂ , succinic ac. Brown, Duncan and Henry, 1924
<i>Bact. termo</i> d-propylene glycol tartaric ac.	lactic ac., propionic ac. LeBel, 1881 acetic ac., propionic ac., succinic ac. König, 1881
<i>Bact. thermoamylolyticum</i> dextrose, sucrose	acetic ac., butyric ac., CO ₂ , H ₂ , propionic ac. Coolhaas, 1928
<i>Bact. xylinum</i> (See also <i>Acetobacter xylinum</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Bact. xylinum</i> dextrose, levulose, mannitol	cellulose Brown, 1886
glycerol	dihydroxyacetone Bernhauer and Schön, 1928
d-perseite	perseulose Bertrand, 1909
<i>Cellulomonas cellaresolvens</i> (See <i>B. cellaresolvens</i>)	
<i>Cellulomonas cellulosa-dissolvens</i> (See <i>Bact. opalescens</i>)	
<i>Cellulomonas opalescens</i> (See <i>Bact. opalescens</i>)	
<i>Citromyces sp.?</i> arabinose, glycerol, lactose, mannose, sucrose, xylose	citric ac. Wehmer, 1913
citric ac.	CO ₂ Buchner and Wüstenfeld, 1909
dextrose	citric ac. Martin, 1916
dextrose	citric ac. Buchner and Wüstenfeld, 1909
dextrose	citric ac. Mazé and Perrier, 1904
ethyl alc.	citric ac., oxalic ac. Mazé and Perrier, 1904
glycerol	citric ac. Mazé and Perrier, 1904
sucrose	citric ac. Filosofov and Malinovski, 1928
sucrose	citric ac. Mazé, 1909

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Citromyces</i> sp.? (cont.) sucrose	citric ac., oxalic ac., Butkewitsch, 1922
<i>Citromyces glaber</i> arabinose, glycerol, mannitol, sucrose citric ac. dextrose quinic ac. sucrose sucrose	citric ac., oxalic ac. Butkewitsch, 1923 oxalic ac. Butkewitsch, 1922 citric ac. Butkewitsch, 1922 protocatechuic ac., pyrocatechol Butkewitsch, 1924 citric ac., gluconic ac. Butkewitsch, 1927 citric ac., oxalic ac. Butkewitsch, 1922
<i>Citromyces lacticus</i> dextrose	citric ac. Mazé and Perrier, 1904
<i>Citromyces oxalicus</i> dextrose	citric ac. Mazé and Perrier, 1904
<i>Citromyces Pfefferianus</i> dextrose sucrose	citric ac. Buchner and Wüstenfeld, 1909 citric ac., oxalic ac. Butkewitsch, 1922
<i>Citromyces tarticus</i> dextrose ethyl alc.	citric ac. Mazé and Perrier, 1904 citric ac., oxalic ac. Mazé and Perrier, 1904
<i>Cladosporium</i> , sp.? phloridzin	dextrose, phloroglucinol Boas, 1916

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Clostridium acetobutylicum</i> starch	acetone, butyl alc., CO ₂ , ethyl alc., H ₂ Killeffer, 1927
<i>Clostridium butyricum</i> (See <i>B. amylobacter</i>)	
<i>Clostridium oedematis-maligni</i> (See bacillus of malignant oedema)	
<i>Clostridium pasteurianum</i> dextrose	acetic ac., acetone, 2, 3-buty- lene glycol, butyric ac., CO ₂ , ethyl alc., formic ac., H ₂ Donker, 1926
<i>Clostridium pastorianum</i> (See also <i>B. amylobacter</i>) (See also <i>B. granulobacter pec- tinovorum</i>)	
<i>Clostridium pastorianum</i> dextrose	acetic ac., butyric ac. Winogradsky, 1902
<i>Clostridium polymyxa</i> (Prazmow- ski) (See <i>B. polymyxa</i>)	
<i>Clostridium thermocellum</i> dextrose, levulose cellulose	d-lactic ac. Peterson, Fred and Marten, 1925 acetic ac., butyric ac., CO ₂ , ethyl alc., H ₂ Viljoen, Fred and Peterson, 1926

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Clostridium Welchii</i> (See <i>B. Welchii</i>)	
<i>Diplococcus pneumoniae</i> dextrose	acetic ac., propionic ac. Brieger, 1883
<i>Eberthella dysenteriae</i> (See <i>B. dysenteriae</i>)	
<i>Eberthella typhi</i> (See <i>B. typhosus</i>) (See <i>B. typhosum</i>)	
<i>Encapsulatus pneumoniae</i> (See Friedländer's pneumo- bacillus)	
<i>Erythrobacillus prodigiosus</i> (See <i>B. prodigiosus</i>)	
<i>Escherichia coli</i> (See <i>B. coli</i>) (See <i>Bact. coli</i>) (See <i>B. coli communis</i>) (See <i>Bact. coli communis</i>)	
Friedländer's pneumococcus dextrose	acetic ac., ethyl alc., formic ac. Frankland, Stanley and Frew, 1891
mannitol	acetic ac., ethyl alc. Frankland, Stanley and Frew, 1891
<i>Fusarium lini</i> dextrose	CO ₂ , ethyl alc. Anderson and Willaman, 1922

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Granulobacter butylicum</i> (See also <i>B. amylobacter</i>) (See also <i>Cl. butyricum</i>)	
<i>Granulobacter saccharobutyricum</i> dextrose	acetic ac., 2, 3-butylene glycol, butyric ac., CO ₂ , formic ac., H ₂ , lactic ac. Donker, 1926
<i>Granulobacterium butylicum</i> starch	ethyl alc., iso-butyl alc., n-butyl alc., iso-propyl alc., propyl alc. Folpmers, 1921
<i>Klebsiella pneumoniae</i> (See Friedländer's pneumo- bacillus)	
<i>Lactobacillus</i> , sp.? dextrose methylglyoxal	lactic ac. Neuberg and Gorr, 1926 lactic ac. Neuberg and Gorr, 1926
<i>Lactobacillus arabinosus</i> arabinose	acetic ac., lactic ac. Fred, Peterson and Anderson, 1921
<i>Lactobacillus berolinensis</i> (See <i>Saccharobacillus pastori-</i> <i>anus var. berolinensis</i>)	
<i>Lactobacillus casei</i> (See <i>B. casei</i>)	
<i>Lactobacillus caucasicus</i> (See <i>Bact. caucasicum</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Lactobacillus Delbrücki</i> (See <i>B. Delbrücki</i>)	
<i>Lactobacillus leichmanni</i> dextrose dextrose, galactose, lactose, levulose	l-lactic ac. Allgeier and Peterson, 1930 l-lactic ac. Fred, Peterson and Stiles, 1925
<i>Lactobacillus pentoaceticus</i> arabinose, xylose dextrose, galactose, lactic ac., mannose levulose malic ac., mannitol pyruvic ac. xylose	acetic ac., lactic ac. Fred, Peterson and Anderson, 1921 acetic ac., ethyl alc., lactic ac. Peterson and Fred, 1920 acetic ac., CO ₂ , lactic ac., man- nitol Peterson and Fred, 1920 acetic ac., lactic ac. Peterson and Fred, 1920 acetic ac., acetaldehyde, CO ₂ , H ₂ Peterson and Fred, 1920 acetic ac., i-lactic ac. Fred, Peterson and Daven- port, 1919
<i>Lactobacillus pentosus</i> arabinose, xylose	acetic ac., lactic ac. Fred, Peterson and Anderson, 1921
<i>Lactobacillus</i> , sp.? phenylglyoxal	l-mandelic ac. Mayer, 1926
<i>Liquidobacterium prodigiosum</i> (See <i>B. prodigiosus</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Micrococcus casei liquifaciens</i> lactic ac., succinic ac. lactic ac.	acetic ac., Orla-Jensen, 1904 acetic ac., propionic ac. Orla-Jensen, 1904
<i>Micrococcus climicus</i> quinic ac.	protocatechuic ac. Emmerling and Abderhalden, 1903
<i>Micrococcus oblongus</i> dextrose	oxygluconic ac. Boutroux, 1886
<i>Monilia candida</i> dextrose pyruvic ac.	acetaldehyde Cohen, 1920 acetaldehyde Nagayama, 1921
<i>Mucor circinelloides</i> (?) dextrin, starch	ethyl alc. Gayon and Dubourg, 1886
<i>Mucor mucedo</i> dextrose, sucrose sucrose	ethyl alc. Kostytschew and Eliasberg, 1920 ethyl alc., succinic ac. Fitz, 1873
<i>Mucor piriformis</i> dextrose	citric ac. Wehmer, 1897
<i>Mucor plumbeus</i> pyruvic ac.	acetaldehyde Nagayama, 1921
<i>Mucor racemosus</i> dextrose	acetaldehyde Cohen, 1920

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Mucor racemosus</i> (cont.)	
dextrose, sucrose	ethyl alc. Kostytschew and Eliasberg, 1920
glycerol	butyl alc., butyric ac., caproic ac., CO ₂ , ethyl alc., H ₂ Fitz, 1876
pyruvic ac.	acetaldehyde Nagayama, 1921
sucrose	ethyl alc. Fitz, 1876
sucrose	ethyl alc., glycerol, succinic ac. Emmerling, 1897
<i>Mucor Rouxii</i>	
dextrose	acetaldehyde Cohen, 1920
pyruvic ac.	acetaldehyde Nagayama, 1921
<i>Mucor stolonifer</i>	
(See also <i>Rhizopus nigricans</i>)	
<i>Mucor stolonifer</i>	
dextrose, sucrose	ethyl alc. Kostytschew and Eliasberg, 1920
<i>Mycoderma aceti</i>	
(See also <i>Bact. aceti</i>)	
<i>Mycoderma aceti</i>	
dextrose	gluconic ac. Boutroux, 1880
d-1-propylene glycol	acetylcarbinol Kling, 1901
2, 3-butylene glycol	acetylmethyl carbinol Kling, 1905

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Mycoderma</i> sp.? dextrose	pyruvic ac. Fernbach and Schoen, 1914
<i>Oidium albicans</i> lactic ac.	pyruvic ac. Mazé and Ruot, 1917
<i>Oidium farinosum</i> lactic ac.	pyruvic ac. Mazé and Ruot, 1917
<i>Oidium guerdali</i> lactic ac.	pyruvic ac. Mazé and Ruot, 1917
<i>Oidium lactis</i> dextrose pyruvic ac.	acetaldehyde Cohen, 1920 acetaldehyde Nagayama, 1921
<i>Oidium lupuli</i> dextrose	acetaldehyde, acetic ac., ethyl alc., succinic ac. Sumiki, 1927
<i>Oidium tenuis</i> lactic ac.	pyruvic ac. Mazé and Ruot, 1917
<i>Pectinobacter amylophilum</i> starch	acetic ac., butyl alc., formic ac., lactic ac., succinic ac. Makrinov, 1915
<i>Penicillium glaucum</i> oleic ac.	keto-stearic ac. Pigulewski and Charik, 1928
sucrose	citric ac., gluconic ac. Butkewitsch, 1927
sucrose	ethyl alc. Kostytschew and Afanassjewa, 1922
sucrose	citric ac., oxalic ac. Butkewitsch, 1922

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Penicillium luteum</i> dextrose	citric ac. Wehmer, 1897
<i>Penicillium purpurogenum</i> dextrose	gluconic ac. May, Thom and Church, 1927
dextrose	gluconic ac. Herrick and May, 1928
Pneumobacillus of Friedländer arabinose	acetic ac., l-lactic ac. Grimbert, 1896
dulcitol	acetic ac., ethyl alc., succinic ac. Grimbert, 1896
mannitol	acetic ac., ethyl alc., succinic ac. Grimbert, 1896
xylose	acetic ac., ethyl alc., l-lactic ac., succinic ac. Grimbert, 1896
<i>Propionibacterium Freudenreichii</i> (See also <i>Bact. acidi propionici</i> <i>a</i>) (See also <i>Bact. acidi propionici</i> <i>var. fuscum</i>)	
<i>Propionibacterium Freudenreichii</i> dextrose, glycerol, lactic ac.	acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Propionibacterium Jensenii</i> (See also <i>Bact. acidi propionici b</i>)	
<i>Propionibacterium Jensenii</i> dextrose, glycerol, lactic ac., pyruvic ac.	acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Propionibacterium pentosaceum</i> (See <i>Bacillus acidi propionici</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Propionibacterium pentosaceum</i> arabinose, dextrose, glycerol, lactic ac., starch, xylose dextrose, glycerol, lactic ac.	acetic ac., CO ₂ , propionic ac. Werkman, Hixon, Fulmer and Rayburn, 1929 acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Propionibacterium Peterssonii</i> (See also <i>Bact. acidi propionici</i> <i>c</i>)	
<i>Propionibacterium Peterssonii</i> dextrose, glycerol, lactic ac.	acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Propionibacterium rubrum</i> (See also <i>Bact. acidi propionici</i> <i>var. rubrum</i>)	
<i>Propionibacterium rubrum</i> dextrose, lactic ac.	acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Propionibacterium Shermanii</i> (See also <i>Bact. acidi propionici</i> <i>d</i>)	
<i>Propionibacterium Shermanii</i> dextrose, glycerol, lactic ac.	acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Propionibacterium technicum</i> dextrose, glycerol, lactic ac., pyruvic ac., starch	acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Propionibacterium Thönii</i> , (See also <i>Bact. acidi propionici</i> <i>var. rubrum</i>)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Propionibacterium Thönii</i> dextrose, glycerol, lactic ac.	acetic ac., CO ₂ , propionic ac., succinic ac. van Niel, 1928
<i>Pseudomonas aeruginosa</i> (See also <i>B. pyocyaneus</i>) dextrose	acetaldehyde, ethyl alc. Nill, 1927
<i>Rhizopus</i> , sp.? dextrose glycerol	ethyl alc. Takahashi and Sakaguchi, 1927 succinic ac. Takahashi and Sakaguchi, 1927
<i>Rhizopus chinensis</i> dextrose	l-lactic ac. Saito, 1911
<i>Rhizopus nigricans</i> (See also <i>Mucor stolonifer</i>)	
<i>Rhizopus nigricans</i> dextrose, levulose pyruvic ac. sucrose, (invert)	fumaric ac. Ehrlich, 1912 acetic ac., fumaric ac., lactic ac. Gottschalk, 1925 fumaric ac., oxalic ac. Butkewitsch, 1927
<i>Saccharobacillus pastorianus</i> var. <i>berolinensis</i> dextrin, sucrose	i-lactic ac. Henneberg, 1903
<i>Saccharomyces cerevisiae</i> (See also under yeast)	

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Sacc. cerevisiae</i> arabinose	CO ₂ , ethyl alc., glyceric aldehyde (?) Abbot, 1926
xylose	CO ₂ , ethyl alc., glyceric aldehyde (?) Abbot, 1926
<i>Sacc. ellipsoideus</i> sucrose	glycerol Adams, 1919
<i>Sacc. Ludwigii</i> dextrose	glycogen, CO ₂ Gottschalk, 1925
dihydroxyacetone	dextrose Neuberg and Kobel, 1928
<i>Sacc. Saké</i> starch	dihexosan, amylobiose Sjöberg, 1927
sucrose	acetaldehyde, acetic ac., ethyl alc., CO ₂ , glycerol Kumagawa, 1922
<i>Salmonella schottmülleri</i> (See <i>B. paratyphoid B</i>)	
<i>Salmonella suipestifer</i> (See <i>Bact. suipestifer</i>)	
<i>Sarcina</i> , sp.? starch	dextrin Glimm and Grimm, 1928
<i>Sarcina maxima</i> levulose	acetic ac., butyric ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Smit, 1928

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Sarcina ventriculi</i> dextrose	acetic ac., acetylmethyl carbinol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac. Smit, 1928
levulose	acetic ac., acetylmethyl carbinol, CO ₂ , ethyl alc., H ₂ , lactic ac. Smit, 1928
Schizomycetes, sp. (?) lactic ac.	propionic ac., valeric ac. Fitz, 1880
quinic ac.	acetic ac., formic ac., propionic ac., protocatechuic ac. Loew, 1881
<i>Serratia marcescens</i> (See also <i>B. prodigiosus</i>)	
<i>Serratia marcescens</i> dextrose	acetic ac., acetylmethyl carbinol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac. Pederson and Breed, 1928
Sorbose bacterium (See also <i>Acetobacter sorbose</i>)	
Sorbose bacterium arabinose	arabonic ac. Bertrand, 1898
arabitol	keto-sugar Bertrand, 1898
dextrose	gluconic ac. Bertrand, 1898
erythritol	erythrulose Bertrand, 1898, 1900

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Sorbose bacterium</i> (cont.)	
galactose	galactonic ac. Bertrand, 1898
α -glucoheptite	α -glucoheptulose Bertrand and Nitzberg, 1928
glycerol	dihydroxyacetone Bertrand, 1898
d-mannitol	levulose Bertrand, 1898
perseitol	keto-sugar Bertrand, 1898
d-sorbitol	sorbose Bertrand, 1898
valemite	keto-sugar Bertrand, 1898
xylose	xylonic ac. Bertrand, 1898
<i>Sterigmatocystis nigra</i>	
sucrose	citric ac., gluconic ac., oxalic ac. Molliard, 1922
<i>Streptococcus brevis</i>	
dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus cremoris</i>	
dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus fecalis</i>	
dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus hemolyticus</i>	
dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus hornensis</i>	
sucrose	dextrose Boekhout, 1900

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
<i>Streptococcus inulinareus</i> dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus lactis</i> dextrose dextrose sucrose	d-lactic ac. Allgeier and Peterson, 1930 acetic ac., lactic ac. Hucker, 1928 d-lactic ac. Virtanen, Wichmann and Lindström, 1927
<i>Streptococcus mitior</i> dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus paracitrovorus</i> dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus pyogenes</i> dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus stenos</i> dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Streptococcus viridans</i> dextrose	acetic ac., lactic ac. Hucker, 1928
<i>Thermobacterium aceti</i> acetic ac., arabinose, dextrose, ethylene glycol, galactose, glycerol, glycollic ac., lactic ac., malonic ac.	oxalic ac. Banning, 1902
<i>Thermobacillus tarbellicus</i> sucrose	lactic ac. Guittonneau, 1928
<i>Tyrothrix tenuis</i> dextrose, glycerol, mannitol	acetylmethyl carbinol Harden and Norris, 1912

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
Yeast (See also <i>Sacc. cerevisiae</i>)	
Yeast acetaldehyde	ethyl alc. Kostytschew and Hübbenet, 1912
acetaldehyde	ethyl alc., acetic ac. Kostytschew, 1914
acetaldehyde, sucrose	acetoin Neuberg and Simon, 1925
acetaldo	β -butyleneglycol Neuberg and Kerb, 1918
acetophenone, sucrose	l-phenylmethyl carbinol Neuberg and Nord, 1919
acetylmethyl carbinol	2, 3-butylene glycol Neuberg and Kobel, 1925
aldehydropropionic ac.	succinic ac. Neuberg and Ringer, 1918
benzaldehyde	benzyl alc. Neuberg and Welde, 1914
benzaldehyde	l-phenylacetyl carbinol Neuberg and Ohle, 1922
benzil	benzoin Neuberg and Nord, 1919
benzylpyruvic ac.	phenylpropylaldehyde Rona, 1914
isobutylaldehyde	isobutyl alc. Ohta, 1914
caproicaldehyde	n-hexyl alc. Neuberg and Nord, 1914
chlorobenzaldehyde	acetyl-chlorbenzyl carbinol, p- benzyl alc., chlorobenzoic ac., chlorobenzyl alc. Neuberg and Liebermann, 1921

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
Yeast (cont.)	
cinnamic aldehyde	cinnamic alc. Rona, 1914
citral	geraniol Neuberg and Kerb, 1918
d-citronellaldehyde	citronella oil or alc. Mayer and Neuberg, 1915
dextrose	acetaldehyde Kostytschew, 1912
dextrose, levulose	acetylmethyl carbinol, 2, 3-buty- lene glycol Kluyver, Donker and Hoof, 1925
dextrose, dioxyacetone, gly- ceraldehyde	lactic ac. Oppenheimer, 1913
dextrose	glycerol Oppenheimer, 1913
dextrose	lactic ac. Aubel, 1929
dextrose	pyruvic ac. Fernbach and Schoen, 1920
dextrose, sucrose	acetaldehyde, acetic ac., ethyl alc., glycerol Neuberg and Hirsch, 1919
dextrose with brucine	brucine pyruvate Traetta-Mosca, 1927
a. a. dichloracetone	a. a. dichlorpropyl alc. Sen, 1924
dihydroxymaleic ac.	CO ₂ , glycollic aldehyde Neuberg and Schwenk, 1915
enanthol	n-heptyl alc. Ohta, 1914
ethyl alc.	acetaldehyde Trillat and Sauton, 1908
ethyl disulfide	ethyl mercaptan Neuberg and Schwenk, 1915

