

## **Biodegradation of Trace Organic Contaminants in Stormwater Infiltration Systems**

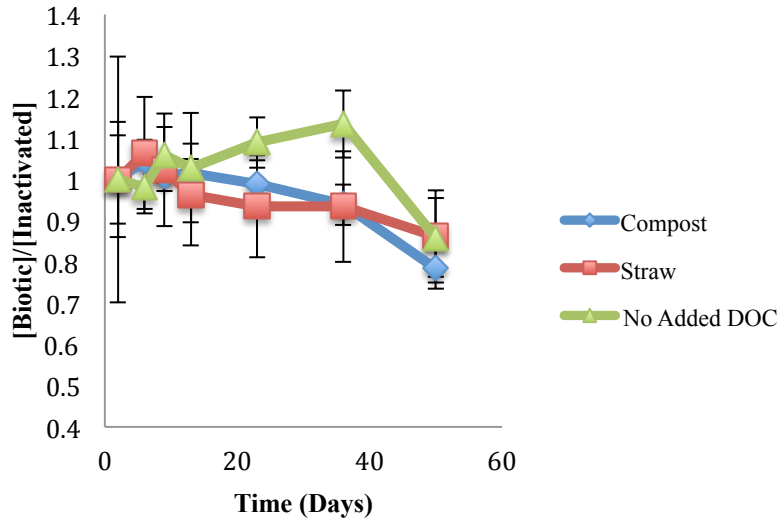
Katelynn J. Edgehouse<sup>1-3</sup>; Bridget A. Ulrich<sup>2,3</sup>; Christopher P. Higgins<sup>2,3</sup>

<sup>1</sup>Cleveland State University, <sup>2</sup>Colorado School of Mines, <sup>3</sup>ReNUWIt ERC

Urbanization has degraded water resources, in part due to poor management of stormwater runoff. Stormwater runoff takes up trace organic contaminants (TOrcs) from urban surfaces, which contaminate urban receiving waters. With water quality and quantity becoming increasingly pressing, it is important that the water resources currently available are relatively free of contaminants. There are some methods currently in place to try to mitigate the affects of stormwater runoff entering urban receiving waters, but these practices are not always effective. For example, most rain gardens have sand as their base, and polar TOrcs filter through the sand instead of being sorped and potentially degraded. Stormwater could become an important water source if there was a way to remove most of the TOrcs from it. For instance, stormwater could be used for land irrigation and toilet flow instead of wasting potable water that is more needed elsewhere. Thus, the goal of this project was to assess the degradation rates of TOrcs and identify transformation products, with the hope that the information gained will provide insight into more effective stormwater infiltration systems. To accomplish this goal, it was hypothesized that the type of carbon source added to a stormwater infiltration basin will have an effect on the TOrc biodegradation rate and transformation products.

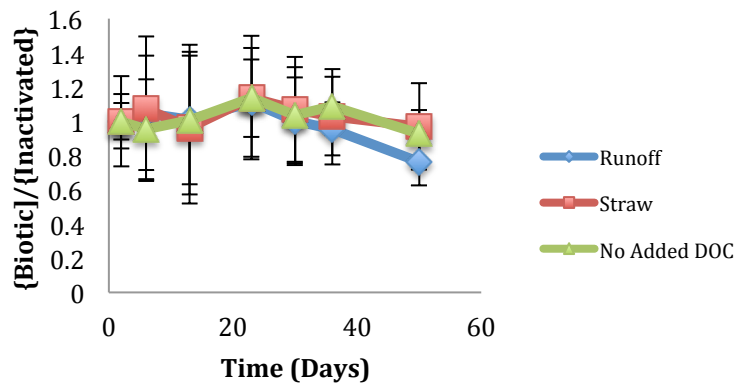
To determine how to improve TOrc degradation in stormwater infiltration systems, two different sources of dissolved organic carbon (DOC) were tested. Out of the thirty total microcosms created for the project, ten had compost as their DOC source and ten had straw as their DOC source. The last ten contained runoff and no added DOC source. In each set of ten microcosms, five measured biodegradation and five were inactivated with sodium azide so that they could act as a control. At the beginning of the project, the microcosms were spiked with the selected TOrcs at a level of 50 µg/L, and then sampled for TOrc degradation approximately weekly. To monitor biodegradation, targeted analysis of the parent TOrcs in the microcosms was done using liquid chromatography tandem mass spectrometry. To screen for transformation products, non-targeted analysis was done using liquid chromatography quadropole time of flight mass spectrometry.

Over the course of this project, there were two trends for degradation in the microcosms. The first was that using a source of DOC promoted more degradation of several parent TOrcs, such as diuron (Figure 1).



