The Response of Lake Nutrients During Treatment of a Harmful Algal Bloom by Nanobubble Ozone Technology

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Anthropogenic changes in land-use have had a large impact on nutrient cycles. In Ohio, nutrient runoff from agricultural fields, mainly of nitrogen and phosphorus, has caused eutrophication in lakes and lead to harmful algal blooms (HABs). There are many proposed methods to either mitigate the nutrients or control algal blooms. One emerging experimental treatment for HABs is Nanobubble Ozone Technology (NBOT). Ozone is used to treat microcystin, an algal toxin, in water treatment plants, and NBOT is a way to deliver ozone to lakes to potentially treat the HABs *in situ*. There is some suggestion it can also mitigate the nutrients which cause eutrophication. Before NBOT can be used, it is important to understand not only how it works with algal blooms but also whether it will alter nutrient cycling in lakes. Grand Lake St. Mary's is the largest inland lake in Ohio and frequently experiences some of the worst HABs in the country. We performed an experimental NBOT treatment at Dog Tail Beach, a protected area of Grand Lake St Mary's, in summer 2022 and 2023. Water samples were collected weekly and consisted of pretreatment, NBOT treatment, and post-treatment samples. In 2022 we observed an increase in dissolved organic carbon (DOC) during initial NBOT treatment, followed by a decline mid-way through treatment and increase in post-treatment samples. Because ozone is known to react with dissolved organic matter (DOM) and any algae treated by the NBOT would release DOM, this suggests a complicated relationship between NBOT treatment and DOM. Total nitrogen increased early on during NBOT treatment, declined, and then continued to increase through treatment and post-treatment. Total phosphorus steadily increased throughout pretreatment, treatment, and post-treatment with the exception of a slight decrease in June. This suggests that NBOT does not remove phosphorus from the water, which it is advertised as doing. Because there are many factors controlling nutrient cycling in this lake, including runoff from agricultural fields, the algal bloom itself, and the treatment, it is difficult to isolate the impact of any individual driver on the nutrient cycling. Further work will involve examining this data with that from experimental NBOT treatments in controlled lab and mesocosm environments.