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
Yeast (cont.)	
formaldehyde	methyl alc. Neuberg and Welde, 1914
furfural	furfuryl alc. Lintner and Liebig, 1911
furfural	furyltrimethyleneglycol Lintner and Liebig, 1913
galactose	acetaldehyde, glycerol Tomita, 1921
glyceric ac.	acetaldehyde, acetic ac., CO ₂ , ethyl alc. Lebedev, 1918
glyceric aldehyde, pyruvic ac.	acetaldehyde, acetic ac., ethyl alc. Lebedev and Polonski, 1917
glycerol, mannitol	ethyl alc., CO ₂ Kostytschew and Faermann, 1928
glycerol	ethyl alc. Neuberg and Kerb, 1913
glycolaldehyde	ethylene glycol Neuberg and Schwenk, 1915
glyoxylic ac.	acetaldehyde, CO ₂ Lebedev, 1918
hydroxyfumaric ac.	acetaldehyde, CO ₂ Mayer, 1913
hydroxypyruvic ac.	CO ₂ , glycolaldehyde Neuberg and Kerb, 1913
α -ketobutyric ac.	ethyl alc., propyl alc. Neuberg and Kerb, 1914
α -ketobutyric ac.	propionaldehyde Neuberg and Kerb, 1912
α -ketobutyric ac.	propionaldehyde, propyl alc. Neuberg and Kerb, 1913
α -keto-n-caprioc ac.	n-amyl alc., CO ₂ , o-methyl-cyclo- hexanol, n-valeraldehyde Sen, 1923

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
Yeast (cont.)	
ketoglutaric ac.	CO ₂ , succinic ac. Neuberg and Ringer, 1914
α-ketoisovaleric ac.	isobutyl aldehyde Sen, 1923
lactic ac.	ethyl alc., pyruvic ac. Kayser, 1923
lactose	acetaldehyde Trillat, 1908
levulose	acetylmethyl carbinol, 2, 3-butylene glycol Kluyver and Donker, 1924
malic ac.	lactic ac. Lebedev and Russ, 1916
mannose	ethyl alc. Mezzadrolì, 1918
methoxybenzaldehyde	methoxybenzoic ac. Neuberg and Liebermann, 1921
methyl-benzoyl-carbinol+ dextrose	methyl-phenyl-ethylene glycol Neuberg and Komarewsky, 1927
methylethyl ketone+sucrose	d-methylethyl carbinol Neuberg and Nord, 1919
methylethyl pyruvic ac.	amyl alc., methyl-ethyl acetaldehyde, valeric ac. Neuberg and Peterson, 1914
methyl-α-chlorethyl ketone	methyl-α-chlorethyl alc. Santomauro, 1924
methyl glyoxal	d-lactic ac. Neuberg and Kobel, 1927, 1929
methyl glyoxal	d-l-lactic ac. Neuberg, 1913
methyl glyoxal	lactic ac. Dakin and Dudley, 1913

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
Yeast (cont.)	
methyl-n-hexyl ketone	d-methyl hexyl carbinol Neuberg and Nord, 1919
methyl-nonyl ketone	d-methyl nonyl carbinol Neuberg and Nord, 1919
methyl-n-propyl ketone+ sucrose	methyl-n-propyl carbinol Neuberg and Nord, 1919
oxalacetic ac.	acetaldehyde, acetone, CO ₂ Neuberg and Gorr, 1925
oxalacetic ac.	acetaldehyde, CO ₂ Neuberg and Kerb, 1913
oxalacetic ac.	acetylmethyl carbinol, 2,3-buty- lene glycol, malic ac. Neuberg and Gorr, 1924
phenylacetaldehyde	phenylethyl alc. Neuberg and Welde, 1914
phenylglyoxal	mandelic ac. Dakin and Dudley, 1913
phenylglyoxalic ac.	benzaldehyde Binder-Kotrba, 1926
pyruvic ac.	acetaldehyde, CO ₂ Gottschalk, 1923
pyruvic ac.	acetaldehyde Neuberg and Reinfürth, 1920
pyruvic ac.	acetylmethyl carbinol Hirsch, 1922
pyruvic ac.	acetaldehyde, CO ₂ Neuberg and Kerb, 1912
pyruvic ac.	acetylmethyl carbinol, CO ₂ Neuberg and May, 1923
pyruvic ac.	aldol Neuberg, 1912
pyruvic ac.	ethyl alc. Neuberg and Kerb, 1913
pyruvic ac., sucrose	acetaldehyde Paris, 1922

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
Yeast (cont.)	
sucrose	acetaldehyde, ethyl alc., glycerol Gehle, 1922
sucrose	acetaldehyde, ethyl alc., glycerol Zerner, 1920
sucrose	acetaldehyde, glycerol Neuberg and Reinfürth, 1918
sucrose	acetic ac., malic ac., succinic ac. Kostytschew and Frey, 1925
sucrose	2, 3-butylene glycol Henninger, 1888
sucrose	glycerol Buchner and Meisenheimer 1906
sucrose	glycerol Abderhalden and Stix, 1922
sucrose	glycerol Connstein and Ludecke, 1919
sucrose	glycerol Tomoda, 1928
sucrose	lactic ac. Fernbach and Schoen, 1923
sucrose	l-malic ac. Dakin, 1924
sucrose	pyruvic ac. Fernbach and Schoen, 1913
sucrose	pyruvic ac. Klein and Fuchs, 1929
d-tartaric ac.	butyric ac., lactic ac., propionic ac., succinic ac. Karczag, 1912
thioacetaldehyde	ethylmercaptan Neuberg and Nord, 1914
o-tolyl aldehyde	o-tolylacetyl carbinol Behrens and Ivanoff, 1926
p-tolyl aldehyde	p-tolylacetyl carbinol Behrens and Ivanoff, 1926

MICROORGANISMS SUBSTRATES	PRODUCTS AUTHORS
Yeast (cont.)	
trichloroacetaldehyde	trichloroethylalcohol Lintner and Lüers, 1913
α , α , β -trichlorobutyl aldehyde	2, 2, 3-trichlorobutanol Rosenfeld, 1925
valeraldehyde	amyl alc. Neuberg and Steenbock, 1914
n-valeraldehyde	n-amyl alc. Neuberg and Nord, 1914
<i>Zygosaccharomyces major</i>	
sucrose	acetaldehyde, acetic ac., CO ₂ , ethyl alc., glycerol Kumagawa, 1922
<i>Zygosaccharomyces salsa</i>	
sucrose	acetaldehyde, acetic ac., CO ₂ , ethyl alc., glycerol Kumagawa, 1922

CHAPTER II

INDEX TO ORGANIC (NON-NITROGENOUS) SUBSTRATES

CHAPTER II

TABLE TWO

INDEX TO ORGANIC (NON-NITROGENOUS) SUBSTRATES

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
ACETALDEHYDE	
acetic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
acetylmethyl carbinol	yeast Neuberg and Simon, 1925
acetic ac., ethyl alc.	yeast Kostytschew, 1914
acetic ac., 2, 3-butylene-glycol, succinic ac.	<i>B. lactis aerogenes</i> Harden and Norris, 1912
ethyl alc.	yeast Kostytschew and Hübbenet, 1912
ACETALDOL	
β , butylene glycol, β , hydroxy- butyric ac.	<i>Bact. ascendens</i> Binder-Kotrba, 1926
β , butylene glycol	yeast Neuberg and Kerb, 1918
ACETIC AC.	
formaldehyde, formic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
glycollic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
oxalic ac.	<i>Asp. niger</i> Wehmer, 1891

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
ACETIC AC. (cont.)	
oxalic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
oxalic ac.	<i>Asp. niger</i> Raistrick and Clark, 1919
oxalic ac.	<i>B. industrium</i> , <i>B. oxydans</i> , <i>Thermo-</i> <i>bacterium aceti</i> Banning, 1902
ACETOIN	
See acetylmethyl carbinol	
ACETONE	
acetic ac., formic ac.	<i>B. pyocyanus</i> Supniewski, 1923
ACETONEDICARBOXYLIC AC.	
oxalic ac.	<i>Asp. niger</i> Walker, Subramaniam and Challenger, 1927
ACETOPHENONE + SUCROSE	
l-phenylmethyl carbinol	yeast Neuberg and Nord, 1919
ACETYLMETHYL CARBINOL	
2, 3-butylene glycol	yeast Neuberg and Kobel, 1925
ADONITOL	
acetylmethyl carbinol, 2, 3- butylene glycol d-adoninulose	<i>B. lactis aerogenes</i> Harden and Norris, 1912 <i>Acetobacter suboxydans</i> Visser 't Hooft, 1925
ALDEHYDOPROPIONIC AC.	
succinic ac.	yeast Neuberg and Ringer, 1918

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
ARABINOSE	
acetic ac., acetone, butyl alc., butyric ac., lactic ac.	<i>B. granulobacter pectinovorum</i> Speakman, 1923
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Harden, 1901
acetic ac., CO ₂ , propionic ac.	<i>Propionibacterium pentosaceum</i> Werkman, Hixon, Fulmer and Rayburn, 1929
acetic ac., ethyl alc., formic ac. succinic ac.	<i>B. ethaceticus</i> Frankland and MacGregor, 1892
acetic ac., lactic ac.	<i>Lactobacillus pentosus</i> , <i>Lactobacil- lus pentoaceticus</i> , <i>Lacto- bacillus arabinosus</i> Peterson, Fred and Anderson, 1921
acetic ac., l-lactic ac.	Pneumobacillus of Friedländer Grimbert, 1896
acetone, butyl alc., CO ₂	<i>B. granulobacter pectinovorum</i> Peterson, Fred and Schmidt, 1924
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. cloacae</i> Harden and Norris, 1912
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
arabonic ac.	Sorbose bacterium Bertrand, 1898
citric ac.	Citromyces, sp.? Wehmer, 1913
citric ac., oxalic ac.	<i>Asp. niger</i> Amelung, 1927
citric ac., oxalic ac.	<i>Asp. niger</i> , <i>Citromyces glaber</i> Butkewitsch, 1923

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
ARABINOSE (cont.)	
CO ₂	<i>B. heribicola aurcum</i> Fred, Peterson and Anderson, 1923
CO ₂ , ethyl alc., glyceric ald. (?)	<i>Sacc. cerevisiae</i> Abbott, 1926
fumaric ac., citric ac.	<i>Asp. fumaricus</i> Schreyer, 1928
gluconic ac.	<i>Asp. niger</i> Bernhauer, 1928
oxalic ac.	<i>B. aceti</i> , <i>B. acetigenum</i> , <i>B. acetosum</i> , <i>B. ascendens</i> , <i>B. Kützingianum</i> , <i>B. xylinum</i> , <i>Termobacterium aceti</i> Banning, 1902
ARABITOL	
keto-pentose	sorbose bacterium Bertrand, 1898
BENZALDEHYDE	
benzyl alc.	yeast Neuberg and Welde, 1914
phenyl-acetyl carbinol	yeast Neuberg and Ohle, 1922
BENZIL	
benzoin	yeast Neuberg and Gorr, 1919
BENZYLPIRUVIC AC.	
phenylpropyl aldehyde	yeast Rona, 1914
BUTYL ALC.	
butyric ac.	<i>B. Kützingianum</i> , <i>B. Pasteurianum</i> Seifert, 1897
butyric ac.	<i>Acetobacter melanogenum</i> Visser't Hooft, 1925

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
2, 3-BUTYLENE GLYCOL acetone	<i>Acetobacter suboxydans</i> <i>Acetobacter xylinum</i>
acetylmethyl carbinol	Visser't Hooft, 1925 Sorbose bacteria, <i>Mycoderma aceti</i> Kling, 1905
BUTYRIC AC. β -hydroxybutyric ac., aceto- acetic ac., acetone	<i>Asp. niger</i> Coppock, Subramaniam and Walker, 1928
CAPROICALDEHYDE n-hexyl alc.	yeast Neuberg and Nord, 1914
CELLULOSE acetic ac., butyric ac., CO ₂ , ethyl alc., H ₂	<i>Clostridium thermocellum</i> Viljoen, Fred and Peterson, 1926
acetic ac., butyric ac., CO ₂ , ethyl alc., H ₂	<i>B. cellulosa dissolvens</i> Khouvine, 1923
acetic ac., butyric ac., lactic ac., cellobiose	<i>Bact. cellaresolvens</i> <i>Bact. opalescens</i> Groenewege, 1923
CHLORAL (See trichloroacetaldehyde)	
CHLOROBENZALDEHYDE chlorobenzoic ac., chlorobenzyl alc.	yeast Neuberg and Liebermann, 1921
CINNAMIC AC. styrol	<i>Asp. niger</i> Herzog and Ripke, 1908
CINNAMIC ALDEHYDE cinnamic alc.	yeast Rona, 1914

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
CITRAL geraniol	yeast Neuberg and Kerb, 1918
CITRIC AC.	
acetic ac., CO ₂ , succinic ac.	<i>B. suipestifer</i> Brown, Duncan and Henry, 1924
acetic ac., CO ₂ , ethyl alc., succinic ac.	<i>B. coli communis</i> Grey, 1923
acetone, glyoxylic ac., malonic ac., oxalic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
acetonedicarboxylic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
glycollic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
oxalic ac.	<i>Citromyces glaber</i> Butkewitsch, 1922
oxalic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
α -CITRONELL ALDEHYDE	
α -citronella oil or alc.	yeast Mayer and Neuberg, 1915
DEXTRIN	
acetone, ethyl alc., formic ac.	<i>B. acetoxylicum</i> Northrop, Ashe and Morgan, 1919
ethyl alc.	<i>Mucor circinelloides</i> (?) Gayon and Dubourg, 1886

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTRIN (CONT.)	
oxalic ac.	<i>Asp. niger</i> Elfving, 1919
oxalic ac.	<i>B. acetosum</i> <i>B. Kützingianum</i> <i>B. Pasteurianum</i> Banning, 1902
DEXTROSE	
acetaldehyde	<i>B. coli communis</i> Grey, 1913
acetaldehyde	<i>Asp. cellulosa</i> <i>Monilia candida</i> <i>Mucor racemosus</i> <i>Mucor rouxii</i> <i>Oidium lactis</i> Cohen, 1920
acetaldehyde	<i>B. lactis aerogenes</i> Kumagawa, 1922
acetaldehyde	yeast Kostytschew, 1912
acetaldehyde, acetic ac., ethyl alc., glycerol	yeast Neuberg and Hirsch, 1919
acetaldehyde, acetic ac., ethyl alc., succinic ac.	<i>Oidium lupuli</i> Sumiki, 1927
acetaldehyde, acetylmethyl carbinol, 2, 3-butylene glycol	<i>B. lactis aerogenes</i> Neuberg, Nord and Wolff, 1920
acetaldehyde, acetic ac., ethyl alc., formic ac., succinic ac.	<i>B. dysenteriae</i> , Shiga-Kruse Bergh, 1928
acetic ac.	<i>B. coli</i> Scheffer, 1928
acetic ac., acetone, butyl alc., butyric ac., lactic ac.	<i>B. granulobacter pectinovorum</i> Speakman, 1923

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (cont.)	
acetic ac., acetone, 2, 3-butylene glycol, butyric ac., CO ₂ , ethyl alc., formic ac., H ₂	<i>Cl. pasteurianum</i> Donker, 1926
acetic ac., acetone, ethyl alc., formic ac., lactic ac.	<i>B. acetothylicum</i> Arzberger, Peterson and Fred, 1920
acetic ac., acetylmethyl carbinol, acetone, butyl alc., 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac.	<i>B. polymyxa</i> Donker, 1926
acetic ac., acetylmethyl carbinol, acetone, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac.	<i>B. acetothylicum</i> Donker, 1926
acetic ac., acetylmethyl carbinol, acetone, butyl alc., butyric ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac.	<i>B. granulobacter pectinovorum</i> (Weizmann) Donker, 1926
acetic ac., acetylmethyl carbinol, 2, 3-butylene glycol, ethyl alc., formic ac., lactic ac., succinic ac.	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
acetic ac., acetylmethyl carbinol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>B. aerogenes</i> Scheffer, 1928
acetic ac., acetylmethyl carbinol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Serratia marcescens</i> Pederson and Breed, 1928
acetic ac., acetylmethyl carbinol, CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. tartricus</i> Grimbert, 1901

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (cont.)	
acetic ac., 2, 3-butylene glycol, butyric ac., CO ₂ , formic ac., H ₂ , formic ac.	<i>Granulobacter saccharo-butyricum</i> Donker, 1926
acetic ac., butyric ac.	<i>Cl. pasteurianum</i> Winogradsky, 1902
acetic ac., butyric ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Sarcina maxima</i> Smit, 1928
acetic ac., butyric ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Sarcina ventriculi</i> Smit, 1928
acetic ac., butyric ac., lactic ac.	<i>B. butylicus</i> Buchner and Meisenheimer, 1908
acetic ac., CO ₂ , ethyl alc., gluconic ac.	<i>Acetobacter Sp.?</i> Söhngen, 1914, 1915
acetic ac., CO ₂ , ethyl alc., H ₂	<i>B. ethaceticus</i> Frankland and Lumsden, 1892
acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Grey and Young, 1921
acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>B. Freundii</i> Scheffer, 1928
acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Grey, 1920
acetic ac., CO ₂ , ethyl alc., formic ac., lactic ac., suc- cinic ac.	<i>B. cloacae</i> , <i>B. coli</i> , <i>B. lactis aerogenes</i> Thompson, 1912
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Harden, 1901

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (CONT.)	
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Grey, 1918
acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>B. aerogenes</i> , <i>B. coli</i> Virtanen and Simola, 1927
acetic ac., CO ₂ , ethyl alc., formic ac., lactic ac., suc- cinic ac.	<i>B. coli communis</i> Kay, 1926
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac.	<i>B. coli communis</i> Harden, 1899
acetic ac., CO ₂ , ethyl alc., formic ac., H ₂	Friedlander's pneumococcus Frankland, Stanley and Frew, 1891
acetic ac., CO ₂ , propionic ac., succinic ac.	<i>Propionibacterium Freudenreichii</i> <i>Propionibacterium Jensenii</i> <i>Propionibacterium pentosaceum</i> <i>Propionibacterium Peterssonii</i> <i>Propionibacterium rubrum</i> <i>Propionibacterium Shermanii</i> <i>Propionibacterium technicum</i> <i>Propionibacterium Thönii</i> Van Niel, 1928
acetic ac., ethyl alc.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetic ac., ethyl alc., formic ac.	<i>Bact. pyocyaneus</i> Aubel, 1921
acetic ac., ethyl alc., formic ac.	<i>B. typhosus</i> Harden, 1901
acetic ac., ethyl alc., formic ac., lactic ac., succinic ac.	<i>B. typhosum</i> Scheffer, 1928
acetic ac., ethyl alc., succinic ac.	Friedländer's pneumobacillus Grimbert, 1896

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (cont.)	
acetic ac., ethyl alc., formic ac., lactic ac., succinic ac.	<i>B. dysenteriae</i> , Shiga-Kruse Scheffer, 1928
acetic ac., ethyl alc., l-lactic ac.	<i>B. coli</i> Grimbert, 1896
acetic ac., lactic ac., succinic ac.	<i>B. coli communis</i> Young, 1924
acetic ac., oxalic ac.	<i>Asp. niger</i> Heinze, 1903
acetic ac., propionic ac., suc- cinic ac.	<i>B. acidi propionici var. fuscum</i> Virtanen, 1923
acetone, ethyl alc., formic ac.	<i>B. acetothylicum</i> Northrop, Ashe and Morgan, 1919
acetone, ethyl alc., pyruvic ac.	<i>B. acetothylicum</i> Speakman, 1925
acetylmethyl carbinol	<i>B. mesentericus vulgatus</i> <i>B. subtilis</i> <i>Tyrothrix tenuis</i> Harden and Norris, 1912
acetic ac., acetylmethyl carbi- nol, CO ₂ , ethyl alc., formic ac., lactic ac., succinic ac.	<i>B. lactis aerogenes</i> Kay, 1926
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. lactis aerogenes</i> Walpole, 1911
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. cloacae</i> Thompson, 1912
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. lactis aerogenes</i> Neuberg, Nord, and Wolff, 1920
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. proteus</i> Lemoigne, 1923

