



This article first appeared in ON COURSE, the magazine of
The Midwest Association of Golf Course Superintendents.

BARLEY STRAW PRODUCTS: ALL-NATURAL SOLUTIONS TO POND PROBLEMS

PONDS ARE GROWING - SO ARE POND PROBLEMS

Recent years have seen a surge in the growth of ponds: backyard ponds for landscaping and raising koi, retention ponds mandated by local authorities in housing developments and golf course ponds on recently-built and existing courses. This growth is fueled by two trends. The first is the consumer trend towards home enhancement and entertainment (named most colorfully as 'Cocooning' by Faith Popcorn) as consumers seek to make their homes islands of tranquility in an ever-busier world. The second is the trend towards larger and newer homes, driving housing developments out onto the prairies and farmland and creating the need for flood control. Many of these new developments are built around golf courses. At the same time, increased use of phosphorus-based fertilizers on lawns and gardens and historically higher temperatures and periods of sunlight have created conditions for higher growth of naturally-occurring pond organisms, such as algae. The result has been a significant increase in the number of ponds with problems ranging from unsightly algal blooms to extensive silt build-up and oxygen deprivation in the water (known as eutrophication), resulting in the death of plants, fish and marine life.

Various chemical pesticides and natural bacteria and enzyme products have been introduced to control these algal blooms, including copper in both sulfate and chelated forms. Both types of products, however, actually increase the problem. The chemical and copper pesticides kill the algae, which fall to the bottom of the pond and release nutrients over time as they decompose, creating a richer environment for the next round of algal bloom. The bacterial/enzyme products eat the nutrients, starving the algae. But when the bacteria die, they, too, release nutrients and enhance the next algal bloom. Both types of treatments lead to increasing boom-and-bust cycles of algal growth and ultimately to eutrophication. In addition, pesticides and copper products may kill or damage plants, fish and marine life and create toxic build-up. The result is an increase in the number of unstable pond environments and frustrated homeowners and association and golf course managers.

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Nature provides the solution in the form of barley straw, which has been used in the United Kingdom for over a decade to clarify ponds. Although the exact process is not fully understood by scientists studying it, the decomposition of barley straw in water appears to release substances that clarify pond water and affect nutrients. The result of decomposing barley straw in water is clear, healthy, natural ponds with sufficient oxygen and sunlight for aquatic plants, fish and frogs. Decomposing barley straw, however, takes one to three months to begin working and leaves a messy residue of rotten straw that must be cleaned out.

A better solution has been developed by environmental experts in the UK, commissioned by a local water company for use in potable water reservoirs. The environmental experts engineered a process that decomposes barley straw in bulk and stops the decomposition at exactly the right point for bottling the 'liquor' that results. When re-exposed to sunlight, this extract of barley straw continues to act like decomposing barley straw and is a powerful water clarifier. Extract of barley straw acts like barley straw itself, but is faster and cleaner than the straw – reaching effectiveness in 2-5 weeks and leaving no messy residue.

Extract of barley straw has been introduced into the US market on a test basis in the summer of 2002. Initial tests have been successful in all segments of the market, despite a much wider range of environmental conditions than those in the UK. The US experiences hotter temperatures, more days of brighter sunlight, greater intensity of fertilizer use and higher flow-through of water in retention and irrigation ponds.

HOW DO BARLEY STRAW AND EXTRACT OF BARLEY STRAW WORK?

No one is exactly certain what takes place when barley straw decomposes. Many of the organic compounds that appear as barley straw rots in water have not been identified. Research has been carried out for the past decade in the UK at the Centre for Aquatic Plant Management (associated with Cambridge University), where Jonathan Newman is the best-known expert. It is generally believed that the decomposition of the straw results in the slow release of hydrogen peroxide:

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“When straw rots, chemicals in the cell walls decompose at different rates. Lignins are very persistent and are likely to remain and be released into the water as the other components decay. If there is plenty of oxygen available in the water, lignins can be oxidised to humic acids and other humic substances. These humic substances occur naturally in many waters and it has been shown that, when sunlight shines onto water which contains dissolved oxygen, in the presence of humic substances, hydrogen peroxide is formed. ... experiments have shown that sustained low concentrations of hydrogen peroxide can have a very similar effect on algae to that of straw. Peroxides are very reactive molecules and will only last in water for a short time. However, when humic substances are present, peroxides will be continuously generated whenever there is sufficient sunlight. The slow decomposition of the straw ensures that humic substances are always present to catalyse this reaction.”¹

However, at least one expert in the US believes that phenols are more likely to be the effective agents.² Aquarium practitioners in Canada and Australia appear to agree with this view:

“There are many phenolic groups in lignin and its decomposition products. Lignin is found in terrestrial plants. Very loosely, it is like glue that holds cellulose bundles together. Sort of the collagen of terrestrial plants. Cellulose is the rigid material in macrophytes or what we think of as regular plants. The decay of plant tissues, even before the leaves detach from the stem, releases phenol and phenolic compounds in very low concentrations. ... It is thought that some plants release phenols and other chemicals as a form of chemical warfare called allelopathy in order to compete with algae and other plants. Straw or hay has been used to clear algae or duckweed from ponds; it works extremely well!”³

¹ CONTROL OF ALGAE WITH STRAW, IACR INFORMATION SHEET 3
IACR - Centre for Aquatic Plant Management, Science and Plants for Schools, Homerton College, Cambridge, UK <http://saps1.plantsci.cam.ac.uk/articles/barley.html> (for the longer article by Jonathan Newman, see “Control of Algae Using Straw” at www.capm.org.uk)

² Dan Terliza, University of Maryland, private conversation

³ <http://fins.actwin.com/aquatic-plants/month.9703/msg00156.html> See also Diana Walstad, ECOLOGY OF THE PLANTED AQUARIUM ISBN 0-9673773-0-7, Chapter 3, and NC Everall and DR Lees “The identification and significance of chemicals released from decomposing barley straw during reservoir algal control”, WATER RESOURCES, Vol. 31, No. 3, pp 614-620, 1997

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NATURAL SOLUTIONS CAN BE TRIED NOW

Barley straw and extract of barley straw are easy to use and can be tried without risk to marine life. It is impossible to overdose the extract, since it was developed for drinking water and is safe enough to drink. Extract of barley straw provides maximum ease of use and is well suited for most ponds. However, if there is extensive flow-through of new water, the action of the water will dilute the extract and limit its effectiveness. Irrigation ponds on golf courses, for example, might experience enough flow-through to affect the working of the extract. The extract is effective in closed systems where water recirculates. In environments with high flow-through, bales of barley straw anchored to the bottom or side of ponds and streams can be effective and do not require breaking up. In slower-moving water, barley straw bales must be broken up to allow the oxygen in the water to act upon the straw. Most sellers of the straw recommend putting the loose straw in some form of netting, such as Christmas tree bags, for ease of removal of the decomposed remains and to prevent unsightly masses of straw in the water.⁴

More research is necessary to establish the organic compounds and mechanism by which decomposing barley straw clarifies pond water. Given the growing interest in all-natural solutions to pond problems, there is little doubt that this scientific puzzle will be solved in the next few years. In the meantime, those charged with keeping their ponds clear - without polluting the environment and de-oxygenating the water - have two natural treatments to try!

⁴ See the IACR Information Sheet 3 for details.