SCM0007: Public Comments

Methodology for Treatment of Harmful Algae Blooms

This methodology was open for public comment for the dates 17 February 2023 – 17 March 2023.

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This comment was received via email to the Social Carbon Foundation

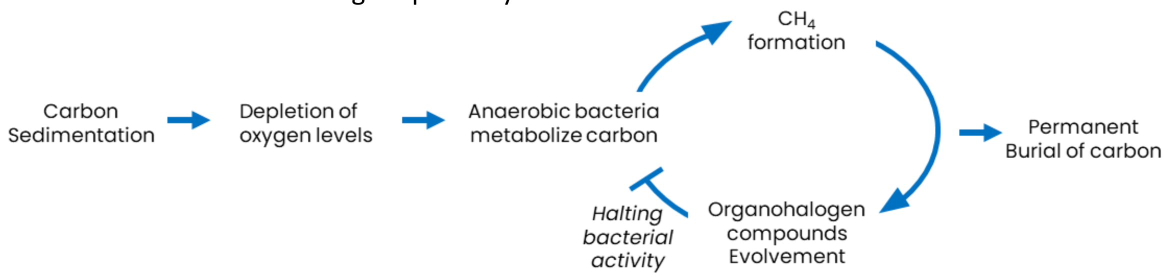
Comment:

During HAB events, most biomass is decomposed by bacteria that respire oxygen, leading to hypoxia in the water column and sediments. The fixed CO2 is released back in the environment. HABs are naturally increasing and cell death is inevitable due to the lack of available light under high algal biomass conditions. Therefore, inducing apoptosis is absolutely unnecessary and it is not possible to "store carbon in sediments" in shallow terrestrial water bodies. Such thing would only be possible in deep oceans. This project is pointless in terms of long-term carbon fixation. It would be useful only if the algal biomass could be removed from the water body and converted into any sort of carbon storage. Yet, the even if biofuels are considered, the carbon is released back to the atmosphere.

Response:

Many peer-reviewed studies demonstrate that algae biomass sedimentation in freshwater bodies offers significant carbon storage. Clow, et al., (2015); Sobek, et al., (2009); Hobbs, et al., (2013); Heathcote & Downing (2012); Ward, et al., (2017); Marcé et al., (2019); Mendonça et al., (2017); Butman et al., (2016).

One of the most comprehensive analyses done by the U.S. Geological Survey over 697 lakes across the US showed that the average burial rate of carbon in lakes and reservoirs was over 55%. The scientific rationale underlined in Chapter 9.3.7 (supported by the above publications) can be described with the below biological pathway:



The methodology takes into account biomass degradation and evolution of Carbon Dioxide (CO_2) Methane (CH_4) and Nitrous Oxide (N_2O) during the sedimentation process. This was based on literature from: Mengis et al., (1997); Wunderlin et al., (2012); Lin et al., (2022); Gruber et al., (2022); Vasilaki et al., (2019). For conservativeness, samples shall be taken only from the waterbody's circumference in a depth that is not greater than 1.5 meters. These samples are used to calculate the burial efficiency of the biomass. In reality, the burial efficiency is expected to be greater in the deeper points of the waterbody. Concerning your inquiry about the sedimentation rate and the Methodology's way of quantifying burial efficiency, please see Chapter 9.3.7 *Sampling Sediment Cores* and the reference therein.

Whereas the depletion of oxygen levels over the sediment creates the ground for anaerobic conditions. Within these conditions, there will be a production of CH4 that quickly interacts (for example) with Chlorine or Bromine ions to become organohalogen compounds (e.g. Chloroform). The latter inhibits any microbial growth, thereby halting any further organic degradation (see references here, here, and here).

Whilst HAB blooms do indeed oscillate throughout the year, for waterbodies with high infestation rates, where >95% of the phytoplankton populations consist of cyanobacterial species, it is assumed that the cyanobacterial biomass does not change significantly during the year – as their pelagic–benthic life cycle helps them survive periods of adverse conditions which contributes greatly to their ecological success. In addition, this methodology does not account for the methane emissions that were avoided as a result of the HAB treatment, that would have otherwise occurred in the baseline scenario (Bižić et al., (2018); Bižić et al., (2020); Fazi et al., (2021)).

Last but not least, the excess emission of methane from the seabed will be controlled by aerobic and anaerobic methanotrophs i.e. it would turn into bacterial biomass. If it turns into CO2 the latter will be consumed once again by local algae at the photic zone (e.g. ref).

The broader environmental impacts of cyanobacteria blooms in freshwater bodies cannot be overlooked; they pose significant risks to both biodiversity and human health. The purpose of this methodology is to treat the algae blooms and prevent the significant ecological damage that would have occurred under natural conditions.

The applicability conditions of the methodology require that the cyanobacteria treatment induces Programmed Cell Death (PCD) and results in significant cell death. The treatment of the HAB will result in rapid sedimentation and burial of the HAB's biomass at rates greater than seen in nature.

The methodology was peer-reviewed by Prof. Yosef Tal (Microbiology), Prof. Aaron Kaplan (Environmental biology and photosynthesis) and Prof. Boaz Lazar (Geochemistry). Their comments and recommendations were embedded in the final version of the Methodology.

We recommend reviewing all the footnotes documented throughout the methodology which provide scientific literature to justify design decisions and rationale used in the methodology.