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (cont.)	
acetylmethyl carbinol, 2, 3- butylene glycol	yeast Kluyver, Donker and Hoof, 1925
acetylmethyl carbinol, 2, 3- butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac.	<i>B. cloacae</i> Scheffer, 1928
butyric ac.	<i>Bact. thermobutyricus</i> Coolhaas, 1928
butyric ac., butyl alc., caproic ac., caprylic ac.	<i>B. butylicus</i> Neuberg and Arinstein, 1921
butyric ac., CO ₂ , H ₂ , mannitol	<i>B. subtilis</i> Vanderwelde, 1884
citric ac.	<i>Asp. fumaricus</i> Schreyer, 1928
citric ac.	<i>Citromyces citricus</i> <i>Citromyces lacticus</i> <i>Citromyces tartricus</i> <i>Citromyces oxalicus</i> Mazé and Perrier, 1904
citric ac.	<i>Citromyces, sp.?</i> Martin, 1916
citric ac.	<i>Asp. niger</i> Bernhauer, 1928
citric ac.	<i>Citromyces citricus</i> Buchner and Wüstenfeld, 1909
citric ac.	<i>Citromyces Pfefferianus</i> Buchner and Wüstenfeld, 1909
citric ac.	<i>Mucor piriformis</i> Wehmer, 1897
citric ac.	<i>Pen. luteum</i> Wehmer, 1897

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (cont.)	
citric ac., gluconic ac.	<i>Asp. niger</i> , <i>Asp. cinnamoneus</i> , <i>Asp. fuscus</i> Falek and Kapur, 1924
citric ac., oxalic ac.	<i>Asp. niger</i> Wehmer, 1924
citric ac., oxalic ac.	<i>Asp. niger</i> Amelung, 1927
citric ac., oxalic ac.	<i>Asp. niger</i> Elfving, 1919
citric ac., oxalic ac.	<i>Citromyces glaber</i> Butkewitsch, 1922
CO ₂ , ethyl alc.	<i>Fusarium lini</i> Anderson and Willaman, 1922
ethyl alc.	<i>Mucor mucedo</i> <i>Mucor racemosus</i> <i>Mucor stolonifer</i> Kostytschew and Eliasberg, 1920
ethyl alc.	yeast Rimini, 1926
ethyl alc.	<i>Rhizopus</i> , sp.? Takahashi and Sakaguchi, 1927
ethyl alc., CO ₂	<i>Asp. niger</i> Kostytschew, 1907
formic ac.	<i>B. prodigiosus</i> Franzen and Egger, 1912
formic ac., CO ₂ , H ₂	<i>B. coli communis</i> Franzen and Kahlenberg, 1916
fumaric ac.	<i>Rhizopus nigricans</i> Ehrlich, 1912
gluconic ac.	<i>Asp. niger</i> Bernhauer, 1928

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (cont.)	
gluconic ac.	<i>Bact. acetii</i> Brown, 1886
gluconic ac.	<i>B. Kützingianum</i> <i>B. Pasteurianum</i> Seifert, 1897
gluconic ac.	sorbose bacterium Bertrand, 1898
gluconic ac.	<i>Pen. purpurogenum</i> May, Thom and Church, 1927
gluconic ac.	<i>Mycoderma acetii</i> Boutroux, 1880
gluconic ac.	<i>Pen. purpurogenum</i> Herrick and May, 1928
gluconic ac.	<i>Asp. niger</i> Müller, 1925
gluconic ac.	<i>Acetobacter</i> , sp.? <i>Bact. acetii viscosum</i> Day and Walker, 1913
gluconic ac.	<i>Bact. acetigenium</i> <i>Bact. acetosum</i> <i>Bact. oxydans</i> Henneberg, 1909
gluconic ac., keto-gluconic ac.	<i>B. xylinum</i> Bernhauer and Schön, 1929
glycerol	yeast Oppenheimer, 1913
lactic ac.	<i>B. casei</i> Virtanen and Karström, 1928
lactic ac.	<i>B. coli</i> Péré, 1898
lactic ac.	<i>Lactobacillus leichmanni</i> Fred, Peterson and Stiles, 1925
l-lactic ac.	<i>Lactobacillus leichmanni</i> Allgeier and Peterson, 1930

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (cont.)	
lactic ac.	<i>Lactobacillus</i> , sp.? Neuberg and Gorr, 1926
d-lactic ac.	<i>Clostridium thermocellum</i> Peterson, Fred and Martin, 1926
d-lactic ac.	<i>Strept. lactis</i> Allgeier and Peterson, 1930
lactic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
lactic ac.	<i>B. propionicus</i> Neuberg and Gorr, 1926
lactic ac.	yeast Aubel, 1929
lactic ac., CO ₂	<i>B. coli communis</i> Goto, 1925
lactic ac., ethyl alc.	B. of malignant oedema King and Frankel, 1890
l-lactic ac.	<i>Rhizopus chinensis</i> Saito, 1911
lactic ac.	yeast Oppenheimer, 1913
oxalic ac.	<i>Asp. niger</i> Wehmer, 1891, 1897
oxalic ac.	<i>B. aceti</i> , <i>B. Kützianum</i> <i>B. acetigenum</i> , <i>B. acetosum</i> <i>B. ascendens</i> , <i>B. industrium</i> <i>B. oxydans</i> , <i>B. Pasteurianum</i> <i>B. xylinum</i> , <i>Termobacterium aceti</i> Banning, 1902
oxygluconic ac.	<i>Micrococcus oblongus</i> Boutroux, 1886
propionic. ac.	<i>Diplococcus pneumoniae</i> Brieger, 1883
pyruvic ac.	yeast Traetta-Mosca, 1927

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
DEXTROSE (CONT.)	
pyruvic ac.	<i>Mycoderma</i> , sp.? Fernbach and Schoen, 1914
pyruvic ac.	<i>B. coli</i> Aubel, 1926
pyruvic ac.	yeast Fernbach and Schoen, 1920
α , α , DICHLOROACETONE	
α , α -di-chloropropylalcohol	yeast Sen, 1924
DIHYDROXYACETONE	
dextrose	<i>Sacc. ludwigii</i> Neuberg and Kobel, 1928
lactic ac.	yeast Oppenheimer, 1913
DIHYDROXYMALEIC AC.	
CO ₂ , glycollic aldehyde	yeast Neuberg and Schwenk, 1915
DULCITOL	
acetic ac., CO ₂ , ethyl alc., H ₂ , succinic ac.	<i>B. ethoacetosuccinicus</i> Frankland and Frew, 1892
ENANTHOL	
n-heptyl alc.	yeast Ohta, 1914
ERYTHRITOL	
erythrulose	sorbose bacterium Bertrand, 1898, 1900
erythrose	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1924
oxalic ac.	<i>B. aceti</i> , <i>B. acetosum</i> <i>B. industrium</i> , <i>B. oxydans</i> Banning, 1902

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
ETHYL ALC.	
acetaldehyde	yeast Trillat and Sauton, 1908
acetaldehyde, acetic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
acetic ac.	<i>Bact. aceti</i> Brown, 1886
acetic ac.	<i>Acetobacter sp.?</i> Knieriem and Mayer, 1872
acetic ac.	<i>B. Kützingianum</i>
acetic ac.	<i>B. Pasteurianum</i> Mayer, 1898
acetic ac.	<i>Acetobacter sp.?</i> <i>B. aceti</i> (Hansen)
acetic ac.	Buchner and Gaunt, 1906
acetic ac.	<i>Acetobacter sp.?</i> Söhngen, 1913
acetic ac.	<i>Acetobacter sp.?</i> <i>Bact. aceti viscosum</i>
acetic ac.	Day and Baker, 1913
acetic ac.	<i>Acetobacter suboxydans</i> Visser't Hooft, 1925
citric ac., oxalic ac.	<i>Citromyces citricus</i> <i>Citromyces tartricus</i> Mazé and Perrier, 1904
ETHYL DISULFIDE	
ethyl mercaptan	yeast Neuberg and Schwenk, 1915
ETHYLENE GLYCOL	
2, 3-butylene glycol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
glycollic ac.	<i>Acetobacter melanogenum</i> Visser't Hooft, 1925 <i>B. Kützingianum</i> Seifert, 1897 <i>B. Pasteurianum</i> Mayer, 1898

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
ETHYLENE GLYCOL (cont.) oxalic ac.	<i>B. aceti</i> , <i>B. acetosum</i> <i>B. ascendens</i> , <i>B. industrium</i> <i>B. Kützingianum</i> , <i>B. oxydans</i> <i>B. Pasteurianum</i> <i>Termobacterium aceti</i> Banning, 1902
FORMALDEHYDE methyl alc.	yeast Neuberg and Welde, 1914
FORMIC AC. CO ₂ , H ₂	<i>B. coli communis</i> Franzen and Kahlenberg, 1916
FUMARIC AC. acetic ac., pyruvic ac.	<i>B. pyocyaneus</i> Quastel, 1924
l-malic ac.	<i>Asp. niger</i> Challenger and Klein, 1929
malic ac.	<i>B. coli</i> Quastel and Whetham, 1924
oxalic ac.	<i>Asp. niger</i> Raistrick and Clark, 1919
pyruvic ac.	<i>B. pyocyaneus</i> Quastel, 1924
succinic ac.	<i>B. coli communis</i> Quastel, Stephenson and Whetham, 1925
FURFURAL furfuryl alc.	yeast Lintner and Liebig, 1911
furyltrimethylene glycol	yeast Lintner and Liebig, 1913
GALACTOSE acetaldehyde	<i>Bact. coli</i> , <i>B. lactis aerogenes</i> Nagai, 1923

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
GALACTOSE (cont.)	
acetaldehyde, CO ₂ , glycerol	yeast Tomita, 1921
acetic ac., acetone, butyl alc., butyric ac., lactic ac.	<i>B. granulobacter pectinovorum</i> Speakman, 1923
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Harden, 1901
acetic ac., ethyl alc., lactic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
citric ac., oxalic ac.	<i>Asp. niger</i> Amelung, 1927
fumaric ac., citric ac.	<i>Asp. fumaricus</i> Schreyer, 1928
galactonic ac.	sorbose bacterium Bertrand, 1898
lactic ac.	<i>B. coli</i> Péré, 1898
oxalic ac.	<i>B. Kützingianum</i> <i>Termobacterium aceti</i> Banning, 1902
α-GLUCOHEPTITE	
α-glucoheptulose	sorbose bacterium Bertrand and Nitzberg, 1928
GLUCONIC AC.	
acetaldehyde	<i>B. lactis aerogenes</i> Nagai, 1923
acetic ac., ethyl alc., formic ac. lactic ac., succinic ac.	<i>B. coli communis</i> Kay, 1926
acetic ac., acetylmethyl car- binol, CO ₂ , ethyl alc., formic ac., lactic ac., succinic ac.	<i>B. lactis aerogenes</i> Kay, 1926

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
GLUCONIC AC. (cont.)	
citric ac.	<i>Asp. fumaricus</i> Schreyer, 1925, 1928
citric ac., saccharic ac.	<i>Asp. niger</i> Walker, Subramaniam and Challenger, 1927
dihydroxyacetone, ethyl alc.	<i>Acetobacter sp.?</i> Söhngen, 1914, 1915
oxalic ac.	<i>Asp. niger</i> Butkewitsch, 1923
oxygluconic ac.	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1921
GLYCERALDEHYDE	
lactic ac.	yeast Oppenheimer, 1913
GLYCERIC AC.	
acetaldehyde	<i>B. lactis aerogenes</i> Nagai, 1923
acetaldehyde	yeast Lebedev and Polonski, 1916
acetaldehyde, acetic ac., CO ₂ , ethyl alc.	yeast Lebedev, 1918
citric ac.	<i>Asp. fumaricus</i> Schreyer, 1928
GLYCEROL	
acetaldehyde	<i>B. lactis aerogenes</i> Kumagawa, 1922
acetic ac., butyl alc., butyric ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
acetic ac., 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac. H ₂ , lactic ac., succinic ac.	<i>B. lactis aerogenes</i> Harden and Norris, 1912
acetic ac., 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Bact. aerogenes</i> Braak, 1928

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
GLYCEROL (cont.)	
acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ lacticac., succi- nic ac., trimethylene glycol	<i>Bact. Freundii</i> Braak, 1928
acetic ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Bact. coli</i> Braak, 1928
acetic ac., CO ₂ , propionic ac., succinic ac.	<i>Propionibacterium pentosaceum</i> Van Niel, 1928
acetic ac., CO ₂ , propionic ac.	<i>Propionibacterium Thonii</i> <i>Propionibacterium technicum</i> <i>Propionibacterium Shermanii</i> <i>Propionibacterium Peterssonii</i> <i>Propionibacterium Jensenii</i> Van Niel, 1928
acetic ac., ethyl alc., formic ac., succinic ac.	<i>B. ethaceticus</i> Frankland and Fox, 1889
acetic ac., CO ₂ , ethyl alc., formic ac., lactic ac., suc- cinic ac.	<i>B. coli</i> Grey, 1923
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetylmethyl carbinol	<i>Tyrothrix tenuis</i> Harden and Norris, 1912
acrolein	<i>B. Welchii</i> Humphreys, 1924
acrylaldehyde	<i>B. amaracrylus</i> Voisenet, 1918
n-amyl alc., n-butyl alc., n- propyl alc.	<i>B. butylicus</i> Morin, 1887
butyl alc.	<i>B. butylicus</i> Emmerling, 1897
butyl alc., butyric ac., lactic ac.	<i>B. butylicus</i> Fitz, 1882
butyl alc., butyric ac., caproic ac., CO ₂ , ethyl alc., H ₂	<i>Mucor racemosus</i> Fitz, 1876

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
GLYCEROL (cont.) n-butyl alc., formic ac., lactic ac.	<i>B. butylicus</i> Buchner and Meisenheimer, 1908
2, 3-butylene glycol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
butyl alc., butyric ac., caproic ac., caprylic ac.	<i>B. butylicus</i> Neuberg and Arinstein, 1921
butyric ac., lactic ac., succinic ac.	<i>B. subtilis</i> Vandewelde, 1884
citric ac.	<i>Citromyces, sp.?</i> Wehmer, 1913
citric ac.	<i>Citromyces citricus</i> Mazé and Perrier, 1904
citric ac., oxalic ac.	<i>Asp. niger</i> <i>Citromyces glaber</i> Butkewitsch, 1923
CO ₂ , glyceric ac., lactic ac.	<i>B. pyocyanus</i> Supniewski, 1923
dihydroxyacetone	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1924
dihydroxyacetone	sorbose bacterium Bertrand, 1904
dihydroxyacetone	<i>B. dioxyaceticum</i> Virtanen and Barlund, 1926
dihydroxyacetone	sorbose bacterium Bertrand, 1898
dihydroxyacetone	<i>B. xylinum</i> Virtanen and Barlund, 1926
dihydroxyacetone	<i>B. xylinum</i> Bernhauer and Schön, 1928
dihydroxyacetone	<i>Acetobacter suboxydans</i> <i>Bact. xylinum</i> Brit. patent 269, 950
dihydroxyacetone	<i>Bact. xylinum</i> Bertrand and Sazerac, 1901

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
GLYCEROL (cont.)	
ethyl alc.	yeast Neuberg and Kerb, 1913
ethyl alc.	<i>Asp. niger</i> Kostytschew and Afanass- jewa, 1922
ethyl alc., CO ₂	yeast Kostytschew and Faermann, 1928
gluconic ac.	<i>Asp. niger</i> Bernhauer, 1928
oxalic ac.	<i>B. aceti</i> , <i>B. ascendens</i> <i>B. oxydans</i> , <i>B. Pasteurianum</i> <i>B. xylinum</i> <i>Termobacterium aceti</i>
oxalic ac.	<i>Asp. niger</i> Banning, 1902 Elfving, 1919
oxymaltol	<i>Asp. glaucus</i> Traetta-Mosca and Preti, 1921
pyruvic ac.	<i>B. subtilis</i> Aubel, 1921
succinic ac.	<i>Rhizopus</i> , <i>sp.</i> ? Takahashi and Sakaguchi, 1927
sucrose	yeast Connstein and Ludecke, 1919
GLYCEROSE	
citric ac., oxalic ac.	<i>Asp. niger</i> Amelung, 1927
GLYCOLALDEHYDE	
ethylene glycol	yeast Neuberg and Schwenk, 1915
GLYCOLLIC AC.	
oxalic ac.	<i>B. aceti</i> , <i>B. acetigenum</i> <i>B. acetosum</i> , <i>B. ascendens</i> <i>B. Kützingianum</i>

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
GLYCOLLIC AC. (cont.)	<i>B. Pasteurianum</i> <i>Termobacterium aceti</i> Banning, 1902
GLYCURONIC AC. acetic ac., CO ₂ , ethyl alc., formic ac., lactic ac., suc- cinic ac.	<i>B. coli communis</i> Kay, 1926
GLYOXYLIC AC. acetaldehyde, CO ₂	yeast Lebedev, 1918
HYDROXYFUMARIC AC. acetaldehyde, CO ₂	yeast Mayer, 1913
HYDROXYPYRUVIC AC. glycolaldehyde, CO ₂ ,	yeast Neuberg and Kerb, 1913
INOSITOL acetaldehyde, CO ₂ , lactic ac., succinic ac.	<i>B. lactis aerogenes</i> Kumagawa, 1922
i-INOSITOL acetic ac., CO ₂ , ethyl alc., succinic ac.	<i>B. lactis</i> Hewitt and Steabbin, 1921
INULIN oxalic ac.	<i>Asp. niger</i> Elfving, 1919
ISOBUTYL ALC. isobutyric ac.	<i>Acetobacter melanogenum</i> Visser't Hooft, 1925
ISOBUTYL ALDEHYDE isobutyl alc.	yeast Ohta, 1914
ISOBUTYRIC AC. oxalic ac.	<i>B. aceti</i> , <i>B. Kützingianum</i> <i>B. Pasteurianum</i> Banning, 1902

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
ISODULCITE See rhamnose	
ISOLICHENIN oxalic ac.	<i>B. aceti</i> , <i>B. industrium</i> <i>B. Kützingianum</i> Banning, 1902
ISOPROPYL ALC. acetone	<i>Acetobacter melanogenum</i> <i>Acetobacter xylinum</i> visser't Hooft, 1925
α -KETOBUTYRIC AC. ethyl alc., n-propyl alc.	yeast Neuberg and Kerb, 1914
propionaldehyde	yeast Neuberg and Kerb, 1912
propionaldehyde, propyl alc.	yeast Neuberg and Kerb, 1913
α -KETO-ISO-VALERIC AC. isobutyl aldehyde	yeast Sen, 1923
α -KETO-n-CAPROIC AC. n-amyl alc., n-valeraldehyde	yeast Sen, 1923
LACTIC AC. acetaldehyde	<i>B. lactis aerogenes</i> Nagai, 1923
acetaldehyde, acetic ac., py- ruvic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
acetic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetic ac.	<i>Acetobacter melanogenum</i> <i>Acetobacter suboxydans</i> <i>Acetobacter xylinum</i> visser't Hooft, 1925
acetic ac., butyl alc., butyric ac.	<i>Amylobacter butylicus</i> Duclaux, 1895

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
LACTIC AC. (CONT.)	
acetic ac., CO ₂ , propionic ac.	<i>Bact. acidi propionici</i> var. <i>fuscum</i> Virtanen, 1923
acetic ac., CO ₂ , propionic ac.	<i>B. acidi propionici</i> <i>Bact. acidi propionici-b</i> <i>Bact. acidi propionici-a</i> Von Freudenreich and Orla- Jensen, 1906
acetic ac., CO ₂ , propionic ac., succinic ac.	<i>Propionibacterium Freudenreichii</i> <i>Propionibacterium Jensenii</i> <i>Propionibacterium pentosaceum</i> <i>Propionibacterium Peterssonii</i> <i>Propionibacterium rubrum</i> <i>Propionibacterium Shermanii</i> <i>Propionibacterium technicum</i> <i>Propionibacterium Thönii</i> Van Niel, 1928
acetic ac., ethyl alc., formic ac.	<i>B. ethoacetosuccinicus</i> Mazé, 1913
acetic ac., ethyl alc., l-lactic ac., succinic ac.	<i>B. coli</i> Grimbert, 1896
acetic ac., propionic ac.	<i>B. motilis</i> Orla-Jensen, 1904
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetylmethyl carbinol	<i>B. subtilis</i> Lemoigne, 1923
2, 3-butylene glycol	<i>B. mesentericus-ruber</i> Lemoigne, 1913
butyl alc., butyric ac., caproic ac., caprylic ac.	<i>B. butylicus</i> Neuberg and Arinstein, 1921
citric ac.	<i>Asp. fumaricus</i> Schreyer, 1928
ethyl alc.	<i>Asp. niger</i> Kostytschew and Afanass- jewa, 1922

