

SOME ORGANIC COMPOUNDS UTILIZED BY OR PRODUCED BY MICROORGANISMS

Carbohydrates – Most culturable microorganisms use carbohydrates as their primary source of energy and carbon. The type and number of substances utilized, and the end products formed by microbes will vary considerably. When studying bacteria, such variations can be useful in identification procedures. Some carbohydrates encountered in our laboratory or significant to laboratory activities include:

Monosaccharides	Disaccharides	Polysaccharides
Hexoses (C₆H₁₂O₆) Glucose (Dextrose) Fructose (Levulose) Galactose	(C₁₂H₂₂O₁₁) Maltose Sucrose Lactose	Starch Dextrin Glycogen Cellulose
Pentoses (C₅H₁₀O₅) Arabinose Xylose Rhamnose Ribose Deoxyribose (C ₅ H ₁₀ O ₄)	Trisaccharides (C₁₈H₃₂O₁₆) Raffinose	
Polyhydric alcohols (C₆H₁₀O₅) Mannitol Glycerol Sorbitol Inositol	Catabolites formed during the break down of carbohydrates include organic acids (lactic, acetic, citric, butyric, etc.), neutral products (acetone, acetoin, ethanol, etc.), and gasses (methane, hydrogen and carbon dioxide).	

Proteins – Many bacteria can degrade proteins and utilize the resulting peptides and amino acids to synthesize cellular proteins or as a source of energy and carbon. The proteolytic ability of an organism type is a feature useful in characterizing a given species. Some proteins commonly used in bacterial identification include **casein** (milk protein) and **gelatin** (an animal protein derived from collagen and catabolized by **gelatinase** enzymes). The partial catabolism of various proteins will yield breakdown products useful as nutrient sources in media preparations, e.g., **peptone**, **tryptone** and **proteoses**.

Individual **amino acids** such as **lysine** and **ornithine** can be decarboxylated to yield amines and carbon dioxide. The amino acid **tryptophan** can be catabolized to yield **indole**, and sulfur-containing amino acids (**cysteine** and **methionine**) can be catabolized to yield **hydrogen sulfide** (H₂S). **Urea**, a protein breakdown product can be hydrolyzed to yield **ammonia**. Since the presence of these end products can be detected in media, they are also useful in the characterization and identification of bacteria.

Lipids – The ability of microorganisms to decompose fats is of occasional importance in identification. The hydrolysis of fats causes a drop in pH due to the production of fatty acids, and this can be detected in media. Glycerol is also produced.

Nucleic acids – Some bacteria produce **DNAase** enzymes that can degrade **deoxyribonucleic acid** (DNA). This can also be useful in bacterial identification.