USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Remediationof Atrazine Contamination in Municipal Drinking Water

Duration: 2 years (9/1/97 to 8/31/99)

Total Federal Funds Requested: $70,000

Non-Federal Funds Pledged: $148,561

Principal Investigators:

Dr. Michael J. Sadowsky

Department of Soil, Water, and Climate and Department of Microbiology University of Minnesota

St. Paul, MN

Dr. Lawrence P. Wackett

Department of Biochemistry and Biological Processes Technology Institute

University of Minnesota

St. Paul, MN

Congressional District: 5th

Statement of Critical Water Problem:

Atrazine is a widely used herbicide for the control of broad-leaf weeds. It is the predominant member of a broad class of *s*-triazine herbicides which are used to control weeds in corn, sorghum and other crops. Atrazine is relatively persiste nt in soils with an average half-life ranging from 4 to 57 weeks. Several studies concerning the environmental fate of atrazine have shown that atrazine is transformed relatively slowly in the environment. Because of its widespread use over the last thirt y years, for both selective and nonselective weed control, atrazine and other s-triazine derivatives have been detected in soils and in ground and surface water in most states in the Midwestern U.S. Atrazine has been shown to move from point of applicatio n in runoff water, and eventually makes its way to surface waters. The median concentration of atrazine in 132 streams during post-planting periods was 3.8 ppb, which exceeds the EPA maximum contaminant level goal for this herbicide (3.0 ppb). Consequentl y, many community water supplies in the Midwestern corn belt may be in violation of the revised Safe Drinking Water Act with respect to atrazine and other triazine herbicides.

Many small drinking water treatment plants in the Midwest and other regions of the U.S. are not equipped to eliminate atrazine from drinking water, since removal of atrazine from ground and drinking water requires expensive chemical adsorption procedur es, usually using activated charcoal. However, federal mandates, health concerns, and public interest requires that potable drinking not contain more than 3 ppb of atrazine. Consequently, rapid, inexpensive, and effective atrazine removal from drinking wa ter supplies is needed. The research proposed below addresses this major national problem by developing an effective atrazine remediation technology. While results from initial research studies will be targeted towards small municipal drinking water suppl iers, the technology to be developed will be equally useful for larger municipal suppliers of drinking water. If successful, this proposed technology will address these concerns by providing an effective and inexpensive method to remove atrazine from drin king water.

Statement of Results and Benefits:

Results from the proposed studies will provide data useful for remediating atrazine from municipal drinking water supplies. Since many of the proposed experiments will be done at a "pilot scale" level, the results obtained will be applicable to exi sting water treatment facilities operating under real-life conditions. Specifically, we will obtain data on the effectiveness of the purified atrazine chlorohydrolase enzyme to remove atrazine from raw, contaminated, surface drinking water supplies. We wi ll also obtain information on the rate at which the enzyme removes atrazine from water and establish how water treatment chemicals (such as Ferric chloride, Alum, Lime, and Chlorine) effect the enzyme treatment system. Lastly, these studies will allow us to determine which water treatment facility entry point is most efficacious for enzyme addition and allow us to ascertain if the atrazine degrading enzyme can maintain functionality in water treatment filtration media. Lastly, we will develop a rapid atra zine detection assay to speed analyses of degradation studies.

The information gained form these studies will be used by operators of municipal water treatment facilities and contractors to develop an effective atrazine removal strategy. We have been collaborating with Montgomery-Watson (a prominent engineering fi rm with offices in Wayzata, MN in the water treatment business) for the purpose of developing this technology further. Genencor, the largest U.S. manufacturer of industrial enzymes, has conducted cost analyses which suggest that enzyme treatment may readi ly compete with activated charcoal for atrazine removal from municipal drinking water. Montgomery-Watson and Novartis (formally Ciba-Geigy) have agreed to work with us in establishing the efficacy of our atrazine enzyme remediation system at a contaminate d drinking water source near Springfield, Illinois (see attached letters). The involvement of these industries in our project allows us to rapidly test our treatment system under real-life conditions. Moreover, these industry representatives provide an ef fective means of disseminating our results to water treatment facilities throughout the U.S. However, these industry representatives will not supply any support funds to us to carry-out the proposed studies. Consequently, funding from the Water Resources Research Competitive Grants Program is crucial for our studies since it will allow us to perform fundamental research which will be publishable in refereed scientific literature, provide funds for personnel to

carry-out the proposed studies, and allow us to develop a model system for the enzymatic treatment of other chemical contaminants of drinking water. For example, such a system could be used for the treatment of drinking water contaminated with organophosphate pesticides.