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
LACTIC AC. (cont.)	
ethyl alc., pyruvic ac.	yeast Kayser, 1923
oxalic ac.	<i>B. Kützingianum</i> <i>Termobacterium acetii</i> Banning, 1902
propionic ac., valeric ac.	<i>B. subtilis</i> Fitz, 1880
pyruvic ac.	<i>Amylomyces Rouxii</i> Mazé and Ruot, 1916
pyruvic ac.	<i>B. coli communis</i> <i>B. pyocyanus</i> Quastel, Stephenson and Whetham, 1925
LACTOSE	
acetaldehyde	<i>Bact. coli.</i> , <i>B. lactis aerogenes</i> Nagai, 1923
acetaldehyde	yeast Trillat, 1908
acetic ac., acetylmethyl carbinol, CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. tartricus</i> Grimbert, 1901
acetic ac., butyl alc., butyric ac., CO ₂ , ethyl alc., H ₂ , lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
acetic ac., propionic ac.	<i>Bact. acidi propionici d</i> Sherman and Shaw, 1923
acetic ac., propionic ac., succinic ac.	<i>Bact. acidi propionici</i> Virtanen, 1923
acetic ac., succinic ac.	<i>B. lactis aerogenes</i> Emmerling, 1900
citric ac.	<i>Citromyces, sp.?</i> Wehmer, 1913
lactic ac.	<i>Lactobacillus leichmani</i> Fred, Peterson and Stiles, 1925

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
LACTOSE (cont.)	
lactic ac.	<i>B. coli</i> Péré, 1898
lactic ac., methylglyoxal, pyruvic ac.	<i>Bact. caucasicum</i> Kostytschew and Soldatenkov, 1927
oxalic ac.	<i>Asp. niger</i> Elfving, 1919
LEVULOSE	
acetaldehyde	<i>Bact. coli</i> , <i>B. lactis aerogenes</i> Nagai, 1923
acetic ac., butyric ac., CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Sarcina maxima</i> Smit, 1928
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Harden, 1901
acetic ac., ethyl alc., formic ac., lactic ac.	<i>Bact. pyocyaneus</i> Aubel, 1921
acetic ac., lactic ac., mannitol	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetone, ethyl alc., formic ac.	<i>B. acetothylicum</i> Northrop, Ashe and Morgan, 1919
acetylmethyl carbinol, 2, 3-butylene glycol	<i>B. lactis aerogenes</i> Walpole, 1911
acetylmethyl carbinol, 2, 3-butylene glycol	<i>B. cloacae</i> Harden and Norris, 1912
acetylmethyl carbinol, 2, 3-butylene glycol	yeast Kluyver, Donker and Hooft, 1925
acetylmethyl carbinol 2,3-butylene glycol	yeast Kluyver and Donker, 1924
acetylmethyl carbinol	yeast
citric ac., oxalic ac.	Neuberg and Reinfurth, 1923 <i>Asp. niger</i> Amelung, 1927

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
LEVULOSE (cont.)	
fumaric ac.	<i>Rhizopus nigricans</i> Ehrlich, 1912
gluconic ac.	<i>Asp. niger</i> Bernhauer, 1928
lactic ac.	<i>Lactobacillus leichmani</i> Fred, Peterson and Stiles, 1925
d-lactic ac.	<i>Clostridium thermocellum</i> Peterson, Fred and Martin, 1926
oxalic ac.	<i>B. aceti</i> , <i>B. oxydans</i> , <i>B. xylinum</i> Banning, 1902
MALIC AC.	
acetaldehyde	<i>B. coli</i> Nagai, 1923
acetic ac., ethyl alc., succinic ac.	<i>B. coli communis</i> Grey, 1923
acetic ac., lactic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetic ac., succinic ac.	<i>B. lactis aerogenes</i> Emmerling, 1899
fumaric ac.	<i>B. coli communis</i> Quastel and Whetham, 1924
lactic ac.	yeast Lebedev and Russ, 1916
oxalic ac.	<i>Asp. niger</i> Raistrick and Clark, 1919
pyruvic ac.	<i>B. fluorescens</i> Bejerinck and Folpmers, 1916
MALONIC AC.	
acetic ac., ethyl alc., lactic ac.	<i>B. coli communis</i> Grey, 1923
oxalic ac.	<i>B. aceti</i> , <i>B. acetosum</i> <i>B. ascendens</i> , <i>B. Kützingianum</i> <i>B. Pasteurianum</i>

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
MALIC AC. (cont.)	
	<i>Termobacterium acetii</i> Banning, 1902
MALTOSE	
acetaldehyde	<i>Bact. coli</i> , <i>B. lactis aerogenes</i> Nagai, 1923
acetic ac., acetylmethyl carbinol, CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. tartricus</i> Grimbert, 1901
acetic ac., butyl alc., butyric ac., CO ₂ , ethyl alc., H ₂ , lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetone, ethyl alc., pyruvic ac.	<i>B. acetoethylicum</i> Speakman, 1925
acetylmethyl carbinol	<i>B. anthracis</i> Lemoigne, 1919
citric ac., oxalic ac.	<i>Asp. niger</i> Amelung, 1927
MANNITOL	
acetic ac., CO ₂ , ethyl alc., formic ac., lactic ac., succinic ac.	<i>B. cloacae</i> , <i>B. coli</i> , <i>B. lactis aerogenes</i> Thompson, 1912
acetic ac., acetone, butyl alc., butyric ac., lactic ac.	<i>B. granulobacter pectinovorum</i> Speakman, 1923
acetic ac., acetylmethyl carbinol, CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. tartricus</i> Grimbert, 1901
acetic ac., acetylmethyl carbinol, ethyl alc., CO ₂ , formic ac., lactic ac., succinic ac.	<i>B. lactis aerogenes</i> Kay, 1926
acetic ac., butyl alc., butyric ac., CO ₂ , ethyl alc., H ₂ , lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
MANNITOL (cont.)	
acetic ac., CO ₂ , ethyl alc., H ₂	<i>B. ethaceticus</i> Frankland and Lumsden, 1892
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Grey, 1918
acetic ac., CO ₂ , ethyl alc., H ₂ , lactic ac., succinic ac.	<i>B. coli communis</i> Harden, 1901
acetic ac., CO ₂ , ethyl alc., H ₂ , succinic ac.	<i>B. ethacetosuccinicus</i> Frankland and Frew, 1892
acetic ac., ethyl alc.	<i>B. ethaceticus</i> Frankland, Stanley and Frew, 1891
acetic ac., ethyl alc.	Friedlander's pneumococcus Frankland, Stanley and Frew, 1891
acetic ac., CO ₂ , ethyl alc., formic ac., lactic ac., suc- cinic ac.,	<i>B. coli communis</i> Kay, 1926
acetic ac., ethyl alc., formic ac., succinic ac.	<i>B. ethaceticus</i> Frankland and Fox, 1889
acetic ac., ethyl alc., l-lactic ac.	Friedlander's pneumobacillus Grimbert, 1896
acetic ac., lactic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetylmethyl carbinol	<i>B. subtilis</i> <i>Tyrothrix tenuis</i> <i>B. mesentericus vulgatus</i> Harden and Norris, 1912
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. cloacae</i> Thompson, 1912
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
butyl alc.	<i>B. butylicus</i> Emmerling, 1897
butyl alc., butyric ac., lactic ac.	<i>B. butylicus</i> Fitz, 1882

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
MANNITOL (cont.)	
citric ac.	<i>Asp. fumaricus</i> Schreyer, 1928
citric ac., oxalic ac.	<i>Asp. niger</i> , <i>Citromyces glaber</i> Butkewitsch, 1923
ethyl alc.	<i>Asp. niger</i> Kostytschew and Afanass- jewa, 1922
ethyl alc., CO ₂	yeast Kostytschew and Faermann, 1928
lactic ac.	<i>B. coli</i> Péré, 1898
levulose	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1924
levulose	<i>Bact. aceti</i> Brown, 1886
levulose	<i>B. xylinum</i> Hoyer, 1898
levulose	Sorbose bacterium Bertrand, 1898
oxalic ac.	<i>Asp. niger</i> Elfvig, 1919
oxalic ac.	<i>B. industrium</i> Banning, 1902
MANNOSE	
acetic ac., ethyl alc., lactic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. cloacae</i> Harden and Norris, 1912
acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
citric ac.	<i>Citromyces</i> , sp.? Wehmer, 1913

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
MANNOSE (cont.)	
ethyl alc.	yeast Mezzadrolì, 1918
gluconic ac.	<i>Asp. niger</i> Bernhauer, 1928
lactic ac.	<i>B. coli</i> Péré, 1898
p-METHOXY-BENZALDEHYDE	
p-methoxy-benzoic ac., p-methoxy-benzyl alc.	yeast Neuberg and Liebermann, 1921
METHYL ACETOL	
See acetylmethyl carbinol	
METHYL ALC.	
formic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
METHYL-BENZOYL CARBINOL + DEXTROSE	
methyl-phenylethylene glycol	yeast Neuberg and Komarewsky, 1927
METHYL- α -CHLOROETHYL KETONE	
methyl- α -chloroethyl alc.	yeast Santomauro, 1924
O-METHYL-CYCLOHEXANONE	
o-methyl cyclohexanol	yeast Akamatsu, 1923
d-l-METHYLETHYL-ACETALDEHYDE	
d-amyl alc., valeric ac.	<i>B. pasteurianum</i> Neuberg and Simon, 1926
METHYLETHYLACETALDEHYDE	
i-amyl alc., i-valeric ac.	<i>B. ascendens</i> <i>B. xylinum</i> Neuberg and Simon, 1926
METHYLETHYLKETONE + SUCROSE	
d-methylethyl carbinol	yeast Neuberg and Nord, 1919

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
METHYL-ETHYL PYRUVIC AC. methyl-ethyl acetaldehyde	yeast Neuberg and Peterson, 1914
METHYLGLYOXAL lactic ac.	<i>Bact. coli</i> , <i>Bact. pasteurianum</i> Gorr and Perlmann, 1926
lactic ac.	<i>B. coli</i> , <i>B. propionicus</i> , <i>Lactobacillus</i> , <i>sp.</i> ?
lactic ac., mandelic ac.	Neuberg and Gorr, 1926
d-lactic ac.	yeast Dakin and Dudley, 1913
d-l-lactic ac.	yeast Neuberg and Kobel, 1927, 1929
d-l-lactic ac.	yeast Neuberg, 1913
d-l-lactic ac.	<i>B. Delbrücki</i> Neuberg and Simon, 1927
METHYLGLYOXAL + SUCROSE l-propylene glycol	yeast Neuberg and Kobel, 1927
METHYL-N-HEXYL KETONE + SUCROSE d-methyl hexyl carbinol	yeast Neuberg and Nord, 1919
METHYL NONYL KETONE + SUCROSE d-methyl nonyl carbinol	yeast Neuberg and Nord, 1919
METHYL-N-PROPYL KETONE + SUCROSE d-methyl-n-propyl carbinol	yeast Neuberg and Nord, 1919
OLEIC AC. keto-stearic ac.	<i>Pen. glaucum</i> Pigulewski and Charik, 1928

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
OXALACETIC AC. acetaldehyde, CO ₂	yeast Neuberg and Kerb, 1913
acetaldehyde, acetone, CO ₂	yeast Neuberg and Gorr, 1925
acetone, butylene glycol, malic ac.	yeast Neuberg and Gorr, 1924
OXALIC AC. glycollic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
PERSEITOL perseulose	Sorbose bacterium Bertrand, 1898
perseulose	<i>Bact. xylinum</i> Bertrand, 1909
PHENYLACETALDEHYDE phenylethyl alc.	yeast Neuberg and Welde, 1914
PHENYLGLYOXAL d-mandelic ac.	<i>Bact. ascendens</i> Mayer, 1926
l-mandelic ac.	<i>Lactobacillus sp.?</i> Mayer, 1926
l-mandelic ac.	<i>B. lactis aerogenes</i> Neuberg and Simon, 1927
d-mandelic ac.	<i>B. Delbrücki</i> Neuberg and Simon, 1927
lactic ac., mandelic ac.	yeast Dakin and Dudley, 1913
PHENYLGLYOXALIC AC. benzaldehyde	yeast Binder-Kotrba, 1926
PHLORIDZIN phloroglucinol	<i>Cladosporium sp?</i> <i>Asp. niger</i> Boas, 1916

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
PROPIONIC AC. butyl alc., butyric ac., caproic ac., caprylic alc.	<i>B. butylicus</i> Neuberg and Arinsein, 1921
PROPYL ALC. propionic ac. propionic ac. propionic ac.	<i>Bact. aceti</i> Brown, 1886 <i>B. Kützingianum</i> <i>B. Pasteurianum</i> Mayer, 1898 <i>Acetobacter, sp.?</i> <i>B. aceti</i> (Hansen) Buchner and Gaunt, 1906
PROPYLENE GLYCOL acetic ac., CO ₂ , propionic ac., succinic ac. acetic ac., CO ₂ , formic ac., gly- collic ac., H ₂ , i-lactic ac., propionic ac. acetic ac., fumaric ac., lactic ac. acetyl carbinol acetylmethyl carbinol acetylmethyl carbinol aldol ethyl alc. lactic ac.	<i>Propionibacterium Jensenii</i> <i>Propionibacterium technicum</i> Van Niel, 1928 <i>B. coli</i> Aubel, 1924 <i>Rhizopus nigricans</i> Gottschalk, 1925 <i>Mycoderma aceti</i> Kling, 1905 yeast Neuberg and May, 1923 yeast Hirsch, 1922 yeast Neuberg, 1912 yeast Neuberg and Kerb, 1913 <i>B. pyocyaneus</i> Aubel, 1924
α-PROPYLENE GLYCOL acetyl carbinol	<i>Acetobacter xylinum</i> visser't Hooft, 1925

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
d-PROPYLENE GLYCOL lactic ac., propionic ac.	<i>Bact. termo</i> LeBel, 1881
d-l-PROPYLENE GLYCOL acetylcarbinol	<i>Mycoderma aceti</i> Kling, 1901
PYRUVIC AC. acetaldehyde	<i>Asp. niger mutante</i> <i>Monilia candida</i> <i>Mucor plumbeus</i> , <i>Mucor racemosus</i> <i>Mucor rouxii</i> <i>Oidium lactis</i> Nayagama, 1921
acetaldehyde	yeast Neuberg and Reinfürth, 1920
acetaldehyde, acetic ac., CO ₂ , H ₂	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
acetaldehyde, acetic ac., ethyl alc.	yeast Lebedev and Polonski, 1917
acetaldehyde, CO ₂	yeast Neuberg and Kerb, 1912
acetaldehyde, CO ₂	yeast Gottschalk, 1923
acetaldehyde, CO ₂ , ethyl alc.	yeast Lebedev and Polonski, 1917
acetaldehyde, CO ₂ , propionic ac.	<i>Bact. acidi propionici</i> var. <i>fuscum</i> Virtanen, 1923
QUINIC AC. acetic ac., formic ac., propionic ac., protocatechuic ac.	Schizomycetes Loew, 1881
ethyl alc.	<i>Asp. niger</i> Kostytschew and Afanassje- wa, 1922

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
QUINIC AC. (cont.) protocatechuic ac. protocatechuic ac.	<i>Micrococcus chinicus</i> Emmerling and Abderhalden, 1903 <i>Asp. niger</i> , <i>Asp. oryzae</i> <i>Citromyces glaber</i> Butkewitsch, 1924
RHAMNOSE acetylmethyl carbinol, 2, 3- butylene glycol	<i>B. cloacae</i> <i>B. lactis aerogenes</i> Harden and Norris, 1912
RAFFINOSE acetone, ethyl alc., formic ac. arabin oxalic ac. oxalic ac.	<i>B. acetoethylicum</i> Northrop, Ashe, and Morgan, 1919 <i>B. spongiosus</i> Ruhland, 1906 <i>Asp. niger</i> Gillot, 1899 <i>B. aceti</i> , <i>B. ascendens</i> <i>B. xylinum</i> Banning, 1902
SACCHARIC AC. acetic ac., ethyl alc., formic ac., lactic ac., succinic ac. acetic ac., acetylmethyl carbi- nol, CO ₂ , ethyl alc., formic ac., lactic ac., succinic ac. citric ac. oxalic ac.	<i>B. coli communis</i> Kay, 1926 <i>B. lactis aerogenes</i> Kay, 1926 <i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927 <i>Asp. niger</i> Butkewitsch, 1923
SORBITOL sorbose	<i>Acet. suboxydans</i> Kluyver and deLeeuw, 1924

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
SORBITOL (CONT.)	
sorbose	sorbose bacterium Bertrand, 1898
sorbose	<i>B. xylinum</i> Seifert, 1897, Mayer, 1898, Noyer, 1898
STARCH	
acetaldehyde	<i>B. acetoethylicum</i> Peterson and Fred, 1920
acetaldehyde, acetic ac., butyric ac., ethyl alc., formic ac.	<i>B. suaveolens</i> Sclavo and Gosio, 1891
acetic ac., acetone, butyl alc., butyric ac.	<i>B. granulobacter pectinovorum</i> Speakman, 1923
acetic ac., acetone, ethyl alc., formic ac., lactic ac.	<i>B. acetoethylicum</i> Arzberger, Peterson and Fred, 1920
acetic ac., butyl alc., butyric ac., CO ₂ , ethyl alc., H ₂ , lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
acetic ac., butyl alc., formic ac., lactic ac., succinic ac.	<i>Pectinobacter amylophilum</i> Makrinov, 1915
acetic ac., butyric ac., ethyl alc., succinic ac.	<i>B. subtilis</i> Fitz, 1878
acetic ac., CO ₂ , propionic ac., succinic ac.	<i>Propionibacterium technicum</i> Van Niel, 1928
acetone, butyl alc., CO ₂ , ethyl alc., H ₂	<i>Cl. acetobutylicum</i> Killeffer, 1927
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetone, ethyl alc., fusel oil	<i>B. acetoethylicus</i> Bakonyi, 1926
amylobiose, dihexosan	<i>Saccharomyces Saké</i> Sjöberg, 1927
dextrin	<i>B. amylobacter</i> Villiers, 1891

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
STARCH (cont.)	
dextrose	<i>B. anthracis</i> Maumus, 1893
ethyl alc.	<i>Mucor circinelloides</i> (?) Gayon and Dubourg, 1886
ethyl alc., isobutyl alc., isopropyl alc., n-butyl alc., propyl alc.	<i>Granulobacterium butylicum</i> Folpmers, 1921
maltose	<i>Bact. thermoamylolyticus</i> Coolhaas, 1928
oxalic ac.	<i>Asp. niger</i> Wehmer, 1891
SUCCINIC AC.	
acetic ac.	<i>Micrococcus casei liquefaciens</i> Orla-Jensen, 1904
acetic ac., formic ac., H ₂	<i>B. coli communis</i> Grey, 1923
acetic ac., propionic ac.	<i>B. casei</i> Orla-Jensen, 1904
fumaric ac.	<i>B. coli communis</i> Quastel and Whetham, 1924
oxalic ac.	<i>Asp. niger</i> Raistrick and Clark, 1919
propionic ac.	<i>B. pyocyaneus</i> Quastel, 1924
SUCROSE	
acetaldehyde	yeast Paris, 1922
acetaldehyde	<i>B. coli</i> , <i>B. lactis aerogenes</i> Nagai, 1923
acetaldehyde, acetic ac., CO ₂ , ethyl alc., glycerol	<i>Sacc. Saké</i> , <i>Zygosacc. major</i> , <i>Zygosacc. salsus</i> Kumagawa, 1922
acetaldehyde, acetic ac., ethyl alc., glycerol	yeast Neuberg and Hirsch, 1919
acetaldehyde, ethyl alc.	yeast Gehle, 1922

