Shining a Light on Water Treatment Technologies

RESEARCH PROJECT TITLE:

Kinetic models for oxidative degradation of cyanotoxins in raw drinking water

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PROJECT SUMMARY

Water treatment plants in Ohio use chlorine as part of their arsenal to fight drinking water contamination, including the presence of toxins like microcystin. Researchers wanted to make that treatment technique more effective by adding UV light and a permanganate oxidant into the equation.

The laboratory experiments have shown that rates of toxin degradation and destruction are higher when UV light treatment is added to current water treatment procedures that use chlorine. It also looks like the combination of UV and chlorine is effective in pH ranges that occur during algal blooms, as well as at a wide range of temperatures. These findings bring the researchers another step closer to using this method at water treatment plants.

Applying permanganate to speed the degradation process along also shows promise, without requiring additional or longer treatment to be most effective. The presence of organic matter – plant debris, mud and other things often suspended in lakes and streams – didn't affect the treatment protocols in a negative way.

Overall, chemical oxidants like chlorine and permanganate that are already commonly used in drinking water treatment can be effective in reducing algal toxin concentrations during typical plant operations. Most water conditions will allow chlorine to react with microcystins in less than 20 minutes, and addition of UV light can speed up the process while allowing chlorine doses to be drastically reduced.

Collaborations with local water utilities and Ohio's harmful algal bloom monitoring program have allowed the scientists to confirm whether the water samples used in the laboratory experiments were correlated with an active algal bloom at the time the samples were taken, based on information provided by OEPA.

AGENCY PRIORITIES ADDRESSED

- Cyanotoxin reaction kinetics: concentration-time (CT) tables for other microcystin variants via chlorine and permanganate

THE BOTTOM LINE

Researchers are enhancing current methods for drinking water treatment by adding UV light disinfection to established treatment protocols that use chlorine.