

Biological Treatment Process

- a. The goal in biological treatment is to convert the incoming organic material into stable products which do not exert an oxygen demand (BOD) in the receiving stream. These stable end products are carbon dioxide (CO_2), water (H_2O), nitrate (NO_3^-), phosphate (PO_4), and sulfate (SO_4).
- b. The removal of organic material is accomplished primarily through bacterial activity. Some of that removal is accomplished by "aerobic" bacteria, some by "anaerobic" bacteria, with the predominant fraction of the material being consumed by "facultative" bacteria.
- c. With an adequate supply of energy (supplied by sunlight) and nutrients such as nitrogen (N), phosphorous (P), and potassium (K), algae will grow and carry on photosynthesis. During this process, oxygen (O_2) is released into the water.
- d. Algae consume as much oxygen during "respiration" and decay as is produced during "photosynthesis" and growth. The "on/off" release and consumption of oxygen has a significant effect on the dissolved oxygen (DO) levels in a lagoon system.
- e. Due to the natural variation in the sunlight intensity, DO levels in lagoons can fluctuate quite widely. During a period of prolonged intense sunlight, the lagoon can become "over-saturated" with dissolved oxygen. The O_2 is lost to the atmosphere through the pond surface, and is no longer available to satisfy the demands from aerobic bacteria or algal respiration.
- f. The presence or absence of DO throughout the depth of the lagoon has a significant effect on the type of bacterial activity occurring in the lagoon. If free oxygen (O_2) is available, the end product of stabilization is water. If O_2 is not available and nitrate (NO_3^-) is available, the end product will be nitrogen gas (N_2). If neither free oxygen nor nitrate is available, and sulfate (SO_4^{2-}) is available, the end product will be hydrogen sulfide (H_2S) with the accompanying problems of odor.
- g. Nitrification and denitrification reactions will also occur in lagoons. The nitrification process (ammonia-----> nitrate) will occur during aerobic conditions. Denitrification (nitrate -----> nitrogen gas) can occur during anaerobic conditions.