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
SUCROSE (cont.)	
acetaldehyde, ethyl alc.	yeast Zerner, 1920
acetaldehyde, glycerol	yeast Neuberg and Reinfurth, 1918
acetaldehyde, acetic ac., ethyl alc., lactic ac.	<i>Amylobacter ethylicus</i> Duclaux, 1895
acetic ac.	<i>Diplococcus pneumoniae</i> Brieger, 1883
acetic ac., acetone, ethyl alc. lactic ac.	<i>B. invertenti-acetici</i> Mezzadrolì, 1917
acetic ac., acetylmethylcarbinol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
acetic ac., butyl alc., butyric ac., CO ₂ , ethyl alc., H ₂ , lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
acetic ac., lactic ac.	<i>B. invertenti-lattici</i> Mezzadrolì, 1917
acetic ac., malic ac., succinic ac.	yeast Kostytschew and Frey, 1925
acetone, ethyl alc., fusel oil	<i>B. acetoethylicus</i> Bakonyi, 1926
acetone, ethyl alc., fusel oil	<i>B. macerans</i> Bakonyi, 1926
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
acetylmethyl carbinol	<i>B. anthracis</i> Lemoigne, 1919
acetylmethyl carbinol	<i>B. subtilis</i> Lemoigne, 1913
acetylmethyl carbinol	yeast Neuberg and Simon, 1925
acetylmethyl carbinol, 2, 3-butylene glycol	<i>B. subtilis</i> Lemoigne, 1912

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
SUCROSE (cont.)	
arabin	<i>B. spongiosus</i> Ruhland, 1906
butyl alc., butyric ac., lactic ac.	<i>B. butylicus</i> Fitz, 1882
2, 3-butylene glycol	yeast Henninger, 1888
citric ac.	<i>Asp. niger</i> Bernhauer, 1928
citric ac.	<i>Citromyces</i> , sp.? Wehmer, 1913
citric ac.	<i>Citromyces</i> , sp.? Filosofov and Malinovskii, 1928
citric ac.	<i>Citromyces</i> (Wehmer) Mazé, 1909
citric ac., fumaric ac., gluconic ac., malic ac.	<i>Asp. fumaricus</i> Wehmer, 1918, 1928
citric ac., gluconic ac.	<i>Citromyces glaber</i> <i>Pen. glaucum</i> Butkewitsch, 1927
citric ac., gluconic ac., oxalic ac.	<i>Asp. niger</i> Bernhauer, 1924, 1926
citric ac., gluconic ac., oxalic ac.	<i>Asp. niger</i> Butkewitsch, 1924
citric ac., gluconic ac., oxalic ac.	<i>Sterigmatocystis nigra</i> Molliard, 1922
citric ac., oxalic ac.	<i>Asp. niger</i> Currie, 1917
citric ac., oxalic ac.	<i>Asp. niger</i> Amelung, 1927
citric ac., oxalic ac.	<i>Asp. niger</i> <i>Citromyces glaber</i> Butkewitsch, 1923
ethyl alc.	<i>Mucor racemosus</i> Fitz, 1876

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
SUCROSE (cont.)	
ethyl alc.	<i>Asp. niger</i> Kostytschew and Afanassjewa, 1922
ethyl alc.	<i>Mucor mucedo</i> <i>Mucor racemosus</i> <i>Mucor stolonifer</i> Kostytschew and Eliasberg, 1920
ethyl alc.	<i>Pen. glaucum</i> Kostytschew and Afanassjewa, 1922
ethyl alc., glycerol, succinic ac.	<i>Mucor racemosus</i> Emmerling, 1897
ethyl alc., succinic ac.	<i>Mucor mucedo</i> Fitz, 1873
gluconic ac.	<i>Asp. niger</i> Bernhauer, 1928
glycerol	<i>Sacc. ellipsoideus</i> Adams, 1919
glycerol	yeast Buchner and Meisenheimer, 1906
glycerol	yeast Connstein and Ludecke, 1919
glycerol	yeast Abderhalden and Stix, 1922
glycerol	yeast Tomoda, 1928
gum levan	<i>B. vulgatus</i> Owen, 1923
lactic ac.	<i>B. coli</i> Péré, 1898
lactic ac.	yeast Fernbach and Schoen, 1923
l-lactic ac.	<i>B. acidi laevolactici</i> Schardinger, 1890

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
SUCROSE (cont.)	
l-lactic ac.	<i>B. casei</i> E. Virtanen, Wichmann and Lindström, 1927
d-lactic ac.	<i>Strep. lactis</i> Virtanen, Wichmann and Lindström, 1927
lactic ac., methylglyoxal	<i>B. coli</i> Virtanen and Simola, 1927
l-malic ac.	yeast Dakin, 1924
oxalic ac.	<i>Asp. niger</i> Elfving, 1919
oxalic ac.	<i>B. acetii</i> <i>B. Pasteurianum</i> Banning, 1902
oxalic ac., citric ac.	<i>Citromyces citricus</i> <i>Citromyces glaber</i> <i>Citromyces Pfefferianus</i> <i>Penicillium glaucum</i> Butkewitsch, 1922
pyruvic ac.	yeast Klein and Fuchs, 1929
SUCROSE+METHYL GLYOXAL	
l-propylene glycol	yeast Neuberg and Kobel, 1927
pyruvic ac.	yeast Fernbach and Schoen, 1913
TARTARIC AC.	
acetaldehyde	<i>B. coli</i> <i>B. lactis aerogenes</i> Nagai, 1923
acetic ac., ethyl alc., succinic ac.	<i>B. coli communis</i> Grey, 1923
acetic ac., propionic ac., suc- cinic ac.	<i>Bact. termo</i> König, 1881

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
TARTARIC AC. (cont.) butyric ac., lactic ac., propionic ac., succinic ac. ethyl alc. oxalic ac. oxalic ac.	yeast Karczag, 1912 <i>Asp. niger</i> Kostytschew and Afanass- jewa, 1912 <i>Asp. niger</i> Wehmer, 1891 <i>Asp. niger</i> Raistrick and Clark, 1919
THIOACETALDEHYDE ethylmercaptan	yeast Neuberg and Nord, 1914
O-TOLYL ALDEHYDE o-tolyl-acetyl carbinol	yeast Behrens and Ivanoff, 1926
P-TOLYL ALDEHYDE p-tolyl-acetyl carbinol	yeast Behrens and Ivanoff, 1926
TRICHLOR ACETALDEHYDE trichlorethylalcohol	yeast Lintner and Lüers, 1913
α , α , β , TRICHLORBUTYL ALDEHYDE 2, 2, 3-trichlorbutanol	yeast Rosenfeld, 1925
VALEMITE keto-hexose	sorbose bacterium Bertrand, 1898
n-VALERALDEHYDE n-amyl alc.	yeast Neuberg and Nord, 1914
VALERALDEHYDE amyl alc.	yeast Neuberg and Steenbock, 1914

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
XYLAN pentose (xylose?)	Actinomyces sp.? Patrick, Werkman and Hixon, 1930
P-XYLOQUINONE p-xylohydroquinone	coli bacteria Neuberg and Simon, 1927
XYLOSE acetic ac., acetone, butyl alc., butyric ac., lactic ac.	<i>B. granulobacter pectinovorum</i> Speakman, 1923
acetic ac., acetylmethyl car- binol, 2, 3-butylene glycol, CO ₂ , ethyl alc., formic ac., H ₂ , lactic ac., succinic ac.	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
acetic ac., butyric ac., ethyl alc. formic ac., lactic ac., suc- cinic ac.	<i>B. lactis aerogenes</i> <i>B. para typhoid</i> <i>B. typhosus</i> Fred and Peterson, 1920
acetic ac., ethyl alc., l-lactic ac., succinic ac.	Friedlander's pneumobacillus Grimbert, 1896
acetic ac., CO ₂ , propionic ac.	<i>Propionibacterium pentosaceum</i> Werkman, Hixon, Fulmer and Rayburn, 1929
acetic ac., lactic ac.	<i>Lactobacillus pentosus</i> <i>Lactobacillus pentoaceticus</i> Fred, Peterson and Anderson, 1921
acetic ac., lactic ac.	<i>Lactobacillus pentoaceticus</i> Fred, Peterson and Daven- port, 1919
acetone, butyl alc., CO ₂	<i>B. granulobacter pectinovorum</i> Peterson, Fred and Schmidt, 1924

SUBSTRATES PRODUCTS	MICROORGANISMS AUTHORS
XYLOSE (cont.) acetone, CO ₂ , ethyl alc.	<i>Acetobacter xylinum</i> , <i>B. herbicola aureum</i> , <i>B. vulgatus</i> Fred, Peterson and Anderson, 1923
acetone, ethyl alc., formic ac.	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
citric ac.	<i>Citromyces</i> , sp.? Wehmer, 1913
citric ac., oxalic ac.	<i>Asp. niger</i> Amelung, 1927
CO ₂ , ethyl alc., glyceric aldehyde (?) xylonic ac.	<i>Sacc. cerevisiae</i> Abbott, 1926 sorbose bacterium Bertrand, 1898

TABLE III

INDEX TO PRODUCTS

TABLE THREE
INDEX TO PRODUCTS

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETALDEHYDE	
dextrose	<i>Asp. cellulosa</i> <i>Monilia candida</i> <i>Mucor racemosus</i> <i>Mucor rouxii</i> <i>Oidium lactis</i> Cohen, 1920
dextrose	<i>B. coli communis</i> Grey, 1913
dextrose	<i>B. dysenteriae</i> , Shiga-Kruse Bergh, 1928
dextrose	yeast Kostytschew, 1912
dextrose	<i>Oidium lupuli</i> Sumiki, 1927
dextrose	<i>B. lactis aerogenes</i> Neuberg, Nord and Wolff, 1920
dextrose	<i>Rhizopus</i> , sp.? Nill, 1927
dextrose, glycerol, inositol	<i>B. lactis aerogenes</i> Kumagawa, 1922
ethyl alc.	yeast Trillat and Sauton, 1908
ethyl alc.	<i>B. pyocyaneus</i> Supniewski, 1923
galactose	yeast Tomita, 1921
galactose, gluconic ac., glyceric ac., lactic ac., lactose, levu- lose, malic ac., maltose, suc- rose, tartaric ac.	<i>B. coli</i> <i>B. lactis aerogenes</i> Nagai, 1923

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETALDEHYDE (cont.)	
glyceric ac.	yeast Lebedev, 1918
glyceric ac., pyruvic ac.	yeast Lebedev and Polonski, 1916
glyoxylic ac.	yeast Lebedev, 1918
hydroxyfumaric ac.	yeast Mayer, 1913
lactic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
lactose	yeast Trillat, 1908
oxalacetic ac.	yeast Neuberg and Kerb, 1913
oxalacetic ac.	yeast Neuberg and Gorr, 1925
pyruvic ac.	yeast Neuberg and Kerb, 1912
pyruvic ac.	<i>Monilia candida</i> , <i>Oidium lactis</i> <i>Asp. niger mutante</i> , <i>Mucor rouxii</i> <i>Mucor racemosus</i>
pyruvic ac.	Nagayama, 1921 <i>Lactobacillus pentoaceticus</i>
pyruvic ac.	Peterson and Fred, 1920 yeast
pyruvic ac.	Neuberg and Reinfürth, 1920 yeast
pyruvic ac.	Gottschalk, 1923 yeast
starch	Paris, 1922 <i>B. acetothyllicum</i>
sucrose	Peterson and Fred, 1920 <i>Sacc. Saké</i> <i>Zygosaccharomyces major</i> <i>Zygosaccharomyces salsa</i> Kumagawa, 1922

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETALDEHYDE (cont.)	
sucrose	<i>Amylobacter ethylicus</i> Duclaux, 1895
sucrose	yeast Gehle, 1922
sucrose	yeast Neuberg and Reinfürth, 1918
sucrose	yeast Zerner, 1920
ACETIC AC.	
acetaldehyde	yeast Kostytschew, 1914
acetaldehyde	<i>B. lactis aerogenes</i> Harden and Norris, 1912
acetaldehyde	<i>B. pyocyaneus</i> Supniewski, 1923
acetone	<i>B. pyocyaneus</i> Supniewski, 1923
arabinose	<i>B. ethaceticum</i> Frankland and MacGregor, 1892
arabinose	<i>Lactobacillus arabinosus</i> Fred, Peterson and Anderson, 1921
arabinose	Pneumobacillus of Friedlander Grimbert, 1896
arabinose, dextrose, galactose, levulose, mannitol	<i>B. coli communis</i> Harden, 1901
arabinose, dextrose, galactose, mannitol, starch, xylose	<i>B. granulobacter pectinovorum</i> Speakman, 1923
arabinose, xylose	<i>Lactob. pentosus</i> <i>Lactob. pentoaceticus</i> Fred, Peterson and Anderson, 1921
arabinose, dextrose, glycerol, lactic ac., starch, xylose	<i>Propionibacterium pentosaceum</i> Werkman, Hixon, Fulmer and Rayburn, 1929

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETIC AC. (cont.) cellulose	<i>Clostridium thermocellum</i> Viljoen, Fred and Peterson, 1926
cellulose	<i>B. cellulosa dissolvens</i> Khouvine, 1923
cellulose	<i>Bact. cellaresolvens</i> <i>Bact. opalescens</i> Groenewege, 1923
citric ac.	<i>B. coli communis</i> Grey, 1923
citric ac.	<i>B. suipestifer</i> Brown, Duncan and Henry, 1924
dextrose	<i>B. coli communis</i> Grey and Young, 1921
dextrose	<i>Granulobacter saccharobutyricum</i> Donker, 1926
dextrose	<i>B. aerogenes</i> <i>B. coli</i> Virtanen and Simola, 1927
dextrose	<i>Clostridium pasteurianum</i> Donker, 1926
dextrose	<i>B. coli communis</i> Young, 1924
dextrose	<i>B. acetothylicum</i> Donker, 1926
dextrose	<i>B. polymyxa</i> Donker, 1926
dextrose	<i>Asp. niger</i> Heinze, 1903
dextrose	<i>B. granulobacter pectinovorum</i> , Weizmann Donker, 1926
dextrose	<i>B. butylicus</i> Buchner and Meisenheimer, 1908

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETIC AC. (cont.)	
dextrose	<i>B. dysenteriae</i> , Shiga-Kruse Bergh, 1929
dextrose	<i>B. coli communis</i> Grey, 1918
dextrose	<i>B. typhosus</i> Harden, 1901
dextrose	<i>B. typhosum</i> Scheffer, 1928
dextrose	<i>B. coli</i> Scheffer, 1928
dextrose	<i>B. dysenteriae</i> , Shiga-Kruse Scheffer, 1928
dextrose	<i>B. aerogenes</i> Scheffer, 1928
dextrose	<i>B. coli communis</i> Harden, 1899
dextrose	<i>Oidium lupuli</i> Sumiki, 1927
dextrose	<i>B. coli</i> Grimbert, 1896
dextrose	<i>Cl. Pasteurianum</i> Winogradsky, 1902
dextrose	Friedlander's pneumococcus Frankland, Stanley and Frew, 1891
dextrose	<i>Serratia marcescens</i> Pederson and Breed, 1928
dextrose, galactose, lactic ac., mannose	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
dextrose, gluconic ac., manni- tol, saccharic ac.	<i>B. lactis aerogenes</i> Kay, 1926
dextrose, glycerol, lactic ac.	<i>Propionibacterium Freudenreichii</i> <i>Propionibacterium Peterssonii</i> <i>Propionibacterium Shermanii</i> <i>Propionibacterium Thönii</i> van Niel, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETIC AC (cont.)	
dextrose, glycerol, lactic ac., pyruvic ac.	<i>Propionibacterium Jensenii</i> van Niel, 1928
dextrose, glycerol, lactic ac., pyruvic ac., starch	<i>Propionibacterium technicum</i> van Niel, 1928
dextrose, glycerol, lactic ac.	<i>Propionibacterium pentosaceum</i> van Niel, 1928
dextrose, lactic ac.	<i>Propionibacterium rubrum</i> van Niel, 1928
dextrose, lactose, maltose, man- nitol, sucrose	<i>B. tartricus</i> Grimbert, 1901
dextrose, lactic ac., lactose, py- ruvic ac.	<i>Bact. acidi propionici</i> , var. <i>fuscum</i> Virtanen, 1923
dextrose, levulose	<i>Bact. pyocyanus</i> Aubel, 1921
dextrose, mannitol	<i>B. coli communis</i> Grey, 1918
dextrose, mannitol	<i>B. ethaceticus</i> Frankland and Lumsden, 1892
dextrose, mannitol	<i>B. cloacae</i> <i>B. coli</i> <i>B. lactis aerogenes</i> Thompson, 1912
dextrose, mannitol	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
dextrose, gluconic ac., glycu- ronic ac., mannitol, saccha- ric ac.	<i>B. coli communis</i> Kay, 1926
dextrose, starch, sucrose	<i>B. acetoethylicum</i> Arzberger, Peterson and Fred, 1920
dulcitol	Pneumobacillus of Friedländer Grimbert, 1896
dulcitol, mannitol	<i>B. ethacetosuccinicus</i> Frankland and Frew, 1892
ethyl alc.	<i>Bact. aceti</i> Brown, 1886

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETIC AC. (cont.)	
ethyl alc.	<i>Acetobacter</i> , sp.? Knieriem and Mayer, 1872 Buchner and Gaunt, 1906 Day and Baker, 1913 Söhngen, 1913
ethyl alc.	<i>Acetobacter suboxydans</i> visser't Hooft, 1925
ethyl alc.	<i>Bact. aceti viscosum</i> Day and Baker, 1913
ethyl alc.	<i>B. aceti</i> (Hansen) Buchner and Gaunt, 1913
ethyl alc.	<i>B. Kützingianum</i> Mayer, 1898
ethyl alc.	<i>B. Pasteurianum</i> Mayer, 1898
ethyl alc.	<i>B. pyocyaneus</i> Supniewski, 1923
fumaric ac.	<i>B. pyocyaneus</i> Quastel, 1924
glyceric ac.	yeast Lebedev, 1918
glycerol	<i>B. coli communis</i> Grey, 1923
glycerol	<i>Bact. aerogenes</i> <i>Bact. coli</i> <i>Bact. Freundii</i> Braak, 1928
glycerol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
glycerol, lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
i-inositol	<i>B. lactis</i> Hewitt and Steabben, 1921
lactic ac.	<i>Acetobacter melanogenum</i> <i>Acetobacter suboxydans</i>

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETIC AC. (cont.)	
	<i>Acetobacter xylinum</i> Visser't Hooft, 1925
lactic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
lactic ac.	<i>B. acidi propionici</i> <i>B. acidi propionici-b</i> <i>B. acidi propionici-a</i> von Freudenreich and Jensen, 1906
lactic ac.	<i>B. ethacetosuccinicus</i> Mazé, 1913
lactic ac.	<i>B. casei</i> <i>B. mobilis</i>
	<i>Micrococcus casei liquefaciens</i> Orla-Jensen, 1904
lactose	<i>Bact. acidi propionici</i> Sherman and Shaw, 1923
lactose	<i>B. lactis aerogenes</i> Emmerling, 1900
lactose	<i>B. coli</i> Grimbert, 1896
lactose, maltose, mannitol, starch, sucrose	<i>Amylobacter butylicus</i> Duclaux, 1895
levulose	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
malic ac.	<i>B. coli communis</i> Grey, 1923
malic ac.	<i>B. lactis aerogenes</i> Emmerling, 1899
malic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
malonic ac.	<i>B. coli communis</i> Grey, 1923
mannitol	Pneumobacillus of Friedlander Grimbert, 1896

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETIC AC. (cont.)	
mannitol	Friedlander's pneumococcus Frankland, Stanley and Frew, 1891
mannitol	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
mannitol	<i>B. ethaceticus</i> Frankland, Stanley and Frew, 1891
mannitol, glycerol	<i>B. ethaceticus</i> Frankland and Fox, 1889
pyruvic ac.	<i>Bact. coli</i> Aubel, 1924
pyruvic ac.	<i>B. coli</i> , <i>B. proteus vulgatus</i> <i>B. pyocyaneus</i> Cambier and Aubel, 1922
pyruvic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
pyruvic ac.	<i>Rhizopus nigricans</i> Gottschalk, 1925
pyruvic ac.	yeast Lebedev and Polonski, 1917
quinic ac.	Schizomycetes Loew, 1881
starch	<i>B. suaveolens</i> Sclavo and Gosio, 1891
starch	<i>B. subtilis</i> Fitz, 1878
starch	<i>Pectinobacter amylophilum</i> Makrinov, 1915
succinic ac.	<i>B. coli communis</i> Grey, 1923
succinic ac.	<i>B. casei</i> <i>Micrococcus casei liquefaciens</i> Orla-Jensen, 1904

