EXO Combines Chlorophyll and Blue-green Algae Measurement in Total Algae Sensor

YSI Environmental Monitoring Systems
Application Note A606

Q: How is the EXO total algae sensor design different?

A: The EXO total algae sensor (TAL) combines a Chlorophyll sensor and Blue-green algae Phycocyanin (BGA-PC) sensor into one submersible dual-channel fluorescence sensor. The unique combination is highly accurate while also "saving space" on the EXO sonde by using one sensor port instead of two, thus freeing up a port for additional optical or physico-chemical sensors.

Q: How is the EXO total algae sensor able to read both Chlorophyll-a and Phycocyanin algae?

A: The EXO total algae sensor contains two excitation beams: a blue excitation beam (470 nm) that directly excites the chlorophyll a molecule, present in all photosynthetic cells, and an orange excitation beam (590 nm) that excites the phycocyanin accessory pigment found in blue-green algae (cyanobacteria).

The total algae sensor generates two independent data sets, one for Chl and one for BGA-PC. Output is in µg/L, which represents an estimate of pigment concentration in the measured water, as well as RFU for the direct fluorometer signal.

The two channels of the Total Algae sensor allow the user to detect algal biomass for planktonic algae and cyanobacteria simultaneously, providing a more accurate estimate of total algae biomass.

Q: What are the implications of measuring both Chl and BGA-PC simultaneously?

A: Using Chlorophyll alone to measure algae biomass has a tendency to underestimate the population. Therefore using Chl and BGA-PC simultaneously---to detect algal biomass for both planktonic algae (chlorophytes, diatoms, dinoflagellates, etc.) and cyanobacteria specifically---generates a more accurate total biomass estimate.

Applications

Drinking water: Research shows that using both *in vivo* Chl and BGA-PC sensors in source waters is helpful in discerning cyanobacteria blooms from other algal blooms, and in quickly assessing the potentially harmful nature of the blooms. Treatment operators and managers can use the combined data to adjust treatment processes as necessary to avoid the intake

or plan the removal of cyanobacteria and possible toxins.

Source water: Readings from the EXO TAL sensor show less interference from turbidity and thus allow for more accurate determination of BGA-PC and Chl content during rainfall events that release both sediment and algae into the water.

Seawater: In coastal applications the fast sensor output of 4 Hz can be used for profiling the water column and detecting algal microlayers at various depths.

The Total Algae sensor on the EXO sonde moves up and down, profiling the water column, and can detect subsurface algal blooms.

Q. How does the EXO total algae sensor handle interference?

The EXO optics detect the fluorescence from Chlorophyll that is triggered by PC excitation. This means that the signal picked up with the EXO is dependent on a viable cell that can transfer energy from the accessory pigments (PC) to the central Chl. This is advantageous because the EXO sensor is then not susceptible to interference from degraded pigments, a condition often seen near the bottom with a spike in the Chl or BGA data caused by accumulating dead algal cells.

The narrow bandpass optics that filter out interference from dead algal cells also reduce interference from suspended sediments in the water (turbidity) and dissolved organic matter.

The EXO total algae sensor can be used for a variety of water quality monitoring applications, including regulated environmental monitoring, analysis of water quality in lakes and rivers, detection of harmful algal blooms and blue-green algae (cyanobacteria), management of reservoirs and dams, and research and education.

Performance Benefits of the EXO Total Algae Sensor

- Two sensors in one
- Senses viable cells only
- Accurate estimate of total algal biomass by addressing 'underestimate issue' with Chl sensors when cyanobacteria are present
- Discriminates between cyanobacteria and other types of algae
- Significantly less sensitive to common interferences (turbidity, fDOM, degraded pigments) due to narrow bandpass optics
- Lower detection limits
- Faster response, T63>2 sec
- Deeper depth rating of 250 m

For information, visit:
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