

The benefits of TiO₂ photocatalytic oxidation systems as a method of risk reduction for Indigenous First Nations Communities Major Water Sources

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The applicability of advanced oxidation processes (AOPs), ultraviolet disinfection in combination with TiO₂ nanoparticles as an alternative to traditional point-of-use treatments in remote Canadian communities was investigated using a comparative study looking at E. coli inactivation via a UV/TiO₂ treatment application. Likewise, boiling E. coli was used as an indicator organism for safe drinking water as per water quality standards in Canada and cultivated with a nutrient-based agar. Water samples spiked with E. coli were treated with TiO₂ treatment applications and boiling, consequently, E. coli content in water was measured before and after using membrane filtration.

The TiO₂ treatment intervention was found to remove E. coli more effectively than boiling, reducing initial E. coli concentrations 107 CFU mL⁻¹ to zero CFU mL⁻¹ whereas boiling left 2-3 CFU mL⁻¹ consistently. Additionally, pretreated drinking samples from Mannheim Water Treatment Plant were tested using TiO₂ advanced oxidation process and, compared to, boiling. The results coincided with the artificially spiked water samples, TiO₂ intervention effectively reduces E. coli to safe drinking levels in significantly less time than traditional boiling.