

Recovering Phosphorous From Waste Water[®]

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The concern of phosphorous entering our waterways and ground water is well recognized at this time. Attempts have been made to reduce the amount of phosphorous in fertilizers to help reduce pollution. Lower levels of P to zero P have been introduced to help mitigate this problem. The challenge we face is phosphorous is an essential element in all living organisms. Modern agriculture cannot continue without this essential element. To put things into prospective 135 million tons of phosphorous is mined annually with over 90% used in the formation of fertilizers. What we may not know is that phosphate rock from which all commercial fertilizers are made is a finite source. The estimates vary, but International Fertility Development Center (IFDC) calculates that there are 50–100 years of reserves remaining. Once this is gone we have no replacement for mined phosphorous. Based on worldwide demand and supply from the IFDC in 7 years with 1.5% annual consumption rate demand will exceed supply (Fig. 1). With this scenario we can anticipate pricing to rise significantly over the long term. Source point pollution occurs from two areas one is from the continued use of phosphorous fertilizers the other is from municipal and industrial waste. The following paper will discuss the method of removing phosphorous from waste water and producing a renewable high-quality, slow-release fertilizer.

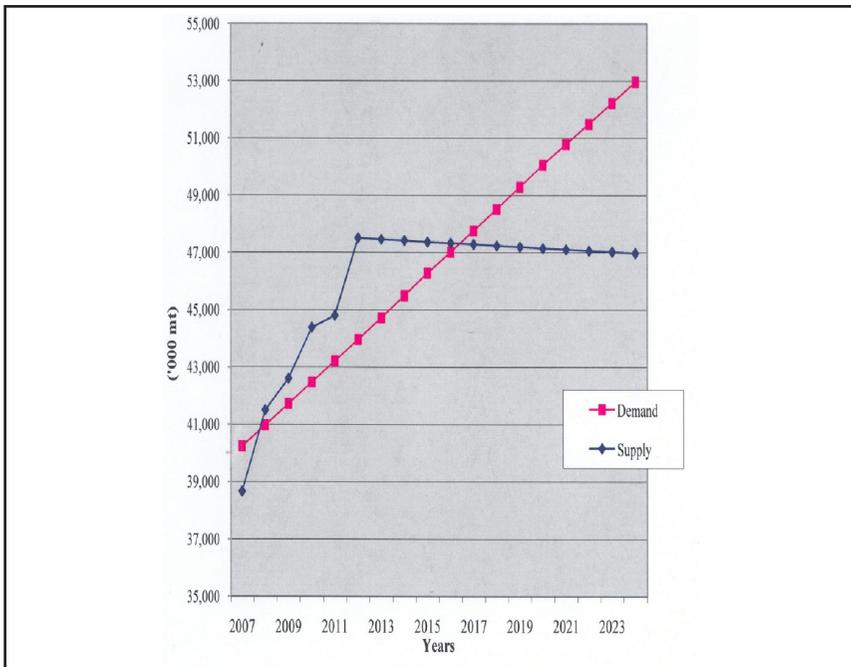


Figure 1. World demand and supply projections of phosphorus fertilizers. Note: demand growth rate is about 1.5% per year; source: International Fertility Development Center, 2008.

The idea of recovering nutrients from waste will help conserve phosphate reserves. It will improve keeping our waterways clean. We will begin to recycle materials locally and actually reduce greenhouse gas emissions. Phosphate mining is a very energy-intensive process and most domestic phosphate mines have become super fund sites due to the on-site pollution they generate. Caustic acids are used to extract the phosphorous from the phosphate rock. The remaining slag ponds become another pollution problem. At the world-wide consumption phosphate deposits will become smaller, much deeper than present, far greater distances from the coasts, in more challenging environments, and at higher costs with a lower grade and more impurities. There is even federal discussion that phosphate rock be considered a strategic reserve.

