# Alternative technologies for water quality management

*Mandla A. Tshabalala*
*USDA Forest Service Forest Products Laboratory, Madison Wisconsin*

Cranberry growers are concerned about the quality of water discharged from cranberry bogs into receiving surface waters. These water discharges may contain traces of pesticides arising from herbicide, insecticide or fungicide applications. They may also contain excess phosphorus from fertilizer application. Some cranberry farms have holding ponds to reduce the amount of pesticide or phosphorus in the discharged water from the bogs before release into receiving surface waters. Most farms can manage water and hold it on the marsh to reduce and or eliminate residues. However, where holding ponds or management options are unavailable or not practical, other means of treating pesticide or phosphorus-containing water may be required.

Removal of pesticides or phosphorus from cranberry bog discharges could be achieved by using sorbents such as granular activated carbon. Although activated carbon sorbents are quite efficient for removing pesticides, they are not as efficient for removing phosphorus. They are also expensive to install, in addition to presenting disposal problems at the end of their service life. Hence, alternative technologies are required to remove pesticides and phosphorus from water discharged from cranberry bogs.

Researchers at the USDA Forest Service Forest Products Laboratory in Madison, Wisconsin, are conducting research on the development of sorbents that are made from lignocellulosic materials for removing various contaminants from water, including toxic metals, pesticides, phosphorus, oil and grease. The strategic goals of the research are to develop sorbents that are relatively low-cost, recyclable and simple to make from widely available lignocellulosic materials such as waste bark, sawmill residues, or low-value forest residues that may be recovered from forest thinning operations. The results of this research are expected to benefit the public in two major areas: sustainable and efficient utilization of forest and agricultural waste products, and enhancement of the quality of our surfacewaters.

The Wisconsin Cranberry Board (WCB) and the Cranberry Institute (CI) are helping support one such project at the Forest Products Laboratory. The objective of the project is to develop cost effective sorbents for removing pesticides and phosphorus that may be in water that is released from cranberry farms into receiving surface waters. The project started last year with initial laboratory screening ofvarious lignocellulosic materials for their capacity to remove pesticides that are commonly used in cranberry farms. The results from those screening experiments indicated that converted loblolly pine (Pinus taeda L.) bark had a relatively high capacity for removing the target pesticides fromwater.

Currently, we are investigating both physical and chemical processes to convert bark into useable sorbents for removing pesticides; from water. Physical processes involve drying the bark chips obtained from a pulp mill to various moisture contents followed by milling to make particles of various mesh sizes. Drying can be accomplished by air or in a drum dryer at elevated temperatures. Milling can be accomplished by using a hammer mill, or a rotary knife cutter, or a high speed Pullman dual rotating cutter.

Chemical processes involve extracting the bark particles with water containing an environmentally acceptable organic solvent to remove water-soluble compounds from the bark and to develop its porous structure. After extraction, the bark particles are treated with organic polyelectrolyte solutions. The polyelectrolyte treatment serves to enhance sorption capacity of the bark particles forphosphorus.

Sorbents prepared from bark according to the scheme outlined in the previous paragraph have shown high capacity for removing pesticides and phosphorus from water in the laboratory. The next phase of our work is to test the performance of these sorbents in the field. In this regard, we plan to install filtration units at a number of cranberry farms in Wisconsin and Massachusetts. Each unit will be set up in the "flow through" mode. Typically, wooden planks placed on top of each other control the water head in the bed during winter flooding or wet harvesting. We plan to install the test filtration units immediately downstream of the water head controller. A computer-controlled composite sampler will be placed to collect samples before and after the water enters the filtration unit. This will enable us to evaluate how well the filtration unit removes pesticides and phosphorus in the presence of natural organic matter in the water released from the bogs.

Field trials of the sorbents require that they be made in larger quantities than has been the case thus far for laboratory trials. Hence we are also continuing research and development on larger scale production of these sorbents. We are also continuing fundamental studies to understand the sorption mechanism of converted lignocellulosic materials for phosphorus. These studies will allow us to develop alternative less-costly chemical processes for enhancing the sorption capacities of these sorbents for phosphorus under field conditions where other water quality parameters such as pH, alkalinity, and turbidity may be a concern.

Our research to date has demonstrated that converted bark is effective for removing pesticides and phosphorus from water and may prove to be an invaluable addition to the arsenal of best management practices for removing them from water released from cranberry bogs.

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