IMPACTS OF ALKALINE STABILIZED BIOSOLIDS APPLICATION ON THE FATE AND TRANSPORT
OF EMERGING SUBSTANCES OF CONCERN IN AGRICULTURAL SOILS, PLANT BIOMASS, AND GROUNDWATER

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WHAT WAS THE RESEARCH FOCUS?

Canadians contribute significant amounts of chemicals to aquatic and terrestrial ecosystems each year. As populations increase, particularly in urban settings, solutions to manage municipal sewage solids need to include recycling back into the soil. The soil is a dynamic system which can filter and degrade many chemicals if it is managed appropriately. While alkaline stabilized biosolids have been found to be a source of ESOC, when managed within the context of recommended agronomic rates and non-intensive application frequencies no significant detrimental effects have been observed.

The reason for conducting this research was to develop a significant knowledge base and toolkit to manage the presence of Emerging Substances of Concern which enter into agro-ecosystems through the application of alkaline stabilized biosolids.

WHAT WAS THE RESEARCH APPROACH?

The research approach involved monitoring field-based locations which had received multiple years of ASB applications for a range of biological impacts, changes in ESOC resulting from different rates and frequencies of ASB application, and examining transport of ESOC into drainage and groundwater. In turn, field- and laboratory-based datasets were used to calibrate and validate environmental fate and transport models as a tool to project potential movement and impacts of using biosolids in agriculture.

WHAT WERE THE RESEARCH RESULTS?

- ESOC were present in alkaline stabilized biosolids but at concentrations which were considerably lower than the raw sewage solids.
- Long-term use of ASB in agricultural soils can lead to accumulation of ESOC, especially if the organic material is not fully decomposed in a single season.
- Transport of phthalates and some pharmaceutical compounds into agricultural tile drained water was possible but one year after ASB application limited movement to a groundwater system was observed.
- Uptake of ESOC into plant material was very low compared to concentrations measured in the soil or leachate water.
- Combining ASB applications with biochar additives reduced the mobility of two estrogenic compounds.
- Using agronomic recommended rates of ASB resulted in low residual ESOC concentrations two years after a single application.

WHAT ARE THE IMPLICATIONS FOR AGRICULTURE AND MUNICIPALITIES?

The implications of this research for agricultural end users and municipalities are that ASB applications can provide some benefits for crop production or amelioration of soil pH in acidic soils. Despite multiple applications of ASB, some sensitive soil bio-indicators, such as nematodes and microbial functional groups, displayed positive population responses to higher rates and no evidence of detrimental effects were observed. The outcomes of this work will provide some modeling tools to help determine appropriate rates of application to minimize the potential for ESOC transport and accumulation in agricultural soils.

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