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## Application of Lanthanum-modified bentonite and flocculent reduces eutrophication in a lake

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Eutrophication control in lakes often consists of a reduction of the external loading of nutrients in combination with in-lake measures. Flock and Lock is a novel technique to reduce the internal loading of phosphorus in lakes. It combines the application of a flocculent, in this research Iron-III-chloride ( $\text{FeCl}_3$ ), with the application of a Lanthanum-modified bentonite clay product, commercially known as Phoslock<sup>®</sup>. The flocculent precipitates phosphorus and particles (like algae cells) from the water body (Flock). The Lanthanum-modified bentonite caps the sediment and binds the phosphorus that escapes from the sediment and from precipitates (Lock).

The effectiveness of Flock and Lock is being studied in a whole-lake application. This application was carried out in May 2009 in Lake De Kuil (the Netherlands). This lake has an area of 7 hectares and a maximum depth of 8 meters. The lake includes a bathing area and used to have a poor water quality due to frequent blooms of Cyanobacteria. In the application 4.3 tons of Iron-III-chloride and 41.5 tons of Lanthanum-modified bentonite were applied. To compensate for the acidification, which was caused by the use of Iron-III-chloride, 0.2 tons of Calciumhydroxide powder ( $\text{Ca}(\text{OH})_2$ ) was added.

Prior to the application a bloom of Aphanizomenon appeared in Lake De Kuil and transparency was low. Within a few days after the application the cyanobacterial bloom disappeared, the transparency increased and the concentration of phosphorus decreased. During the summer of 2009 cyanobacterial blooms did not occur again, the transparency remained high, the phosphorus concentrations remained low and the macrophytes increased. During the winter of 2009-2010 the lake was covered with ice for over two months. In early spring 2010 water quality remained good.

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