

## **CASE STUDY - REAL TIME MONITORING OF BOD IN A MUNICIPAL WASTE WATER TREATMENT PLANT**



### **The Present Situation**

In heavily polluted waters (e.g., municipal wastewater), biochemical oxygen demand (BOD) and chemical oxygen demand (COD) tests are traditionally used for assessing the effectiveness of biological treatment. The BOD test is widely used to determine the degree to which a waste stream will contribute to pollution of receiving waters by depriving organisms in those waters (fish) of their source of oxygen. The BOD test is of prime importance in regulatory programs and in determining the overall health of receiving waters.

The BOD test measures the ability of naturally occurring microorganisms to digest organic matter, usually in a 5 day incubation at 20°C, by analyzing the depletion of oxygen that measures biodegradable organic matter. The BOD analysis is an attempt to simulate the effect a waste will have on the dissolved oxygen of a stream by a laboratory test. It gives an indication of the amount of oxygen needed to stabilize or biologically oxidize the waste.

Chemical Oxygen Demand measures the ability of hot chromic acid solution to oxidize organic matter. This analyzes both biodegradable and non-biodegradable (refractory) organic matter.

### **The Problem**

The main disadvantage of the standard BOD test is the 5 day time lag and the difficulty in obtaining consistent repetitive values. The COD test, on the other hand, can be performed in a few hours, but the results of the test are usually higher than the corresponding BOD test

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for several reasons. Many organic compounds which are dichromate oxidizable are not biochemically oxidizable; Certain inorganic substances, such as sulfides, sulfites, thiosulfates, nitrites and ferrous iron are oxidized by dichromate, creating an inorganic COD, which is misleading when estimating the organic content of the wastewater.

### **The Solution**

**CheckLight** was able to demonstrate that its proprietary BOD test kit could provide the means to measure in real time BOD values in industrial and municipal waste water.

Unlike the COD test, it measures the concentration of biodegradable organic matter. Acquiring this vital information in real time enables timely corrective measures in waste water processing.

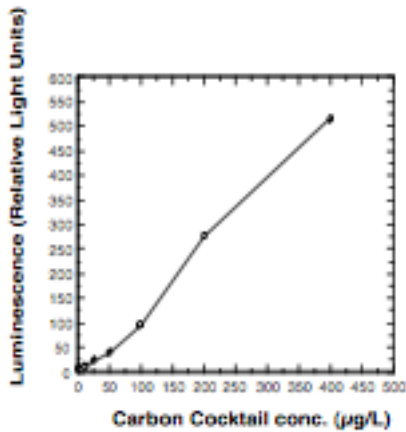
### **CheckLight BOD Testing Method**

The non-assimilable organic compounds in water (including carbohydrates, proteins, and complex nutrients) are first hydrolyzed by a mild HCl pre-treatment (1N HCl, 45 minutes at 100°C). This treatment breaks down polymers into assimilable oligomers and monomers. CheckLight's specially formulated reagent is then exposed to the treated sample, and luminescence is recorded after 2-3 hours of incubation at ambient temperature. The level of luminescence is proportional to the concentration of utilizable organic carbon in the sample. Figure 1 shows the resultant measurements of the standard Carbon Cocktail used as reference and positive control in the test system.

Figure 1-

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Data analysis is straightforward: **the higher the luminescence, the higher the concentration of utilizable carbon.**

### The Results

In order to verify the accuracy and reliability of the CheckLight test, multiple samples were collected from a large municipal waste water treatment plant and tested in parallel with both standard test (5 days long; measured in mg/L O<sub>2</sub>) and **CheckLight** test (3 hours; measured in mg/L carbon). As can be seen in Figure 2, a high correlation was found between the tests.

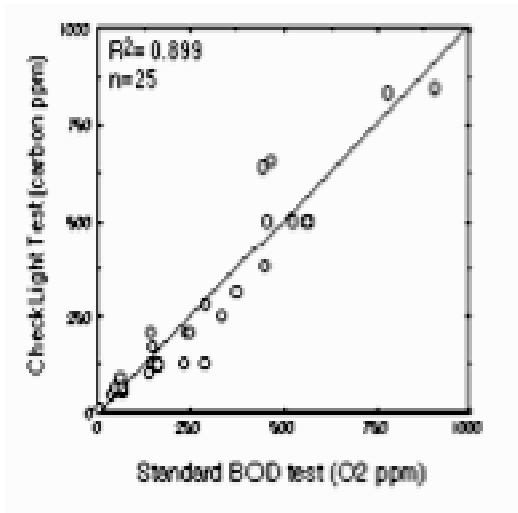
The operators noted that in addition to the clear advantages of rapidity and simplicity, the test has additional benefits:

1. Acid hydrolysis of the tested water converts all the water flora into bio-degradable nutrients (a potential oxygen consuming nutrient source not measured in the standard BOD method).
2. The test determines only the consumption of O<sub>2</sub> due to bio-oxidation of organic carbon sources (rather than reduced inorganic compounds utilized by some litho-autotrophic bacteria).
3. The high sensitivity of the test allows extensive dilution of the sampled water before testing thus minimizing possible inhibitory effects stemming from sample turbidity or the presence of toxic agents.

Figure 2:

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### The Outcome

The waste water treatment plant operators were pleased with the results from the comparison and can now regularly use the **CheckLight** kit to monitor treatment plant efficiency thus enabling rapid response to changing conditions.

**CheckLight** kits are favoured for the following reasons:

**Time saving** - accurate and meaningful results of dozens of samples obtained within 3-4 hours. No need for sample transportation to external labs.

**Reliable** - data highly correlative with standard test.

**Easy to use** - personnel do not require special laboratory skills to use kits.

**Cost effective**- enabling frequent monitoring for rapid response to changing conditions in water quality.

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