University of British Columbia (UBC) has developed a process to extract phosphorous from waste water. They licensed the technology to Ostara Nutrient Recovery, Vancouver, B.C. Ostara took this technology from the lab and built the first full-scale facility in Edmonton, Alberta. With the success of this plant built a multiple reactor in Portland, Oregon. Two more facilities are scheduled in York, Pennsylvania, and Hampton Roads, Virginia, with more on the horizon here in the U.S.A. and internationally. In parallel work is beginning on recovery of phosphorous from animal waste and ethanol plants.

Every day the phosphorous we consume from the food we eat enters into the waste water stream. Presently waste-water treatment plants dose these facilities to precipitate the phosphorous with chemicals to tie up the free phosphorous in the waste stream. In turn this precipitate is hauled to landfills. The Ostara technology enters into this process and eliminates the need for chemicals from the treatment plants. The reactors from Ostara inject a small amount of magnesium and cause a crystal to form called magnesium ammonia phosphate hexa-hydrate ($\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$) (Fig. 2). With the formation of this crystalline fertilizer, Crystal Green[®] removes 85% of the phosphorous and 40% of the nitrogen from the available waste water.

The research we've conducted for the last 3 years with this product concluded that this technology has produced a viable slow-release fertilizer. Extensive laboratory



Figure 2. Crystalline granular magnesium ammonia phosphate hexa-hydrate.

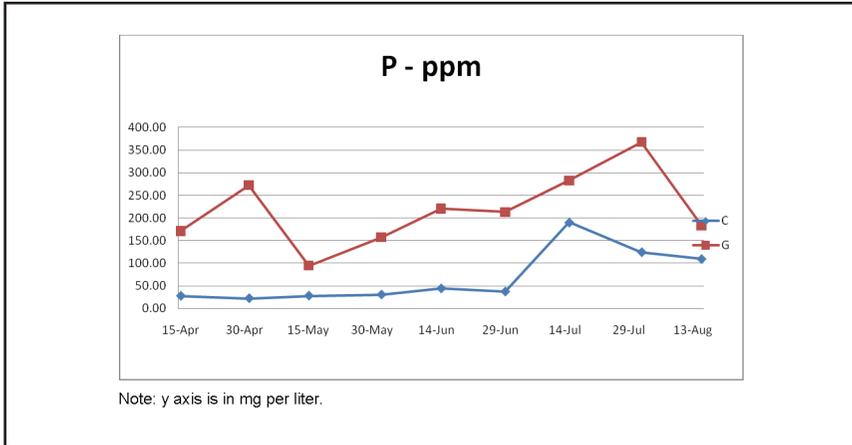


Figure 3. Product release versus time.

analysis shows that in the formation of this fertilizer prill no metals or pathogens are present. The finished product is cleaner than all the phosphorous fertilizers we presently use. Leach aide tests conducted by Dr. Tom Banko from Virginia Tech and Dr. Jim Robbins from University of Arkansas have concluded the product releases over a 8–9 month time frame. We’ve also concluded that the nitrogen, phosphorous, and magnesium release exactly the same, in a slow-release profile. The technology can make any prill size which allows blending for various turf and nursery markets. Ongoing tests are being conducted using Crystal Green in fertilizer blends on nursery, turf, and specialty agriculture crops. With the addition of Crystal Green in fertilizer we’ve demonstrated that this product can replace either agriculture grade fertilizers or coated fertilizers with as good or better results than industry standards. The ability to introduce slow-release magnesium has shown much darker, greener, and fuller plants. Crystal Green also delivers all of its available phosphorous-something coated fertilizers cannot.

This new technology harvests phosphorous from the most unlikely place, making it a renewable, sustainable, and environmentally friendly fertilizer, something that our industry has never seen before.

LITERATURE CITED

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- Robbins, J.** 2009. University of Arkansas Cooperative Extension Service, P.O. Box 391, Little Rock, Arkansas 72203; email: <jrobbins@uaex.edu>.