Life without Oxygen

CHEM-643 Intermediary Metabolism
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<http://www.3dchem.com/molecules.asp?ID=225>

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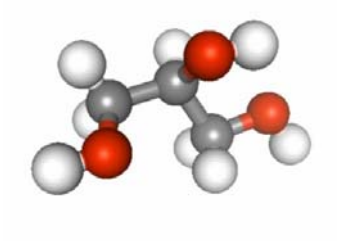

http://jchemed.chem.wisc.edu/Journal/Issues/2002/Oct/Images/JCE2002p1246fig.jpg

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Produced in bulk and distributed by the tank car load, glycerol has many uses in the pharmaceutical, food, plastic, cosmetic, and explosive industries. You will find it as an ingredient in many household products from food and drugs to toothpaste and cosmetics. A patent issued in 1823 describes the production of glycerol from the saponification of fat. Companies such a Procter and Gamble still produce glycerol as a by-product of soap manufacture but the increased use of detergents is limiting the source. During World War I and suffering from a trade blockade, Germany's demand for explosives (nitroglycerin) exceeded the availability of glycerol from fat sources. They developed commercial scale production of glycerol from yeast by fermentation in the presence of bisulfite, which reacts with acetaldehyde and prevents its conversion to ethanol. Subsequently, other commercial strategies have exploited the natural production of glycerol by yeast and other organisms in response to osmotic shock. During World War II, a chemical synthesis of glycerol from propylene, a petroleum product, provided the glycerol needed for explosives.

Petroleum reserves are limited. Even with conservation and recycling, sooner or later and perhaps within our lifetimes, demand will exceed supply. The consequences will affect all aspects of industrialized society - international relations, transportation, food production and distribution, urban planning, housing, and manufacturing. On the scale of things, the industrial production of glycerol from petroleum is minor. However, it symbolizes many of the issues associated with renewable resources and sustainability of contemporary society.

Why and how does yeast metabolically produce glycerol when ethanol production is blocked?

How might you determine whether a sample of glycerol was chemically synthesized from petroleum?