EMERGING CONTAMINANT REMOVAL
IN WASTEWATER TREATMENT TRAINS UNDER CANADIAN CONDITIONS

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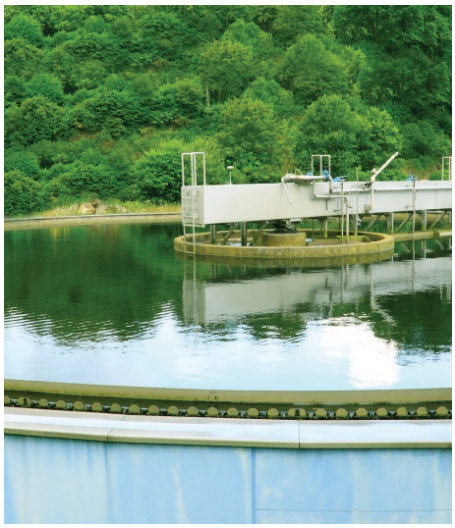
KEY MESSAGES FOR DECISION MAKERS

- Wastewater treatment plants with improved nitrogen removal (nitrification and denitrification) can result in enhanced emerging contaminants (EC) removal. There is evidence that this can reduce the harmful effects of the effluents on biota.
- The extent of improvement appears to depend upon the operating conditions of the treatment processes as the ranking of the performance of the treatment trains changed when the operation was switched from winter to summer operating conditions.
- For selected compounds similar removals of ECs were observed in activated sludge, membrane bioreactors and lagoon systems.
- Lagoons appear to be particularly effective in removing ECs that are sensitive to photo-degradation.



WHO IS THIS INFORMATION RELEVANT FOR?

- Municipal, provincial and federal government agencies
- Wastewater engineers
- Source water protection managers
- Community-based groups and non-governmental organizations

WHAT WAS THE RESEARCH FOCUS?

This nation-wide project expands our knowledge on removing ECs in wastewater over a range of climatic and seasonal conditions and included:

- Comprehensive assessment of the relationship between the removal of emerging contaminants in wastewaters and the impacts of treated wastewater on aquatic species
- Assessment of the impact of treatment process configuration on these responses
- Assessment of the impact of climatic conditions on these responses.

WHAT WAS THE RESEARCH METHOD?

Research at 4 locations across Canada included:

- Comparison of CAS, CAS-N, BNR wastewater treatment processes
- Comparison of membrane bioreactor (MBR) with activated sludge
- Lagoon study
- Biological nutrient removal transient loading study

EC concentrations were measured, as well as the impacts of treated effluents on biological endpoints.

WHAT WERE THE RESEARCH RESULTS?

- CAS-N and BNR processes achieved lower effluent concentrations of some ECs than a CAS process.
- BNR effluent had the lowest Yeast Estrogen Screen (YES) responses; CAS effluent had higher YES responses with a large degree of variability. The CAS-N effluent differed between winter and summer phases.
- Exposure of fathead minnow to CAS effluent resulted in considerable mortality, reduced growth and reduced egg production. The CAS-N effluent also resulted in some mortality and reduced growth and egg production in the fathead minnows. BNR effluent had no effect on mortality, growth or egg production.
- The presence of elevated ammonia concentrations in the CAS effluent likely contributed to some of the biological responses.
- Membrane bioreactor and the two full-scale activated sludge plants achieved similar EC removals, which was attributed to relatively long solids residence time.
- Compounds susceptible to photodegradation showed greater removals in a lagoon in the summer.
- There were substantial differences in concentrations of target compounds in raw wastewaters between the four locations.

WHAT ARE THE IMPLICATIONS FOR DECISION MAKERS?

The effluents from conventional activated sludge processes may have impacts on aquatic biota under some discharge conditions. Municipalities have several technology options for reducing the impact of ECs on the aquatic environment. Upgrading of treatment for biological nutrient removal may have ancillary environmental benefits as a result of EC removal. Small communities that employ lagoon-based technologies can benefit from photolytic destruction of some ECs.

FOR MORE INFORMATION, PLEASE CONTACT WAYNE PARKER AT WJPARKER@UWATERLOO.CA

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