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETIC AC. (cont.)	
sucrose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
sucrose	<i>B. invertenti-lattici</i> <i>B. invertenti-acetici</i>
sucrose	Mezzadrolì, 1917
sucrose	<i>Diplococcus pneumoniae</i> Brieger, 1883
sucrose	<i>Amylobacter ethylicus</i> Duclaux, 1895
sucrose	<i>Sacc. Saké</i> , <i>Zygosacc. major</i> , <i>Zygosacc. salsus</i> Kumagawa, 1922
sucrose	yeast Kostytschew and Frey, 1925
tartaric ac.	<i>B. coli communis</i> Grey, 1923
tartaric ac.	<i>B. tartricus</i> Grimbert and Ficquet, 1898
tartaric ac.	<i>Bact. termo</i> König, 1881
xylose	Pneumobacillus of Friedländer Grimbert, 1896
xylose	<i>Lactobacillus pentoaceticus</i> Fred, Peterson and Daven- port, 1919
xylose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
xylose	<i>B. lactis aerogenes</i> , <i>B. paratyphoid</i> <i>B. typhosus</i> Fred and Peterson, 1920
ACETOACETIC AC.	
butyric ac.	<i>Asp. niger</i> Coppock, Subramaniam and Walker, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETOIN See acetylmethyl carbinol	
ACETOL See acetyl carbinol	
ACETONE arabinose, dextrin, dextrose, galactose, glycerol, lactic ac., levulose, maltose, man- nose, raffinose, starch, su- crose, xylose	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan. 1919
arabinose, dextrose, galactose, mannitol, starch, xylose	<i>B. granulobacter pectinovorum</i> Speakman, 1923
arabinose, xylose	<i>B. granulobacter pectinovorum</i> Peterson, Fred and Schmidt, 1924
butyric ac.	<i>Asp. niger</i> Coppock, Subramaniam and Walker, 1928
2, 3-butylene glycol	<i>Acetobacter suboxydans</i> <i>Acetobacter xylinum</i> visser't Hooft, 1925
citric ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
dextrose	<i>Cl. pasteurianum</i> Donker, 1926
dextrose	<i>B. granulobacter pectinovorum</i> Donker, 1926
dextrose	<i>B. acetoethylicum</i> Donker, 1926
dextrose	<i>B. polymyxa</i> Donker, 1926
dextrose, maltose	<i>B. acetoethylicum</i> Speakman, 1925

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETONE (cont.)	
dextrose, starch, sucrose	<i>B. acetoethylicum</i> Arzberger, Peterson and Fred, 1920
isopropyl alc.	<i>Acetobacter xylinum</i> visser't Hooft, 1925
oxalacetic ac.	yeast Neuberg and Gorr, 1925
starch	<i>Cl. acetobutylicum</i> Killeffer, 1927
starch, sucrose	<i>B. acetoethylicus</i> <i>B. macerans</i> Bakonyi, 1926
sucrose	<i>B. invertenti-acetici</i> Mezzadroli, 1917
xylose	<i>Acetobacter xylinum</i> , <i>B. vulgatus</i> Fred, Peterson and Anderson, 1923
ACETONE DICARBOXYLIC AC.	
citric ac.	<i>Asp. niger</i> Walker, Subramaniam and Challenger, 1927
ACETYL CARBINOL	
d-l-propylene glycol	<i>Mycoderma aceti</i> Kling, 1901, 1905
ACETYL CHLORBENZYL CARBINOL	
chlorobenzaldehyde	yeast Neuberg and Liebermann, 1921
ACETYLMETHYL CARBINOL	
acetaldehyde, sucrose	yeast Neuberg and Simon, 1925
adonitol, mannitol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
arabinose, dextrose, galactose, isodulcîte, mannose	<i>B. cloacae</i> <i>B. lactis aerogenes</i> Harden and Norris, 1912

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETYL METHYL CARBINOL (cont.)	
2, 3-butylene glycol	<i>Mycoderma aceti</i> Kling, 1905
dextrose	<i>B. lactis aerogenes</i> Neuberg, Nord and Wolff, 1920
dextrose	<i>Serratia marcescens</i> Pederson and Breed, 1928
dextrose	<i>B. granulobacter pectinovorum</i> , Weizmann Donker, 1926
dextrose	<i>B. acetoethylicum</i> Donker, 1926
dextrose	<i>B. polymyxa</i> Donker, 1926
dextrose	<i>B. aerogenes</i> <i>B. cloacae</i> Scheffer, 1928
dextrose, lactic ac.	<i>B. proteus</i> , <i>B. subtilis</i> Lemoigne, 1923
dextrose, lactose, maltose, mannitol, sucrose	<i>B. tartricus</i> Grimbert, 1901
dextrose, levulose	<i>B. lactis aerogenes</i> Walpole, 1911
dextrose, levulose	<i>Sarcina ventriculi</i> Smit, 1928 yeast Kluyver, Donker and Hooft 1925
dextrose, levulose, sucrose, acetaldehyde	yeast Neuberg and Reinfürth, 1923
dextrose, mannitol	<i>B. cloacae</i> Thompson, 1912
dextrose, mannitol	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
dextrose, mannitol	<i>B. mesentericus vulgatus</i> <i>B. subtilis</i>

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ACETYLMETHYL CARBINOL (cont.)	<p><i>Tyrothrix tenuis</i> Harden and Norris, 1912</p> <p><i>B. lactis aerogenes</i> Kay, 1926</p> <p><i>Tyrothrix tenuis</i> Harden and Norris, 1912</p> <p>yeast Kluyver and Donker, 1924</p> <p><i>B. anthracis</i> Lemoigne, 1919</p> <p><i>B. mesentericus vulgatus</i> Harden and Norris, 1912</p> <p>yeast Neuberg and Gorr, 1924</p> <p>yeast Hirsch, 1922</p> <p><i>B. subtilis</i> Lemoigne, 1913</p> <p><i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930</p>
ACROLEIN	<p><i>B. Welchii</i> Humphreys, 1924</p> <p><i>B. amaracrylus</i> Voisenet, 1918</p>
glycerol	
glycerol	
ACRYLALDEHYDE	
See acrolein	
ADONINULOSE	
adonitol	<p><i>Acetobacter suboxydans</i> Visser't Hooft, 1925</p>
ALDOL	
pyruvic ac.	<p>yeast Neuberg, 1912</p>

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
d-AMYL ALC. d-l-methylethyl acetaldehyde	<i>B. pasteurianum</i> Neuberg and Simon, 1926
i-AMYL ALC. methylethylacetaldehyde methylethyl pyruvic ac.	<i>B. xylinum</i> Neuberg and Simon, 1926 yeast Neuberg and Peterson, 1914
l-AMYL ALC. methylethylacetaldehyde	<i>B. ascendens</i> Neuberg and Simon, 1926
n-AMYL ALC. glycerol α -keto-n-caproic ac.	<i>B. butylicus</i> Morin, 1887 yeast Sen, 1923
n-valeraldehyde	yeast Neuberg and Nord, 1914
valeraldehyde	yeast Neuberg and Steenbock, 1914
AMYLOBIOSE starch	<i>Sacc. Saké</i> Sjöberg, 1927
ARABIN raffinose, sucrose	<i>B. spongiosus</i> Ruhland, 1906
ARABONIC AC. arabinose	sorbose bacterium Bertrand, 1898
BENZALDEHYDE phenylglyoxalic ac.	yeast Binder-Kotrba, 1926

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
BENZOIN benzil	yeast Neuberg and Nord, 1919
BENZYL ALC. benzaldehyde	yeast Neuberg and Welde, 1914
2, 3-BUTANEDIOL See 2, 3-butyleneglycol	
BUTYL ALC. arabinose, dextrose, galactose, mannitol, starch, xylose arabinose, xylose	<i>B. granulobacter pectinovorum</i> Speakman, 1923 <i>B. granulobacter pectinovorum</i> Peterson, Fred and Schmidt, 1924
dextrose	<i>B. granulobacter pectinovorum</i> <i>B. polymyxa</i> Donker, 1926
dextrose, glycerol, lactic ac., propionic ac. glycerol	<i>B. butylicus</i> Neuberg and Arinstein, 1921 <i>B. butylicus</i> Buchner and Meisenheimer, 1908
glycerol	<i>B. butylicus</i> Morin, 1887
glycerol	<i>Mucor racemosus</i> Fitz, 1876
glycerol, lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
glycerol, mannitol	<i>Bact. butylicus</i> Emmerling, 1897
glycerol, mannitol, sucrose	<i>B. butylicus</i> Fitz, 1882
lactose maltose, mannitol, starch, sucrose	<i>Amylobacter butylicus</i> Duclaux, 1895

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
BUTYL ALC. (cont.)	
starch	<i>Cl. acetobutylicum</i> Killeffer, 1927
starch	<i>Pectinobacter amylophilum</i> Makrinov, 1915
starch	<i>Granulobacter butylicum</i> Folpmers, 1921
β -BUTYLENE GLYCOL	
See 1, 3-butylene glycol	
1, 3-BUTYLENE GLYCOL	
acetylmethyl carbinol	yeast Neuberg and Kobel, 1925
2, 3-BUTYLENE GLYCOL	
acetaldehyde	<i>Bact. ascendens</i> Binder-Kotrba, 1926
acetaldehyde	<i>B. lactis aerogenes</i> Harden and Norris, 1912
acetaldol	yeast Neuberg and Kerb, 1918
adonitol, mannitol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
arabinose, dextrose, galactose, isodulcite, mannose	<i>B. lactis aerogenes</i> Harden and Norris, 1912
arabinose, levulose, galactose, isodulcite, mannose	<i>B. cloacae</i> Harden and Norris, 1912
dextrose	<i>B. lactis aerogenes</i> Neuberg, Nord and Wolff, 1920
dextrose, levulose	<i>B. lactis aerogenes</i> Walpole, 1911
dextrose	<i>Serratia marcescens</i> Pederson and Breed, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
2, 3,-BUTYLENE GLYCOL (cont.)	
dextrose	<i>B. acetoethylicum</i> <i>B. polymyxa</i> <i>Cl. pasteurianum</i> <i>Granulobacter saccharobutyricum</i>
dextrose	Donker, 1926 <i>B. aerogenes</i> , <i>B. cloacae</i>
dextrose, levulose	Scheffer, 1928 yeast
dextrose, mannitol	Kluyver, Donker and Hoof, 1925
dextrose, mannitol	<i>B. cloacae</i> Thompson, 1912
dextrose, mannitol	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
ethylene glycol, glycerol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
glycerol	<i>Bact. aerogenes</i> Braak, 1928
glycerol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
lactic ac.	<i>B. mesentericus</i> Lemoigne, 1913
lactic ac.	<i>B. subtilis</i> Lemoigne, 1923
levulose	yeast Kluyver and Donker, 1924
oxalacetic ac.	yeast Neuberg and Gorr, 1924
sucrose	<i>B. subtilis</i> Lemoigne, 1912
sucrose	yeast Henninger, 1888
sucrose, xylose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
BUTYRIC AC.	
arabinose, dextrose, galactose, mannitol, starch, xylose	<i>B. granulobacter pectinovorum</i> Speakman, 1923
butyl alc.	<i>B. Kützingianum</i> Mayer, 1898
butyl alc.	<i>B. pasteurianum</i> <i>B. Kützingianum</i> Seifert, 1897
butyl alc.	<i>Acetobacter melanogenum</i> visser't Hooft, 1925
cellulose	<i>Bact. cellaresolvens</i> <i>Bact. opalescens</i> Groenewege, 1923
cellulose	<i>Clostridium thermocellum</i> Viljoen, Fred and Peterson, 1926
cellulose	<i>B. cellulosa dissolvens</i> Khouvine, 1923
dextrose	<i>B. butylicus</i> Buchner and Meisenheimer, 1908
dextrose	<i>Bact. thermobutyricus</i> Coolhaas, 1928
dextrose	<i>B. granulobacter pectinovorum</i> , <i>Cl. pasteurianum</i> <i>Granulobacter saccharobutyricum</i> Donker, 1926
dextrose	<i>Cl. Pasteurianum</i> Winogradsky, 1902
dextrose, glycerol, lactic ac., propionic ac.	<i>B. butylicus</i> Neuberg and Arinsein, 1921
dextrose, glycerol	<i>B. subtilis</i> Vandevelde, 1884
glycerol, lactic ac.	<i>Amylobacter butylicus</i> Duclaux, 1895
glycerol, mannitol, sucrose	<i>B. butylicus</i> Fitz, 1882

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
BUTYRIC AC. (cont.)	
lactose, maltose, mannitol,	<i>Amylobacter butylicus</i>
starch, sucrose	Duclaux, 1895
levulose	<i>Sarcina maxima</i>
	Smit, 1928
starch	<i>B. suaceolens</i>
	Sclavo and Gosio, 1891
starch	<i>B. subtilis</i>
	Fitz, 1878
tartaric ac.	yeast
	Karczag, 1912
xylose	<i>B. paratyphoid</i>
	<i>B. typhosus</i>
	Fred and Peterson, 1920
CAPROIC AC.	
dextrose, glycerol, lactic ac.,	<i>B. butylicus</i>
propionic ac.	Neuberg and Arinstein,
	1921
CAPRYLIC AC.	
dextrose, glycerol, lactic ac.,	<i>B. butylicus</i>
propionic ac.	Neuberg and Arinstein, 1921
CELLOBIOSE	
cellulose	<i>Bact. cellaresolvens</i>
	<i>Bact. opalescens</i>
	Groenwege, 1923
CELLULOSE	
dextrose, levulose, mannitol	<i>Bact. xylinum</i>
	Brown, 1886
CHLORO BENZOIC AC.	
chlorobenzaldehyde	yeast
	Neuberg and Liebermann,
	1921
CHLORO BENZYL ALC.	
chlorobenzaldehyde	yeast
	Neuberg and Liebermann,
	1921

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
CINNAMIC ALC. cinnamic aldehyde	yeast Rona, 1914
CITRIC AC.	
arabinose, dextrose, galactose, glycerose, levulose, maltose, mannose, sucrose, xylose	<i>Asp. niger</i> Amelung, 1927
arabinose, glycerol, lactose, mannose, sucrose	<i>Citromyces</i> , sp.? Wehmer, 1913
arabinose, glycerol, mannitol, sucrose	<i>Asp. niger</i> , <i>Citromyces glaber</i> Butkewitsch, 1923
dextrose	<i>Asp. cinnamoneus</i>
	<i>Asp. fuscus</i>
	<i>Asp. niger</i>
	Falck and Kapur, 1924
dextrose	<i>Asp. niger</i>
	Wehmer, 1924
dextrose	<i>Asp. niger</i>
	Elfving, 1919
dextrose	<i>Citromyces</i> , sp.?
	Martin, 1916
dextrose	<i>Citromyces citricus</i>
	Buchner and Wüstenfeld, 1909
dextrose	<i>Citromyces glaber</i>
	Butkewitsch, 1922
dextrose	<i>Citromyces Pfefferianus</i>
	Buchner and Wüstenfeld, 1909
dextrose	<i>Mucor piriformis</i>
	<i>Penicillium luteum</i>
	Wehmer, 1897
dextrose	<i>Citromyces citricus</i>
	<i>Citromyces lacticus</i>
	<i>Citromyces oxalicus</i>
	<i>Citromyces tartricus</i>
	Mazé and Perrier, 1904
dextrose, gluconic ac., glyceric ac., glycerol, lactic ac., mannitol	<i>Asp. fumaricus</i> Schreyer, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
CITRIC AC. (cont.) dextrose, sucrose	<i>Asp. niger</i> Bernhauer, 1928
ethyl alc.	<i>Citromyces citricus</i> <i>Citromyces tartricus</i> Mazé and Perrier, 1904
gluconic ac.	<i>Asp. niger</i> Walker, Subramaniam and Challenger, 1927
gluconic ac.	<i>Asp. fumaricus</i> Schreyer, 1925
glycerol	<i>Citromyces citricus</i> Mazé and Perrier, 1904
saccharic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
sucrose	<i>Asp. niger</i> Bernhauer, 1926
sucrose	<i>Asp. niger</i> Butkewitsch, 1924
sucrose	<i>Asp. niger</i> Bernhauer, 1924
sucrose	<i>Asp. niger</i> Currie, 1917
sucrose	<i>Citromyces</i> , sp.? Filosofov and Malinovski, 1928
sucrose	<i>Citromyces</i> , sp.? Mazé, 1909
sucrose	<i>Asp. fumaricus</i> Wehmer, 1918, 1928
sucrose	<i>Citromyces citricus</i> <i>Citromyces glaber</i> <i>Citromyces Pfefferianus</i> <i>Penicillium glaucum</i> Butkewitsch, 1922

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
CITRIC AC. (cont.)	
sucrose	<i>Citromyces glaber</i> <i>Penicillium glaucum</i> Butkewitsch, 1927
sucrose	<i>Sterigmatocystis nigra</i> Molliard, 1922
CITRONELLA OIL (OR ALC.)	
α -citronellaldehyde	yeast Mayer and Neuberg, 1915
DEXTRIN	
dihydroxyacetone	<i>S. ludwigii</i> Neuberg and Kobel, 1928
starch	<i>B. amylobacter</i> Villiers, 1891
DEXTROSE	
starch	<i>B. anthracis</i> Maumus, 1893
phloridzin	<i>Asp. niger</i> <i>Cladosporium</i> , sp.? Boas, 1916
α , α , DICHLORPROPYL ALC.	
α , α , dichloracetone	yeast Sen, 1924
gluconic ac.	<i>Acetobacter</i> sp? Söhngen, 1914, 1915
DIHYDROXYACETONE	
glycerol	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1924
glycerol	sorbose bacterium Bertrand, 1904
glycerol	<i>B. xylinum</i> Bernhauer and Schön, 1928
glycerol	<i>B. dioxyaceticum</i> <i>B. xylinum</i> Virtanen and Barlund, 1926

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
DIHYDROXYACETONE (cont.) glycerol	<i>Acetobacter suboxydans</i> <i>Bact. xylinum</i> Brit. patent 269,950
glycerol	<i>Bact. xylinum</i> Bertrand and Sazerac, 1901
glycerol	sorbose bacterium Bertrand, 1898
ERYTHROSE erythritol	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1924
ERYTHRULOSE erythritol	Sorbose bacterium Bertrand, 1898, 1900
ETHYL ALC. acetaldehyde	yeast Kostytschew and Hübbenet, 1912
arabinose	<i>B. ethaceticus</i> Frankland and MacGregor, 1892
arabinose, dextrin, dextrose, galactose, glycerol, lactic ac., levulose, maltose, man- nose, raffinose, starch, su- crose, xylose	<i>B. acetoethylicum</i> Northrop, Ashe and Morgan, 1919
arabinose, dextrose, galactose, levulose, mannitol	<i>B. coli communis</i> Harden, 1901
cellulose	<i>Clostridium thermocellum</i> Viljoen, Fred and Peterson, 1926
cellulose	<i>B. cellulosa dissolvens</i> Khouvine, 1923
citric ac.	<i>B. coli communis</i> Grey, 1923
dextrin, starch	<i>Mucor circinelloides</i> (?) Gayon and Dubourg, 1886

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ETHYL ALC. (cont.)	
dextrose	<i>Asp. niger</i>
	Kostytschew, 1907
dextrose	<i>B. coli communis</i>
	Grey and Young, 1921
dextrose	<i>B. aerogenes</i>
	<i>B. coli</i>
	Virtanen and Simola, 1927
dextrose	<i>B. coli</i>
	Grimbert, 1896
dextrose	<i>B. coli communis</i>
	Harden, 1899
dextrose	<i>B. dysenteriae</i> , Shiga-Kruse
	Bergh, 1928
dextrose	<i>B. aectothylicum</i>
	<i>B. granulobacter pectinovorum</i>
	Weizmann
	<i>B. polymyxa</i>
	<i>Clostridium pasteurianum</i>
	Donker, 1926
dextrose	<i>B. aerogenes</i>
	<i>B. cloacae</i>
	<i>B. coli</i>
	<i>B. dysenteriae</i> , Shiga-Kruse
	<i>B. Freundii</i>
	<i>B. typhosus</i>
	Scheffer, 1928
dextrose	<i>Oidium lupuli</i>
	Sumiki, 1927
dextrose	<i>Rhizopus</i> , sp.?
	Takahashi and Sakaguchi,
	1927
dextrose	yeast
	Rimini, 1926
dextrose	<i>B. coli communis</i>
	Grey, 1918

