



Designation: D 4478 – 85

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Standard Test Methods for OXYGEN UPTAKE¹

This standard is issued under the fixed designation D 4478; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

These oxygen uptake methods use a dissolved oxygen (DO) probe to monitor the response of an activated sludge when a biodegradable substance is added. An oxygen uptake test is a bioassay conducted under prescribed, standard conditions using microbial respiration to measure the effect of the material being tested. Presence of an inhibitory or toxic substance in a wastewater being tested adversely affects activated sludge and would be reflected by a reduced rate or cessation of oxygen uptake or the amount of oxygen consumed, or both.

Oxygen uptake responses of an acclimated activated sludge may vary from day to day even when a standard reference compound is used. Any changes in the activity of the activated sludge can be determined by comparing results obtained periodically on a standard reference compound. An appropriate reference compound should be a constituent of the wastewater being treated or closely related in chemical structure. Factors that may affect the oxygen uptake include: source of the activated sludge, sludge age, variations in the treatment system of factors such as pH, temperature, retention time, dissolved oxygen, concentration of dissolved salts, and composition of the wastewater.

Activated sludge is a complex mixture which includes many different genera and species of living microorganisms; it is a dynamic ecosystem responsive to environmental changes. Test conditions in these methods are prescribed to minimize variations in oxygen uptake due to pH and temperature changes.

Complete stabilization of biodegradable substances may take days or even weeks since organic materials vary in biodegradability. Addition of a biodegradable substrate to activated sludge usually results in the following sequence of events:

1. oxygen uptake, yielding energy for cell synthesis;
2. conversion of the substrate to metabolic products;
3. oxygen uptake and sequential growth of other microorganisms using the metabolic products as an energy source; and,
4. metabolism of products stored intracellularly.

These oxygen uptake test procedures are not intended to replace the five-day biochemical oxygen demand (BOD_5) test. However, these procedures do provide an additional tool for the control and operation of a biological treatment facility. These procedures also provide an additional parameter for characterizing a wastewater to be treated by an activated sludge process.

1. Scope

1.1 These test methods cover the determination of the oxygen utilization response of an acclimated activated sludge to untreated waste-

¹ These test methods are under the jurisdiction of ASTM Committee D-19 on Water and are the direct responsibility of Subcommittee D19.24 on Water Microbiology.

Current edition approved March 29, 1985. Published May 1985.