

New Book Explores Links Between “Green” Chemistry and Agriculture

Exploring how environmentally friendly chemistry can be applied to agriculture is the subject of a new book edited by Dr. William Nelson of the Illinois Waste Management and Research Center (WMRC).

“Agricultural Applications in Green Chemistry” is published by the American Chemical Society (ACS) and distributed by Oxford University Press. Dr. Nelson directs the Alternative Cleaning Technology and Chemical Process Alternatives labs at WMRC. He is an expert on cleaning processes that reduce waste generation, and the author of a recently published book on “green” solvents for use in chemistry.

“Green” chemistry is the use of a set of principles that reduce or eliminate the use or generation of hazardous substances in the design, manufacture and application of chemical products. Green chemistry takes a long-term, holistic view of chemical processes and applications to make them more environmentally benign.

Nelson says he has been interested in applying the principles of green chemistry to agriculture since the discipline began to emerge in 1996. “It’s a natural match,” said Nelson, given his interest and experience in green chemistry and the location of WMRC in the midst of Illinois agricultural lands. In 2002, Nelson organized a symposium for ACS on agricultural applications in green chemistry. The symposium grew out of conversations between Nelson, colleagues at the U.S. Department of Agriculture in Peoria, Dow Chemical, Monsanto, and researchers at the University of Illinois, including Richard Larson and Constantin Rebeiz. The book is the result of research and ideas presented at that symposium.

Nelson sees the application of green chemistry to agriculture as an opportunity to learn from, and work in tandem with, nature in an effort to make agriculture more sustainable. With the widespread use of chemicals in modern agriculture, we’re potentially “sitting on a powder keg,” according to Nelson. He pointed to the infamous case of DDT, a pesticide that was once widely used, but banned in the U.S. in 1972 after it was discovered to be harmful to wildlife. DDT builds up in plants and in the fatty tissues of fish, birds and other animals. “DDT still appears periodically in the environment, and who knows what other chemical may turn out to be the next DDT,” Nelson said.

DDT is one example of how “chemists and chemistry have helped to create environmental problems, but this book is an example of how chemists and chemistry can help solve environmental problems,” according to Nelson. The book includes material on the connection between green chemistry and sustainable agriculture, as well as agricultural products as examples of green chemistry (such as ethanol as an alternative fuel or the use of a

plant's essential oils as alternative pesticides). Also included is material on agricultural processes in green chemistry, such as bioremediation (using plants or microbes to clean up contaminated soil) and increasing the efficiency of photosynthesis so that crop yields are naturally higher, decreasing the need for artificial fertilizers and pesticides. Finally, the book looks to nature for models of how to deal with agricultural problems, such as using biological control to eliminate pests instead of chemical pesticides. "Nature is very efficient," said Nelson. "It has had millions of years to develop its processes."

The book is written primarily for researchers and educators in chemical and agricultural sciences, though Nelson says interested farmers could also gain inspiration from the material. Nelson hopes the book will spur further interest and research in the application of green chemistry to agriculture. The book is available from the Oxford University Press and the American Chemical Society. Requests for it can be made at university and local bookstores.

WMRC is a division of the Illinois Department of Natural Resources, and is headquartered on the campus of the University of Illinois, Urbana-Champaign.