S-TRIAZINE HERBICIDES AND THEIR TRANSFORMATION PRODUCTS IN THE NORTH FORK OF THE SHENANDOAH RIVER

Thomas B. Huff1,*, Jun Liu1 and Gregory D. Foster2

1Shared Research Instrumentation Facility, George Mason University, Manassas, VA, 20110, 2Department of Chemistry and Biochemistry, George Mason University, Fairfax, VA, 22030

ABSTRACT

Surface water samples were taken during seven consecutive months from April through October 2008 from two different regions in the Shenandoah River watershed within the Potomac River basin. Five sites were monitored on the Shenandoah River including four sites on the North Fork near the town of Luray, Virginia and one reference site on the South Fork near Luray, Virginia. The samples were filtered and extracted using solid phase extraction. Extracts were analyzed by liquid chromatography-mass spectrometry for atrazine, simazine and propazine and their primary transformation products hydroxy atrazine, desethyl atrazine and desisopropyl atrazine. It has been surmised that these transformation products have the same ecological impacts as their parent compounds.

The samples demonstrated seasonal high concentrations during the springtime application period. They also showed that the transformation products persisted throughout the study period even while the parent compound concentrations decreased. The data showed that the transformation products had a greater overall contribution to the total triazine herbicide burden on the streams except during application periods during major storms.

PARENT HERBICIDES: atrazine, simazine, propazine

TRANSFORMATION PRODUCTS:
- Hydroxy Atrazine
- Desethyl Atrazine
- Desisopropyl Atrazine
- Desethyl-2-hydroxy Atrazine
- Desethyl-desisopropyl Atrazine

ATRAZINE

Most widely used pesticide in the U.S. and the pre-emergent herbicide for corn crops.

In Europe, the standard is 100 mg/L and includes the sum of the transformation products.

Current studies are underway to determine the ecological effects of atrazine herbicide transformation products. Work has shown that DEA and DIA degradates can increase aromatase activity in human cell lines to the same extent as simazine, propazine, atrazine (Gentles et al. 2003). Increased estradiol levels in males has been associated with intersex morphology leading to oocytes formation (Khan and Behki and Khan 1994). Pseudomonas sp. can transform into 6 major products abiotically or biologically from chlorohydrolases (Seffernick, McTavish et al. 2002).

FIELD SAMPLING

Sample Filtration

Solid Phase Extraction

LC-ESI-MS Analysis

The Huff family River Samplers (Sophie, Nathan and Alex)