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ETHYL ALC. (cont.)	
dextrose	<i>B.</i> of malignant oedema Kerry and Frankel, 1890
dextrose	Friedlander's pneumococcus Frankland, Stanley and Frew, 1891
dextrose	<i>Rhizopus</i> , sp.? Nill, 1927
dextrose	<i>Fusarium lini</i> Anderson and Willaman, 1922
dextrose	<i>B. typhosus</i> Harden, 1901
dextrose	<i>Serratia marcescens</i> Pederson and Breed, 1928
dextrose, galactose, mannose	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
dextrose, gluconic ac., glycerol, mannitol	<i>B. coli communis</i> Kay, 1926
dextrose, gluconic ac., mannitol	<i>B. lactis aerogenes</i> Kay, 1926
dextrose, lactose, maltose, mannitol, sucrose	<i>B. tartricus</i> Grimbert, 1901
dextrose, levulose	<i>Bact. pyocyaneus</i> Aubel, 1921
dextrose, levulose	<i>Sarcina maxima</i> <i>Sarcina ventriculi</i> Smit, 1928
dextrose, maltose	<i>B. acetothylicum</i> Speakman, 1925
dextrose, mannitol	<i>B. coli communis</i> Grey, 1918
dextrose, mannitol	<i>B. cloacae</i> , <i>B. coli</i> <i>B. lactis aerogenes</i> Thompson, 1912
dextrose, mannitol	<i>B. ethaceticus</i> Frankland and Lumsden, 1892

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ETHYL ALC. (cont.)	
dextrose, mannitol	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
dextrose, starch, sucrose	<i>B. acetothyllicum</i> Arzberger, Peterson and Fred, 1920
dextrose, sucrose	<i>Mucor mucedo</i> <i>Mucor racemosus</i> <i>Mucor stolonifer</i> Kostytschew and Eliasberg, 1920
dulcitol	Pneumobacillus of Friedländer Grimbert, 1896
gluconic ac.	<i>Acetobacter</i> , sp.? Söhngen, 1914, 1915
glyceric ac.	yeast Lebedev, 1918
glycerol	<i>B. coli communis</i> Grey, 1923
glycerol	<i>Bact. aerogenes</i> <i>Bact. coli</i> <i>Bact. Freundii</i> Braak, 1928
glycerol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
glycerol	<i>Mucor racemosus</i> Fitz, 1876
glycerol	yeast Neuberg and Kerb, 1913
glycerol, mannitol	yeast Kostytschew and Faermann, 1928
i-inositol	<i>B. lactis</i> Hewitt and Steabben, 1921
ketobutyric ac.	yeast Neuberg and Kerb, 1914

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ETHYL ALC. (cont.)	
lactic ac.	<i>B. ethacetosuccinicus</i> Mazé, 1913
lactic ac.	yeast Kayser, 1923
lactose	<i>B. coli</i> Grimbert, 1896
lactose, maltose, mannitol, starch, sucrose	<i>Amylobacter butylicus</i> Duclaux, 1895
malic ac.	<i>B. coli communis</i> Grey, 1923
malonic ac.	<i>B. coli communis</i> Grey, 1923
mannitol	Pneumobacillus of Friedländer Grimbert, 1896
mannitol	<i>B. ethaceticus</i> Frankland, Stanley and Frew, 1891
mannitol, glycerol	<i>B. ethaceticus</i> Frankland and Fox, 1889
mannose	yeast Mezzadrolì, 1918
pyruvic ac.	yeast Neuberg and Kerb, 1913
pyruvic ac.	yeast Lebedev and Polonski, 1917
starch	<i>Granulobacterium butylicum</i> Folpmers, 1921
starch	<i>Clostridium acetobutylicum</i> Killeffer, 1927
starch, sucrose	<i>B. acetoethylicus</i> <i>B. macerans</i> Bakonyi, 1926
sucrose	<i>Amylobacter ethylicus</i> Duclaux, 1895
sucrose	<i>B. inconvertenti-acetici</i> Mezzadrolì, 1917

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ETHYL ALC. (cont.)	
sucrose	<i>Mucor racemosus</i> Emmerling, 1897
sucrose	<i>Mucor racemosus</i> Fitz, 1876
sucrose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
sucrose	<i>Mucor mucedo</i> Fitz, 1873
sucrose	yeast Gehle, 1922
sucrose	<i>Sacc. Saké</i>
	<i>Zygosacc. major</i>
	<i>Zygosacc. salsus</i> Kumagawa, 1922
sucrose	<i>Penicillium glaucum</i> Kostytschew and Afanassje- wa, 1922
tartaric ac.	<i>B. coli communis</i> Grey, 1923
xylose	<i>Acetobacter xylinum</i> , <i>B. vulgatus</i> Fred, Peterson and Anderson, 1923
xylose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
xylose	<i>B. lactis aerogenes</i> <i>B. paratyphoid</i> <i>B. typhosus</i> Fred and Peterson, 1920
xylose	Pneumobacillus of Friedländer Grimbert, 1896
ETHYLENE GLYCOL glycolaldehyde	yeast Neuberg and Schwenk, 1915

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ETHYL MERCAPTAN ethyl disulfide thioacetaldehyde	yeast Neuberg and Schwenk, 1915 yeast Neuberg and Nord, 1914
FORMALDEHYDE acetic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
FORMIC AC. acetic ac., acetone arabinose, dextrin, dextrose, galactose, glycerol, lactic ac., levulose, maltose, man- nose, raffinose, starch, sucrose, xylose dextrose dextrose dextrose dextrose dextrose dextrose dextrose dextrose dextrose	<i>B. pyocyaneus</i> Supniewski, 1923 <i>B. acetothylicum</i> Northrop, Ashe and Morgan, 1919 <i>B. aerogenes</i> , <i>B. coli</i> Virtanen and Simola, 1927 <i>B. coli communis</i> Grey, 1918 <i>B. coli communis</i> Franzen and Kahlenberg, 1916 <i>B. coli communis</i> Grey and Young, 1921 <i>B. prodigiosus</i> Franzen and Egger, 1924 <i>B. typhosus</i> Harden, 1901 Friedländer's pneumococcus Frankland, Stanley and Frew, 1891 <i>Serratia marcescens</i> Pederson and Breed, 1928 <i>B. dysenteriae</i> , Shiga-Kruse Bergh, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
FORMIC AC. (cont.)	
dextrose	<i>B. acetoethylicum</i> <i>B. granulobacter pectinovorum</i> , Weizmann <i>Clostridium pasteurianum</i> <i>Granulobacter saccharobutyricum</i>
dextrose	<i>B. aerogenes</i> <i>B. cloacae</i> <i>B. coli</i> <i>B. dysenteriae</i> , Shiga-Kruse <i>B. Freundii</i> <i>B. polymyxa</i> <i>B. typhosum</i> Scheffer, 1928
dextrose, gluconic ac., glycuronic ac., mannitol, saccharic ac.	<i>B. coli communis</i> Kay, 1926
dextrose, gluconic ac., mannitol, saccharic ac.	<i>B. lactis aerogenes</i> Kay, 1926
dextrose, levulose	<i>Bact. pyocyanus</i> Aubel, 1921
dextrose, levulose	<i>Sarcina maxima</i> <i>Sarcina ventriculi</i> Smit, 1928
dextrose, mannitol	<i>B. cloacae</i> , <i>B. coli</i> <i>B. lactis aerogenes</i> Thompson, 1912
dextrose, mannitol	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
dextrose, starch, sucrose	<i>B. acetoethylicum</i> Arzberger, Peterson and Fred, 1920
glycerol	<i>Bact. aerogenes</i> <i>Bact. coli</i> <i>Bact. Freundii</i> Braak, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
FORMIC AC. (CONT.)	
glycerol	<i>B. butylicus</i> Buchner and Meisenheimer, 1908
glycerol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
glycerol	<i>B. coli communis</i> Grey, 1923
lactic ac.	<i>B. ethacetosuccinicus</i> Mazé, 1913
mannitol, glycerol	<i>B. ethaceticus</i> Frankland and Fox, 1889
methyl alc.	<i>B. pyocyaneus</i> Supniewski, 1923
pyruvic ac.	<i>B. coli</i> , <i>B. pyocyaneus</i> Cambier and Aubel, 1922
pyruvic ac.	<i>Bact. coli</i> Aubel, 1924
quinic ac.	Schizomycetes Loew, 1881
starch	<i>Pectinobacter amylophilum</i> Makrinov, 1915
starch	<i>B. suaveolens</i> Sclavo and Gosio, 1891
succinic ac.	<i>B. coli communis</i> Grey, 1923
sucrose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
xylose	<i>B. paratyphoid</i> <i>B. typhosus</i> Fred and Peterson, 1920
xylose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
FUMARIC AC. arabinose, galactose	<i>Asp. fumaricus</i> Schreyer, 1928
dextrose, levulose	<i>Rhizopus nigricans</i> Ehrlich, 1912
malic ac., succinic ac.	<i>B. coli communis</i> Quastel and Whetham, 1924
pyruvic ac.	<i>Rhizopus nigricans</i> Gottschalk, 1925
sucrose	<i>Asp. fumaricus</i> Wehmer, 1918, 1928
FURFURYL ALC. furfural	yeast Lintner and Liebig, 1911
FURYLTRIMETHYLENEGLYCOL furfural	yeast Lintner and Liebig, 1913
GALACTONIC AC. galactose	sorbose bacterium Bertrand, 1898
GERANIOL citral	yeast Neuberg and Kerb, 1918
α -GLUCOHEPTULOSE α -glucoheptite	Sorbose bacterium Bertrand and Nitzberg, 1928
GLUCONIC AC. arabinose, dextrose, glycerol, levulose, mannose, sucrose dextrose	<i>Asp. niger</i> Bernhauer, 1928 <i>Asp. cinnamomeus</i> <i>Asp. fuscus</i> <i>Asp. niger</i> Falck and Kapur, 1924
dextrose	<i>Bact. aceti</i> Brown, 1886

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
GLUCONIC AC. (cont.)	
dextrose	<i>Acetobacter</i> , sp.? Day and Walker, 1913 Söhngen, 1914, 1915
dextrose	<i>Bact. aceti viscosum</i> Day and Walker, 1913
dextrose	<i>B. Kützingianum</i> Seifert, 1897
dextrose	<i>B. Pasteurianum</i> Mayer, 1898
dextrose	<i>B. xylinum</i> Bernhauer and Schön, 1929
dextrose	<i>Bact. acetigenum</i> <i>Bact. acetosum</i> <i>Bact. oxydans</i> Henneberg, 1909
dextrose	<i>Penicillium purpurogenum</i> May, Thom and Church, 1927
dextrose	<i>Asp. niger</i> Bernhauer, 1928
dextrose	<i>Asp. niger</i> Müller, 1925
dextrose	<i>Mycoderma aceti</i> Boutroux, 1880
dextrose	<i>Penicillium purpurogenum</i> Herrick and May, 1928
dextrose	Sorbose bacterium Bertrand, 1898
sucrose	<i>Asp. niger</i> Bernhauer, 1926
sucrose	<i>Citromyces glaber</i> <i>Penicillium glaucum</i> Butkewitsch, 1927
sucrose	<i>Asp. fumaricus</i> Wehmer, 1928
sucrose	<i>Asp. niger</i> Butkewitsch, 1924

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
GLUCONIC AC. (cont.) sucrose	<i>Asp. niger</i> Bernhauer, 1924, 1926
GLYCERIC AC. glycerol	<i>B. pyocyaneus</i> Supniewski, 1923
GLYCEROL dextrose	yeast Oppenheimer, 1913
dextrose, sucrose	yeast Neuberg and Hirsch, 1919
galactose	yeast Tomita, 1921
sucrose	<i>Mucor racemosus</i> Emmerling, 1897
sucrose	<i>Sacc. ellipsoideus</i> Adams, 1919
sucrose	<i>Sacc. Saké, Zygosacc. major</i> <i>Zygosacc. salsus</i>
sucrose	<i>Sterigmatocystis nigra</i> Molliard, 1922
sucrose	yeast Zerner, 1920
sucrose	yeast Abderhalden and Stix, 1922
sucrose	yeast Gehle, 1922
sucrose	yeast Neuberg and Reinfürth, 1923
sucrose	yeast Buchner and Meisenheimer, 1906
sucrose	yeast Tomoda, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
GLYCOGEN dextrose	<i>Sacc. Ludwigii</i> Gottschalk, 1925
GLYCOLALDEHYDE dihydroxymaleic ac.	yeast Neuberg and Schwenk, 1915
hydroxy-pyruvic ac.	yeast Neuberg and Kerb, 1913
GLYCOLLIC AC. acetic ac., citric ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
ethylene glycol	<i>B. Kützingianum</i> Seifert, 1897
ethylene glycol	<i>B. Pasteurianum</i> Mayer, 1898
oxalic ac., pyruvic ac.	<i>B. coli</i> <i>B. proteus vulgatus</i> Cambier and Aubel, 1922
pyruvic ac.	<i>Bact. coli</i> Aubel, 1924
n-HEPTYL ALC. enanthol	yeast Ohta, 1914
n-HEXYL ALC. caproic aldehyde	yeast Neuberg and Nord, 1914
β -HYDROXYBUTYRIC AC. acetaldol	<i>B. ascendens</i> Binder-Kotrba, 1926
butyric ac.	<i>Asp. niger</i> Coppock, Walker and Su- bramaniam, 1928
ISOBUTYL ALC. iso-butylaldehyde	yeast Ohta, 1914

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
ISOBUTYLALDEHYDE α -keto-isovaleric ac.	yeast Sen, 1923
ISOBUTYRIC AC. isobutyl alc.	<i>Acetobacter melanogenum</i> Visser't Hooft, 1925
KETOGLUCONIC AC. dextrose	<i>B. xylinum</i> Bernhauer and Schön, 1929
KETO-HEPTOSE arabitol, volemitol	sorbose bacterium Bertrand, 1898
KETO-STEARIC AC. oleic ac.	<i>Pen. glaucum</i> Pigulewski and Charik, 1928
LACTIC AC. arabinose	<i>Lactobacillus arabinosus</i> Fred, Peterson and Anderson, 1921
arabinose	<i>Pneumobacillus</i> of Friedländer Grimbert, 1896
arabinose, dextrose, galactose, levulose, mannitol	<i>B. coli communis</i> Harden, 1901
arabinose, dextrose, galactose, mannitol, starch, xylose	<i>B. granulobacter pectinovorum</i> Speakman, 1923
arabinose, xylose	<i>Lactobacillus pentosus</i> <i>Lactobacillus pentoaceticus</i> Fred, Peterson and Anderson, 1921
cellulose	<i>Bact. cellaresolveus</i> <i>Bact. opalescens</i> Groenewege, 1923
dextrose	<i>B. aerogenes</i> , <i>B. coli</i> Virtanen and Simola, 1927
dextrose	<i>B. coli communis</i> Goto, 1925
dextrose	<i>B. coli communis</i> Grey and Young, 1921

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
LACTIC AC. (cont.)	
dextrose	<i>B. coli communis</i> Grey, 1918, 1920
dextrose	<i>B. coli communis</i> Young, 1924
dextrose	<i>Serratia marcescens</i> Pederson and Breed, 1928
dextrose	<i>B. typhosus</i> Harden, 1901
dextrose	<i>B. casei</i> Virtanan and Karström, 1928
dextrose	<i>B. acetoethylicum</i> <i>B. granulobacter pectinovorum</i> , Weizmann
	<i>B. polymyxa</i> <i>Granulobacter saccharobutyricum</i> Donker, 1926
dextrose	<i>B. coli</i> Grimbert, 1886
dextrose	<i>B. coli communis</i> Harden, 1899
dextrose	<i>B. coli</i> <i>B. propionicus</i> <i>Lactobacillus</i> , sp.? Neuberg and Gorr, 1926
dextrose	<i>B. aerogenes</i> <i>B. cloacae</i> <i>B. coli</i> <i>B. dysenteriae</i> , Shiga-Kruse <i>B. Freundii</i> <i>B. typhosum</i> Scheffer, 1928
dextrose	<i>B. butylicus</i> Buchner and Meisenheimer, 1908
dextrose	<i>Lactobacillus leichmanni</i> Allgeier and Peterson, 1930

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
LACTIC AC. (cont.)	
dextrose	<i>B. coli</i> Péré, 1898
dextrose	<i>Rhizopus chinensis</i> Saito, 1911
dextrose	B. of malignant oedema King and Frankel, 1890
dextrose	<i>Streptococcus lactis</i> Algeier and Peterson, 1930
dextrose	yeast Aubel, 1929
dextrose, dextrin, maltose, sucrose	<i>B. Delbrücki</i> <i>B. lactis acidii</i> Henneberg, 1903
dextrose, dihydroxyacetone, glyceraldehyde	yeast Oppenheimer, 1913
dextrose, galactose, mannose	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
dextrose, gluconic ac., glycuronic ac., mannitol, saccharic ac.	<i>B. coli communis</i> Kay, 1926
dextrose, gluconic ac., mannitol, saccharic ac.	<i>B. lactis aerogenes</i> Kay, 1926
dextrose, glycerol	<i>B. subtilis</i> Vandevelde, 1884
dextrose, lactose, maltose, mannitol, sucrose	<i>B. tartricus</i> Grimbert, 1901
dextrose, levulose	<i>Clostridium thermocellum</i> Peterson, Fred and Marten, 1926
dextrose, levulose	<i>Sarcina maxima</i> <i>Sarcina ventriculi</i> Smit, 1928
dextrose, mannitol	<i>B. coli communis</i> Grey, 1918

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
LACTIC AC. (cont.) dextrose, mannitol	<i>B. cloacae</i> , <i>B. coli</i> <i>B. lactis aerogenes</i> Thompson, 1912
dextrose, mannitol	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
dextrose, starch, sucrose	<i>B. acetoethylicum</i> Arzberger, Peterson and Fred, 1920
galactose	<i>B. coli</i> Péré, 1898
glycerol	<i>Bact. aerogenes</i> <i>B. coli</i> <i>B. Freundii</i> Braak, 1928
glycerol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
glycerol	<i>B. pyocyaneus</i> Supniewski, 1923
glycerol	<i>B. coli communis</i> Grey, 1923
glycerol	<i>B. butylicus</i> Buchner and Meisenheimer, 1908
inositol	<i>B. lactis aerogenes</i> Kumagawa, 1922
lactose	<i>Bact. caucasicum</i> Kostytschew and Soldaten- kov, 1927
lactose	<i>B. coli</i> Grimbert, 1896
lactose	<i>B. coli</i> Péré, 1898
lactose	<i>B. lactis acidi</i> Henneberg, 1903
lactose, maltose, mannitol, starch, sucrose	<i>Amylobacter butylicus</i> Duclaux, 1895

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
LACTIC AC. (cont.)	
levulose	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
levulose	<i>Bact. pyocyaneus</i> Aubel, 1921
malic ac.	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
malic ac.	yeast Lebedev and Russ, 1916
malonic ac.	<i>B. coli communis</i> Grey, 1925
mannitol	<i>B. coli</i> Péré, 1898
mannitol	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
mannitol	Pneumobacillus of Friedländer Grimbert, 1896
mannose	<i>B. coli</i> Péré, 1898
methylglyoxal	<i>Bact. pasteurianum</i> Gorr and Perlman, 1926
methylglyoxal	<i>Bact. coli</i> Neuberg and Gorr, 1925
methylglyoxal	<i>B. coli</i> <i>B. propionicus</i>
methylglyoxal	<i>Lactobacillus</i> , sp.? Neuberg and Gorr, 1927
methylglyoxal	<i>B. Delbrücki</i>
methylglyoxal	<i>Bact. lactis aerogenes</i> Neuberg and Simon, 1927
methylglyoxal	yeast Neuberg and Kobel, 1927, 1929
methylglyoxal	yeast Neuberg, 1913
methylglyoxal	yeast Dakin and Dudley, 1913

