

# Phosphate removal with a Crystalactor®

## Alto Dairy, Procorp Incorporated, USA

**Scope of services:**

pilot testing, design and detail engineering, delivery of equipment, start-up assistance

**Location:**

Alto Dairy Cooperative, Waupun (Wisconsin), USA

**Utilization:**

2003-2005

**Situation**

DHV and Procorp, Inc. (Procorp), the U.S. licensee of the Crystalactor® process, have recently completed the first full-scale installation in the U.S. dairy industry. The client, Alto Dairy Cooperative (Alto), produces American and Italian style cheeses for the food service and industrial markets as well as whey and milk replacement products. The resultant wastewater contains organic and phosphorus compounds that are treated at the Alto Dairy wastewater treatment plant using a biological activated sludge system. While this treatment system removes the organics from the water, a level of phosphorus remains that requires further treatment.

**Assignment**

Prior to building the full-scale Crystalactor®, DHV and Procorp, Inc. reviewed the site requirements to determine whether the Crystalactor® process would be appropriate for the application.

A pilot test was conducted to ensure that the technology would be effective under the specific conditions at the site.

DHV provided consultation, design review, and technical support to Procorp. At last, DHV delivered key-equipment for the plant and assisted during start-up.

**The Project**

It is well known that the Crystalactor® technology can be used for the removal of hardness, phosphate and heavy metals. Due to stringent effluent limits for various industries, DHV has successfully investigated and optimised the crystallisation of phosphate.

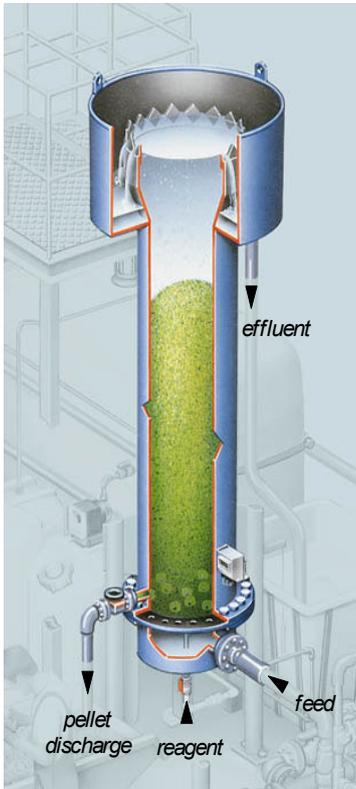
At Alto, the Crystalactor® is located after the activated sludge treatment system and handles about 125 m<sup>3</sup>/h of wastewater with a maximum phosphorus concentration of 25 mg/L. The “pellet” reactor, 3.0 meters in diameter, is filled with quartz sand as seed material. By adding lime, calcium phosphate is crystallized on the sand particles. After drying, the formed pellets are suitable for recycling. The regulatory agency, Wisconsin Department of Natural Resources, embraced this technology as an innovative means to meet the objective of phosphorus reduction in Wisconsin.



*The Crystalactor®*



*Aerial picture of the plant  
©2005 Alto Dairy Cooperative*



Currently, the wastewaters treated by the Alto Crystalactor® are of a consistently lower phosphorus concentration than the established discharge limit of 3 mg/L.

### Crystalactor® Technology

The heart of the Crystalactor® installation is the so-called pellet reactor, partially filled with a suitable seed material such as sand or minerals. The wastewater is pumped in an upward direction, maintaining the pellet bed in a fluidized state. In order to crystallise the target component on the pellet bed, a driving force is created by a reagent dosage and pH-adjustment. By selecting the appropriate process conditions, co-crystallization of impurities is minimised and high-purity crystals are obtained. The pellets grow and move towards the reactor bottom. At regular intervals, a quantity of the largest fluidized pellets is discharged from the reactor and fresh seed material is added. After atmospheric drying, readily handled pellets are obtained and the need for sludge dewatering or hauling of sludge is eliminated. Due to their excellent composition, the pellets can often be recycled or reused.

The four steps commonly required in conventional phosphorus treatment processes - coagulation, flocculation, separation and dewatering - are combined in one by the Crystalactor®. This results in a compact unit with a small footprint.

The Crystalactor® has been used for water softening, phosphorus removal and metal recovery in over 30 projects worldwide including the Municipal Waterworks of Amsterdam, Dejtár Waterworks in Hungary and the largest yet, Chen Chin Lake in Taiwan at 450,000 m<sup>3</sup>/day.

DHV B.V.  
Water  
Laan 1914 no. 35  
3818 EX Amersfoort  
P.O. Box 1132  
3800 BC Amersfoort  
The Netherlands  
T +31 33 4682290  
F +31 33 4682801  
E [info-water@dhv.com](mailto:info-water@dhv.com)  
[www.dhv.com](http://www.dhv.com)