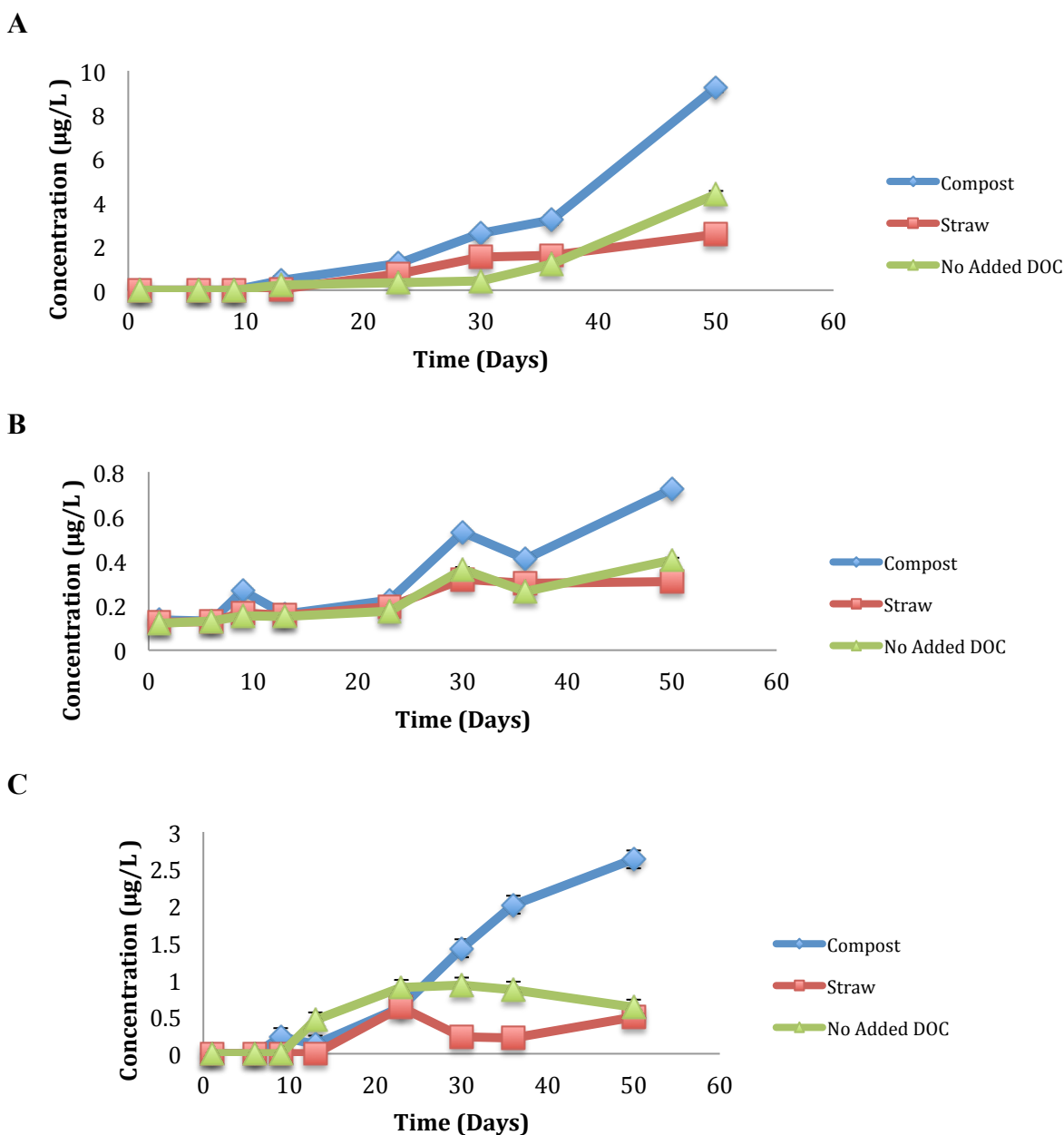
**Figure 1.** Diuron degradation over the course of this project

The parent compound concentration is expressed as the ratio of the concentration in the biotic microcosms to the concentration in the inactivated microcosms to observe effects due to biodegradation only. This ratio was normalized, such that a ratio below 1 indicates biodegradation. Atrazine was the one compound that was slightly different for this experiment because there was less of a difference in degradation between the microcosms that had added DOC and those that did not (Figure 2).



**Figure 2.** Atrazine degradation within the microcosms over the course of the experiment.

The second trend for the experiment was that the compost microcosms tended to have the highest generation of transformation products (Figure 3). This is particularly important because sometimes the transformation product is more toxic and mobile than the parent TOrC, which is the case for diuron and its transformation product dichloroaniline.



**Figure 4.** Generation of DCPMU (A), dichloroaniline (B), and atrazine deisopropyl (C) in the microcosms throughout the experiment.

In conclusion, an added DOC source generally does promote more parent TOxC degradation than if there was no added DOC source. This also means that transformation product appearance needs to be monitored more closely so that more toxic and mobile compounds are not being leached into urban water supplies. Further analysis of the LC-QTOF-MS data and a mass balance for each parent TOxC will need to be carried out so that all of the transformation products present are identified.