

BOD Determination of Strongly-loaded Organic Waste Water with the BOD-OxiDirect

- respirometric method -

Introduction

Strongly loaded organic industrial waste water, i.e. from sugar- or paper-factories, need to be pre-treated before determining the BOD value. Because of the very high content of organic material in the sample, there is a disparity between the nutrients ratio (C:N:P). The lack of nitrogen (N) and phosphorus (P) causes a strong decrease in microbial capability and abundance, what lead to a subestimate of the BOD as a consequence. In the following the pretreatment of a sample with so called dilutionwater is described, which contains the missing nutrients and microorganisms and with which an adequate BOD measurement will be obtained.

Preparation¹

A beaker² for storage and ventilation with air is needed.

Composition:

- Drinking water with 1 % settled wastewater, taken from the effluent of a well working domestic treatment plant
- 4 mg/l urea
- 1,6 mg/l penta-sodium-tri-phosphate.

This composition should be aerated for 3 to 10 days at 20 °C before use.

Sample preparation

To determine the full BOD content, a sample with unresolved ingredients or particles should be homogenised. Dilute the sample with the prepared dilutionwater to an expected BOD value between 100-200 mg/l. In case of unknown BOD calculate with a maximum of 80 % of the COD-value.

Measurement

- Proceed as usual with the pre-treated samples and consider the adequate measuring range (see Instruction Manual)
- A blank value, the BOD of the dilution-water itself, should be determined, because this raises the BOD value and need to be subtracted to obtain the true samplevalue
- The use of nitrification-inhibitor is recommended.
- We strongly recommend to carry out at minimum a parallel determination of each sample for a procedure-check and to calculate the mean value (preparation inaccuracies would be multiplied with the dilution factor later).

Evaluation

$$BOD_n = \frac{V_{total}}{V_s} \cdot \left[BOD_{total} - \left(\frac{V_{total} - V_s}{V_{total}} \cdot BOD_{DW} \right) \right]$$

BOD_n : Biochemical Oxygen Demand of the sample after n days [mg/l O₂]

n: test duration in days (commonly 5 days)

V_{total} : Total volume, consists of volume of sample water (V_s) and volume of dilution water

V_s : Volume of sample water

BOD_{total} : Biochemical Oxygen Demand of the sample, consists of sample water and dilution water, after n days

BOD_{DW} : Biochemical Oxygen Demand of the dilution water after n days

Example

n: 5 days

V_{total} : 21.7 ml (corresponds to range 0 - 4000 mg/l)

V_s : 10 ml

BOD_{total} : 3445 mg/l O₂

BOD_{WW} : 14 mg/l O₂

$$BOD_n = \frac{21.7 \text{ ml}}{10 \text{ ml}} \cdot \left[3445 \text{ mg/l O}_2 - \left(\frac{21.7 \text{ ml} - 10 \text{ ml}}{21.7 \text{ ml}} \cdot 14 \text{ mg/l O}_2 \right) \right]$$

$$BOD_n = 7459 \text{ mg/l O}_2$$

Tip

We recommend to use preadapted microorganisms, taken from an effluent of a domestic treatment plant, because an artificial cocktail of microbes doesn't contain all the biochemical capability and complexity of an original, autochthonous microbial population.

¹ see German Standard DIN 38 409 - H 51 or international Standard ISO 5815

² individual size

³ see table of measurement ranges in the Instruction Manual