

SEWAGE COMPOSITION

Sewage is composed of the liquid and solid wastes from the human, or animal, body. Because water is used as a carrier, the total solids content would be approximately 0.2 lb person per day, of which 0.1 lb would be suspended or undissolved, and 0.1 lb would be dissolved solids.

The biochemical oxygen demand, commonly referred to as "BOD," is defined as being the amount of oxygen required to stabilize or oxidize the sewage within a given period of time and at a specific temperature. This is usually five days and 20 C (68 F) respectively. The amount of BOD per person per day would be approximately 0.17 lb. The body wastes, or excreta, are almost 100 percent organic matter, because they are the residue of the food we eat after the body has extracted its nutrients. Our food is made up of animal and vegetable tissues. These tissues are highly complex organic substances. By organic, we mean that the atomic composition is basically carbon, hydrogen, and oxygen, which form the carbohydrates. With the addition or substitution of nitrogen, the proteins are formed. In order for the body to obtain nutrition, these complex compounds must be broken down into simple substances that the body can absorb through the various membranes that make up the intestinal tract, thence into the blood stream and to the muscular and other body tissues. As the tissues use these nutrients, or fuel, in the production of energy, waste products are formed and carried away from the tissues by the blood stream, and discharged via the excretory system. The human, or animal, body might be described as a very complex chemical refinery and filtration plant. The raw materials are broken down by chemical reactions catalyzed by bacteria and enzymatic action; and by selective filtration, the substances are absorbed by the tissue, where partial oxidation is accomplished to fulfill the needs of the tissue. The surplus and residue is either stored or cast off. That which is cast off is ultimately the sewage which we find so obnoxious and a problem of disposal. The decomposition of food in the digestive process is not complete. Consequently, the body excreta is composed of organic matter in various stages of decomposition together with enzymes and masses of bacteria common to the intestinal tract, called *Bacterium Coli*. Since the excreta is of such composition, it is very unstable chemically. As a result, the substances will readily combine with oxygen or other oxidizing agents. The BOD test measures the amount of the waste present in water by simply putting a measured portion of sewage in a measured volume of air-saturated water, and incubating for five days at 20 C. The oxygen content of the mixture is determined before and after the incubation period. From the depletion of the oxygen content, the biochemical oxygen demand is calculated.

MUNICIPAL TREATMENT PLANTS

In municipal sewage-treatment plants, the sewage enters the plant from the sewers. After passing through the bar screens which remove large foreign items that would damage or clog the pumps, the sewage is pumped through the primary sedimentation tanks, where the coarse solids settle out. The retention period in these tanks is approximately two hours. The solids are collected and pumped to digesters, or tanks, where bacterial decomposition reduces the solids to inert material which can be dried and used for soil conditioners.

In the decomposition process, liquefaction and gasification takes place. The gas is collected and used to produce heat and power. It has a high methane content and a Btu value as much as 900 to 1000 per cubic foot; the average is 650 to 700. The population equivalent is approximately one cubic foot of gas per person per day.

Going back to the primary sedimentation tank, the liquid, or effluent, containing dissolved and suspended solids is pumped to the secondary treatment. This phase is the oxidation stage, which is accomplished by either biological filtration or a bioaeration process, called activated sludge. In the former, the sewage is sprayed on a rock bed in which the rocks are covered with a gelatinous mass of bacteria. Within the strata of the filter, both plant and animal life thrives. Herein, carbohydrates and proteins are reduced to simple carbonaceous and nitrogenous compounds which are oxidized in stages by bacterial action. For example, the proteins are reduced to ammonia by one type of bacteria. Another type oxidizes the ammonia to nitrites. The third type oxidizes the nitrites to nitrates, which are stable. The efficiency of the filter is determined by a BOD test on the influent and effluent, as well as a chemical analysis of the ammonia, nitrite, and nitrate content of the effluent.