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
LACTIC AC. (cont.)	
d-propylene glycol	<i>Bact. termo</i> LeBel, 1881
pyruvic ac.	<i>B. coli</i> , <i>B. proteus vulgaris</i> Cambier and Aubel, 1922
pyruvic ac.	<i>Bact. coli</i> Aubel, 1924
pyruvic ac.	<i>B. pyocyaneus</i> Aubel, 1924
pyruvic ac.	<i>Oidium albicans</i> <i>O. farinosum</i> <i>O. gueraldi</i> <i>O. tenuis</i> Mazé and Ruot, 1917
pyruvic ac.	<i>Rhizopus nigricans</i> Gottschalk, 1925
starch	<i>Pectinobacter amylophilum</i> Makrinov, 1915
sucrose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
sucrose	<i>Amylobacter ethylicus</i> Duclaux, 1895
sucrose	<i>B. acidi laevolactici</i> Schardinger, 1890
sucrose	<i>B. casei</i> E Virtanen, Wichmann and Lindström, 1927
sucrose	<i>B. coli</i> Virtanen and Simola, 1927
sucrose	<i>B. coli</i> Péré, 1898
sucrose	<i>B. invertenti-lactici</i> <i>B. invertenti-acetici</i> Mezzadrolì, 1917

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
LACTIC AC. (cont.)	
sucrose	<i>Strept. lactis</i> Virtanen, Wichmann and Lindström, 1927
sucrose	yeast Fernbach and Schoen, 1923
d-tartaric ac.	yeast Karczag, 1912
xylose	<i>Lactobacillus pentoaceticus</i> Fred, Peterson and Davenport, 1919
xylose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
xylose	<i>B. lactis aerogenes</i> <i>B. paratyphoid</i> <i>B. typhosus</i>
xylose	Fred and Peterson, 1920 Pneumobacillus of Friedländer Grimbert, 1896
LEVULOSE	
mannitol	<i>Acet. suboxydans</i> Kluyver and deLeeuw, 1924
mannitol	Sorbosé bacterium Bertrand, 1898
mannitol	<i>Bact. aceti</i> Brown, 1886
mannitol	<i>B. xylinum</i> Hoyer, 1898
MALIC AC.	
fumaric ac.	<i>Asp. niger</i> Challenger and Klein, 1929
oxalacetic ac.	yeast Neuberg and Gorr, 1924
sucrose	<i>Asp. fumaricus</i> Wehmer, 1928
sucrose	yeast Kostytschew and Frey, 1925

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
MALIC AC. (CONT.) sucrose	yeast Dakin, 1924
MANDELIC AC. phenylglyoxal	yeast Dakin and Dudley, 1913
phenylglyoxal	<i>Lactobacillus</i> , sp.? Mayer, 1926
MANNITOL dextrose	<i>B. subtilis</i> Vandevelde, 1884
levulose	<i>Lactobacillus pentoaceticus</i> Peterson and Fred, 1920
METHYLETHYLACETALDEHYDE methylethyl pyruvic ac.	yeast Neuberg and Peterson, 1914
d-METHYLETHYLCARBINOL methylethylketone + sucrose	yeast Neuberg and Nord, 1919
d-METHYLHEXYLCARBINOL methyl-n-hexylketone + sucrose	yeast Neuberg and Nord, 1919
d-METHYLNONYLCARBINOL methylnonylketone + sucrose	yeast Neuberg and Nord, 1919
d-METHYL-N-PROPYLCARBINOL methyl-n-propyl ketone + sucrose	yeast Neuberg and Nord, 1919
p-METHOXYBENZOIC AC. p-methoxybenzaldehyde	yeast Neuberg and Liebermann, 1921
p-METHOXYBENZYL ALC. p-methoxybenzaldehyde	yeast Neuberg and Liebermann, 1921

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
METHYL ALC. formaldehyde	yeast Neuberg and Welde, 1914
METHYLCHLORETHYL ALC. methylchlorethyl ketone	yeast Santomauro, 1924
O-METHYLCYCLOHEXANOL o-methylcyclohexanone	yeast Akamatsu, 1923
METHYL ACETOL See acetylmethyl carbinol	
METHYLGLYOXAL lactose	<i>Bact. caucasicum</i> Kostytschew and Soldaten- kov, 1927
sucrose	<i>B. coli</i> Virtanen and Simola, 1927
METHYLPHENYLETHYLENE GLYCOL methylbenzoyl carbinol	yeast Neuberg and Komarewsky, 1927
OXALIC AC. acetic ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927
acetic ac., arabinose, dextrose, ethylene glycol, galactose, glycerol, glycollic ac., lactic ac., malonic ac.	<i>Termobacterium aceti</i> Banning, 1902
acetic ac., dextrose, erythritol, ethylene glycol, isolichenin, mannitol	<i>B. industrium</i> Banning, 1902
acetic ac., dextrose, erythritol, ethylene glycol, glycerol, levulose	<i>B. oxydans</i> Banning, 1902
acetic ac., dextrose, starch, tartaric ac.	<i>Asp. niger</i> Wehmer, 1891

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
OXALIC AC. (cont.)	
acetic ac., fumaric ac., malic ac., succinic ac., tartaric ac. acetonedicarboxylic ac.	<i>Asp. niger</i> Raistrick and Clark, 1919
	<i>Asp. niger</i> Walker, Subramaniam and Challenger, 1927
arabinose, dextrose, glycollic ac.	<i>B. acetigenum</i> Banning, 1902
arabinose, dextrin, dextrose, ethylene glycol, galactose, glycollic ac., isobutyric ac. isolichenin, lactic ac., malonic ac.	<i>B. Kützingianum</i> Banning, 1902
arabinose, dextrin, dextrose, erythritol, ethylene glycol, glycollic ac., malonic ac.	<i>B. acetosum</i> Banning, 1902
arabinose, dextrose, ethylene-glycol, glycerol, glycollic ac., malonic ac., rhamnose	<i>B. ascendens</i> Banning, 1902
arabinose, dextrose, glycerol, levulose, rhamnose	<i>B. xylinum</i> Banning, 1902
arabinose, dextrose, erythritol, ethylene glycol, glycerol, glycollic ac., isobutyric ac., isolichenin, levulose, malonic ac., rhamnose	<i>B. aceti</i> Banning, 1902
arabinose, dextrose, galactose, glycerose, levulose, maltose, mannose, sucrose, xylose	<i>Asp. niger</i> Amelung, 1927
arabinose, gluconic ac., glycerol, mannitol, saccharic ac., sucrose	<i>Asp. niger, Citromyces glaber</i> Amelung, 1927
citric ac.	<i>Citromyces glaber</i> Butkewitsch, 1922
citric ac.	<i>Asp. niger</i> Challenger, Subramaniam and Walker, 1927

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
OXALIC AC. (cont.)	
dextrin, dextrose, ethylene glycol, glycerol, glycollic ac., isobutyric ac., malonic ac., sucrose	<i>B. Pasteurianum</i> Banning, 1902
dextrin, dextrose, glycerol, inulin, lactose, mannitol, sucrose	<i>Asp. niger</i> Elfving, 1919
dextrose	<i>Asp. niger</i> Wehmer, 1897, 1924
dextrose	<i>Asp. niger</i> Heinze, 1903
dextrose	<i>Citromyces glaber</i> Butkewitsch, 1922
ethyl alc.	<i>Citromyces citricus</i> <i>Citromyces tartricus</i> Mazé and Perrier, 1904
raffinose	<i>Asp. niger</i> Gillot, 1899
sucrose	<i>Asp. niger</i> Bernhauer, 1926
sucrose	<i>Asp. niger</i> Currie, 1917
sucrose	<i>Asp. niger</i> Butkewitsch, 1923, 1924
sucrose	<i>Asp. niger</i> Bernhauer, 1924
sucrose	<i>Citromyces citricus</i> <i>Citromyces glaber</i> , <i>Citromyces Pfefferianus</i> , <i>Penicillium glaucum</i> Butkewitsch, 1922 <i>Sterigmatocystis nigra</i> Molliard, 1922
β -OXYBUTYRIC AC.	
acetalddol	<i>Bact. ascendens</i> Binder-Kotrba, 1926

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
OXYGLUCONIC AC. gluconic ac. dextrose	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1924 <i>Micrococcus oblongus</i> Boutroux, 1886
OXYMALTOL glycerol	<i>Asp. glaucus</i> Traetta-Mosca and Preti, 1921
PERSEULOSE perseitol d-perseitol	Sorbose bacterium Bertrand, 1898 <i>Bact. xylinum</i> Bertrand, 1909
L-PHENYLACETYL CARBINOL benzaldehyde	yeast Neuberg and Ohle, 1923
PHENYLETHYL ALC. phenylacetaldehyde	yeast Neuberg and Welde, 1914
L-PHENYLMETHYL CARBINOL acetophenone + sucrose	yeast Neuberg and Nord, 1919
PHLOROGLUCINOL phloridzin	<i>Asp. niger, Cladosporium, sp.?</i> Boas, 1916
PHENYLPROPYLALDEHYDE benzylpyruvic ac.	yeast Rona, 1914
PROPIONALDEHYDE α -ketobutyric ac.	yeast Neuberg and Kerb, 1912, 1913
PROPIONIC AC. arabinose, xylose dextrose	<i>Propionibacterium pentosaceum</i> Werkman, Hixon, Fulmer and Rayburn, 1929 <i>Diplococcus pneumoniae</i> Brieger, 1883

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
PROPIONIC AC. (cont.) dextrose, glycerol, lactic ac.	<i>Propionibacterium Freudenreichii</i> <i>Propionibacterium Jensenii</i> <i>Propionibacterium pentosaccum</i> <i>Propionibacterium Peterssonii</i> <i>Propionibacterium rubrum</i> <i>Propionibacterium Shermanii</i> <i>Propionibacterium technicum</i> <i>Propionibacterium Thonii</i> van Niel, 1928
dextrose, lactic ac., lactose, pyruvic ac. lactic ac.	<i>Bact. acidi propionici</i> Virtanen, 1923 <i>B. acidi propionici</i> <i>B. acidi propionici-a</i> <i>B. acidi propionici-b</i> von Freudenreich and Jensen, 1906
lactic ac.	<i>B. subtilis</i> Fitz, 1880
lactic ac.	<i>B. casei</i> <i>B. mobilis</i>
lactose	<i>Micrococcus casei liquefaciens</i> Orla-Jensen, 1904 <i>Bact. acidi propionici</i> Sherman and Shaw, 1923
propyl alc.	<i>Bact. acetii</i> Brown, 1886
propyl alc.	<i>Acetobacter</i> , sp.? <i>B. acetii</i> (Hansen) Buchner and Gaunt, 1906
propyl alc.	<i>B. Kützingianum</i> <i>B. Pasteurianum</i> Mayer, 1898
d-propyleneglycol	<i>Bact. termo</i> LeBel, 1881
pyruvic ac.	<i>Bact. coli</i> Aubel, 1924

PRODUCTS SUBSTATES	MICROORGANISMS AUTHORS
PROPIONIC AC. (cont.)	
quinic ac.	Schizomycetes Loew, 1881
succinic ac.	<i>B. pyocyaneus</i> Quastel, 1924
succinic ac.	<i>B. casei</i> Orla-Jensen, 1904
tartaric ac.	<i>Bact. termo</i> König, 1881
d-tartaric ac.	yeast Karczag, 1912
PROPYL ALC.	
glycerol	<i>B. butylicus</i> Morin, 1887
α -ketobutyric ac.	yeast Neuberg and Kerb, 1914
starch	<i>Granulobacterium butylicum</i> Folpmers, 1921
PROTocatechuic AC.	
quinic ac.	<i>Micrococcus chinicus</i> Emmerling and Abderhalden, 1903
quinic ac.	Schizomycetes Loew, 1881
quinic ac.	<i>Asp. niger</i> , <i>Asp. oryzae</i> <i>Citromyces glaber</i> Butkewitsch, 1924
PYROCATECHOL	
quinic ac.	<i>Asp. niger</i> , <i>Asp. oryzae</i> <i>Citromyces glaber</i> Butkewitsch, 1924
PYRORACEMIC AC.	
See pyruvic ac.	
PYRUVIC AC.	
dextrose	<i>B. coli</i> Aubel, 1926

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
PYRUVIC AC. (cont.)	
dextrose	<i>Mycoderma</i> , sp.? Fernbach and Schoen, 1914
dextrose	yeast Fernbach and Schoen, 1920
dextrose, maltose	<i>B. acetothylicum</i> Speakman, 1925
fumaric ac.	<i>B. pyocyaneus</i> Quastel, 1924
fumaric ac.	<i>B. pyocyaneus</i> Quastel, Stephenson and Whetham, 1925
glycerol	<i>B. subtilis</i> Aubel, 1921
lactic ac.	<i>Amylomyces rouxii</i> Mazé and Ruot, 1916
lactic ac.	<i>B. coli communis</i> <i>B. pyocyaneus</i> Quastel, Stephenson and Whetham, 1925
lactic ac.	<i>B. pyocyaneus</i> Supniewski, 1923
lactic ac.	<i>Oidium albicans</i> , <i>O. farinosum</i> <i>O. gueraldi</i> , <i>O. tenuis</i> Mazé and Ruot, 1917
lactic ac.	yeast Kayser, 1923
lactose	<i>Bact. caucasicum</i> Kostytschew and Soldatenkov, 1927
malic ac.	<i>B. fluorescens</i> Beijerinck, 1916
sucrose	yeast Fernbach and Schoen, 1913
sucrose	yeast Kostytschew and Solda- tenkov, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
SACCHARIC AC. gluconic ac.	<i>Asp. niger</i> Walker, Subramaniam and Challenger, 1927
SORBOSE sorbitol sorbitol d-sorbitol	<i>Acetobacter suboxydans</i> Kluyver and deLeeuw, 1924 <i>B. xylinum</i> Seifert, 1897, Mayer, 1898 Sorbose bacterium Bertrand, 1898
STYROL cinnamic ac.	<i>Asp. niger</i> Herzog and Ripke, 1908
SUCCINIC AC. acetaldehyde aldehydropropionic ac. arabinose	<i>B. lactis aerogenes</i> Harden and Norris, 1912 yeast Neuberg and Ringer, 1918 <i>B. ethaceticum</i> Frankland and MacGregor, 1892
arabinose, dextrose, galactose, levulose, mannitol	<i>B. coli communis</i> Harden, 1901
citric ac.	<i>B. coli communis</i> Grey, 1923
citric ac.	<i>B. suipestifer</i> Brown, Duncan and Henry, 1924
dextrose	<i>B. dysenteriae</i> , Shiga-Kruse Bergh, 1928
dextrose	<i>B. aerogenes</i> <i>B. coli</i> <i>B. dysenteriae</i> , Shiga-Kruse <i>B. Freundii</i> <i>B. typhosum</i> Scheffer, 1928

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
SUCCINIC AC. (cont.)	
dextrose	<i>B. aerogenes</i> , <i>B. coli</i> Virtanen and Simola, 1927
dextrose	<i>B. coli communis</i> Grey and Young, 1921
dextrose	<i>B. coli communis</i> Grey, 1918
dextrose	<i>B. coli communis</i> Young, 1924
dextrose	<i>B. typhosus</i> Harden, 1901
dextrose	<i>Oidium lupuli</i> Sumiki, 1927
dextrose	<i>Serratia marcescens</i> Pederson and Breed, 1928
dextrose, gluconic ac., gly- curonic ac., mannitol, sac- charic ac.	<i>B. coli communis</i> Kay, 1926
dextrose, gluconic ac., man- nitol, saccharic ac.	<i>B. lactis aerogenes</i> Kay, 1926
dextrose, glycerol, lactic ac.	<i>Propionibacterium Freudenreichii</i> <i>Propionibacterium pentosaceum</i> <i>Propionibacterium Peterssonii</i> <i>Propionibacterium rubrum</i> <i>Propionibacterium Shermanii</i> <i>Propionibacterium Thonii</i> van Niel, 1928
dextrose, glycerol, lactic ac., pyruvic ac., starch	<i>Propionibacterium technicum</i> van Niel, 1928
dextrose, glycerol, lactic ac.	<i>Propionibacterium Jensenii</i> van Niel, 1928
dextrose, lactose	<i>Bact. acidi propionici</i> , var. <i>fuscum</i> Virtanen, 1923
dextrose, lactose, maltose, mannitol, sucrose	<i>B. tartaricus</i> Grimbert, 1901

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
SUCCINIC AC. (CONT.) dextrose, mannitol	<i>B. cloacae</i> , <i>B. coli</i> <i>B. lactis aerogenes</i> Thompson, 1912
dextrose, mannitol	<i>B. lactis aerogenes</i> Harden and Walpole, 1906
dextrose, mannitol	<i>B. coli communis</i> Grey, 1918
dulcitol	Pneumobacillus of Friedländer Grimbert, 1896
dulcitol, mannitol	<i>B. ethacetosuccinicus</i> Frankland and Frew, 1892
fumaric ac.	<i>B. pyocyaneus</i> Quastel, Stephenson and Whetham, 1925
glycerol	<i>Bact. aerogenes</i> <i>Bact. coli</i> <i>Bact. Freundii</i> Braak, 1928
glycerol	<i>B. lactis aerogenes</i> Harden and Norris, 1912
glycerol	<i>Rhizopus</i> , sp? Takahashi and Sakaguchi, 1927
glycerol	<i>B. subtilis</i> Vandevelde, 1884
glycerol	<i>B. coli communis</i> Grey, 1923
inositol	<i>B. lactis aerogenes</i> Kumagawa, 1922
i-inositol	<i>B. lactis</i> Hewitt and Steabben, 1921
α -ketoglutaric ac.	<i>B. xylinum</i> Iwatsuru, 1925
ketoglutaric ac.	yeast Neuberg and Ringer, 1914

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
SUCCINIC AC. (cont.)	
lactose	<i>B. lactis aerogenes</i> Emmerling, 1900
lactose	<i>B. coli</i> Grimbert, 1896
levulose	<i>Sarcina maxima</i> Smit, 1928
malic ac.	<i>B. coli communis</i> Grey, 1923
malic ac.	<i>B. lactis aerogenes</i> Emmerling, 1899
mannitol, glycerol	<i>B. ethaceticus</i> Frankland and Fox, 1889
starch	<i>B. subtilis</i> Fitz, 1878
starch	<i>Pectinobacter amylophilum</i> Makrinov, 1915
sucrose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930
sucrose	<i>Mucor mucedo</i> Fitz, 1873
sucrose	<i>Mucor racemosus</i> Emmerling, 1897
sucrose	yeast Kostytschew and Frey, 1925
tartaric ac.	<i>B. coli communis</i> Grey, 1923
tartaric ac.	<i>B. tartaricus</i> Grimbert and Ficquet, 1898
tartaric ac.	<i>Bact. termo</i> König, 1881
d-tartaric ac.	yeast Karczag, 1912
xylose	<i>Aerobacter faeni</i> Breden, Fulmer, Werkman and Hixon, 1930

PRODUCTS SUBSTRATES	MICROORGANISMS AUTHORS
SUCCINIC AC. (cont.) xylose	Pneumobacillus of Friedländer Grimbert, 1896
xylose	<i>B. paratyphoid</i> , <i>B. typhosus</i> Fred and Peterson, 1920
O-TOLYLACETYL CARBINOL o-tolylaldehyde	yeast Behrens and Iwanoff, 1926
p-TOLYLACETYL CARBINOL p-tolylaldehyde	yeast Behrens and Iwanoff, 1926
2, 2, 3-TRICHLORBUTANOL 2, 2, 3-trichlorbutylaldehyde	yeast Rosenfeld, 1925
TRICHLORETHYLALCOHOL trichloracetaldehyde	yeast Lintner and Lüers, 1913
TRIMETHYLENE GLYCOL glyccrol	<i>Bact. Freundii</i> Braak, 1928
n-VALERALDEHYDE α-keto-n-caproic ac.	yeast Sen, 1923
VALERIC AC. lactic ac.	<i>B. subtilis</i> Fitz, 1880
methyl-ethyl-acetaldehyde	<i>B. ascendens</i> <i>B. pasteurianum</i> <i>B. xylinum</i> Neuberg and Simon, 1926
methyl-ethyl pyruvic ac.	yeast Neuberg and Peterson, 1914
XYLONIC AC. xylose	Sorbose bacterium Bertrand, 1913
XYLOSE (?) xylan	<i>Actinomyces sp.?</i> Patrick, Werkman and Hixon, 1930

CHAPTER IV
REFERENCES

CHAPTER IV

REFERENCES

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