A grain polymer prevents freeze-thaw damage.

Admixture from Amber Waves

Renewable resources make all of our lives better in the long run. So when I found a concrete admixture that is, at least in part, made from a grain, it seemed like a positively perfect way to exemplify how renewable resources can be used in ways we might never have considered.

The admixture I found was developed by inventors Zongjin Li, Chung Kong Chau, Faming Li, and Baoguo Ma of Hong Kong, and is designed to make concrete resistant to the effects of freezing and thawing. Filed under U.S. Patent No. 6,153,006 issued Nov. 28, 2000, the "Concrete Durability Enhancing Admixture" includes millet components.

There are about 25 different types of millet. Although it doesn't specifically restrict the use of others, the patent document calls out only two specific species: Panicum Miliacum or Setaria italica Beauv (shown below) and goes on to specify only the use of Panicum Miliacum. What the admixture really incorporates is a natural polymer made from these grains. It also contains smaller quantities of naphthenic sulfate salt, triethanolamine, and formaldehyde.

In cold weather, exterior concrete is subjected to temperature differences that cause moisture trapped within the concrete or pores in the concrete to produce hydraulic pressure from the expansion of the water as it freezes. Water is a "polar molecule" that undergoes a massive expansion when it changes states from a liquid to a solid. That expansion is about 9% in volume and happens quite rapidly between 4° C and 0° C (about 39° F and 32° F). The result is varying degrees of internal stress on the concrete, surface fractures and pitting, and possibly even structural fracture.

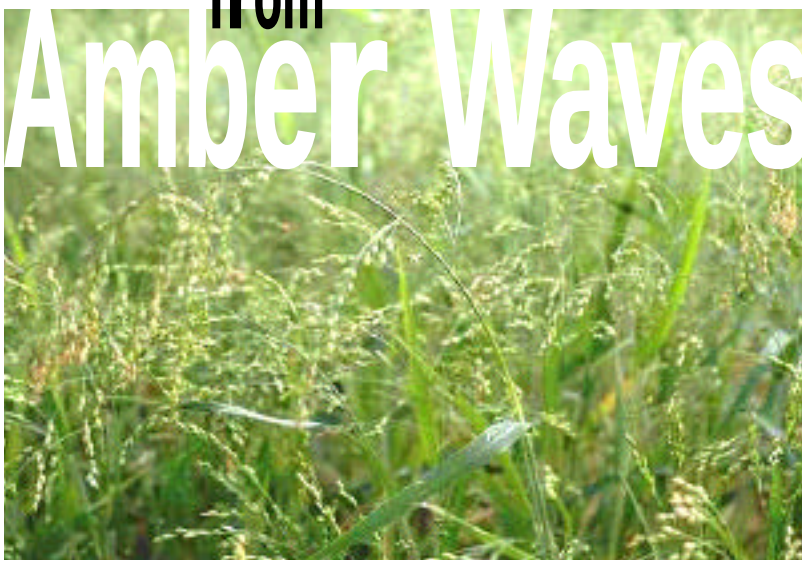
An increasing percentage of natural polymer added to the concrete mix results in a corresponding reduction in compressive strength and Young's modulus (modulus of elasticity). Testing by the inventors has shown that the optimum amount of natural polymer additive is in the range of 0.1% to 2% of the solid content by weight of the cement.

Testing using mercury intrusion porosimetry measurements shows significantly fewer surface cracks in the samples incorporating the new admixture. The results also show that the microstructure of the concrete modified with natural grain polymer is very stable, and both the pore sizes and amount of pores are similar whether or not the concrete is subjected to freeze-thaw exposure. In contrast, freeze-thaw cycles substantially alter the microstructure of ordinary concrete.

Additional information about this new admixture is available from the Hong Kong University of Science & Technology, Technology Transfer Center, Clear Water Bay, Kowloon, Hong Kong, phone: 852-2358-7917, e-mail: *ttcac@usthk.ust.hk*. The points of contact are Dr. Matthew M.F. Yuen, director, e-mail: *meymf@ust.hk*, or Dr. Wai M. Chung, development manager of technology, e-mail: *ttchung@ust.hk*.

There is also additional information about working with the Hong Kong University of Science & Technology on the Internet at *http://www.ust.hk/*, or on licensing patents from HKUST Technology Transfer Center, also on the Internet at *http://www.ttc.ust.hk/*.

Paul D.Q. Campbell is a Titusville, Fla.-based science and technology writer. E-mail: techpubs@ix.netcom.com*; Web site:* http://techpubs.home.netcom.com.



One of the earth's natural resources—grain—improves the durability of concrete, another environmentally friendly material.

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