

TECHNOLOGY OVERVIEW - DETERMINATION OF AOC (ASSIMILABLE ORGANIC CARBON) IN WATER

Why is it important to determine the presence of Assimilable Organic Compounds (AOC) in water as opposed to TOC and DOC?

Regrowth potential of heterotrophic bacteria in potable water depends mainly on the presence of assimilable organic carbon source. Many bacteria are capable of dividing in water containing as low as 2-5 ppb of different carbon sources. The potential hazard in the distribution of pathogenic bacteria and the effect of bacterial growth on water quality and biofilm formation demands the addition of proper biocidal agents to water supplies. Since such treatment is costly and may result in the formation of toxic derivatives, determination of the regrowth potential of bacteria in water is vital.

Not all organic compounds present in water support microbial growth. Hence, it is important to be able to quantitatively measure the levels of biodegradable (or assimilable, utilizable) organic matter. Various chemical parameters such as total or dissolved organic carbon (TOC, DOC) proved inadequate for this purpose; it has been shown (Van der Kooij et al, 1982; Werner and Hambsch, 1986,1988) that the fraction of the total organic carbon pool which is available for biodegradation can be very small and is generally highly variable.

What is unique in the CheckLight Test?

The standard procedures for AOC determination in water rely on direct measurement of microbial growth; either a single- or multiple-species inocula, as well as a natural consortium of indigenous microbial flora have been used in different assays (Hambsch and Werner, 1989; APHA, 1996; Rice et al, 1990). While generally accurate and reliable, these technologies are tedious and require days to weeks before data are available; obviously, results obtained after such a long procedure have little value.

A suitable test for AOC in water should be rapid, inexpensive, and sensitive enough to detect very low concentrations of diverse groups of utilizable organic compounds in water. CheckLight's AOC test stands in the above requirements. The test is very simple, short, and shows high correlation with the capacity of bacteria to divide in the studied water.

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The principle of the CheckLight AOC test

The test is based on the effect of assimilable organic compounds on the development of luminescence in *Vibrio harveyi*. The bacteria are given all the environmental and nutritional conditions necessary for light production, except an organic carbon source, instead of which the cells are exposed to the tested sample. The luminous bacteria are provided in a freeze-dried state. Upon hydration in the questioned water sample, these bacteria undergo prompt induction of the luminescence system if the sample contains assimilable organic compounds. Luminescence increases with time, with an intensity dependent on the concentration of the organic compound. Sub-ppm concentrations of different kinds of assimilable organic compounds can be determined within 2-3 hours.

Dechlorination of water samples

The presence of chlorine and its byproducts lead to rapid decay of bacterial bioluminescence. When required, up to 2 ppm chlorine can be chelated by addition of sodium thiosulphate (100 ppm). Higher concentrations of chlorine should be properly diluted in clean water prior to addition of thiosulphate, or removed by other means.

Note that the provided Metal-Chelator solution contains sodium thiosulfate and may be used by dispensing 10µl (1:100 dilution) into each of the tubes in the dilution set. In the new version of the test, thiosulfate and metal chelator are already included in the provided assay buffer.

How might toxicants present in the tested water sample effect the results?

Whenever a water sample contains both assimilable organic compounds (that promote light development) and toxic compounds (that might diminish light level), the luminescence obtained may not behave in a concentration-dependent manner. Spiking various toxicants (tested at concentrations that were a hundred fold higher than the allowable level in drinking water) into water with 10-1000 ppb carbon source, did not affect the test performance.

It can not be ruled out, however, that low AOC water samples containing a high concentration of toxicants might exhibit inhibited luminescence. When the AOC level is high enough in the toxic sample, luminescence will develop in diluted water samples, but

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not in the concentrated ones.

One way of gauging the possible presence of toxic elements in the tested water sample is to spike the tested sample with increasing concentrations of the Carbon Cocktail Solution provided.

References

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