

***Long term phosphorus removal in soil infiltration systems:  
Swedish experiences***

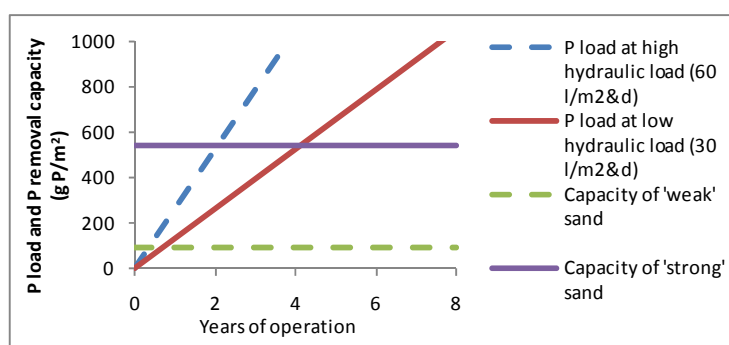
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During the last two decades a limited amount of research targeting soil treatment systems has been performed in Sweden. However, the legal parts of the Swedish on site wastewater treatment guidelines have been rephrased and restricted. One consequence of the new guidelines is that there is now need for reliable estimations of the P removal capacity of soil treatment systems (the removal that will be achieved within the technical boundaries of the system). Much earlier research has not targeting this question in a fully adequate manner. Most studies have used an inflow/outflow (I/O) approach (P concentration in inflow and outflow are compared to determine reduction). This technique could be erroneous when trying to determine the long term P removal due to e.g. variations in the P reduction, interference with ground and surface water and temporary bioaccumulation. For undrained systems the outflow concentration for practical reasons has to be observed through measurements in adjacent groundwater.

To overcome the limitations of the I/O approach and further explore the mechanisms behind P removal in soil treatment systems, KTH and JTI have performed a series of studies. The core of the research has been to investigate the filter media instead of monitoring the wastewater flow. Until today, eight different sites have been sampled. At these sites the accumulated phosphorus was determined by analysis of total phosphorus content and subtraction of background concentrations. Background concentrations were estimated by means of reference samples (uncharged material). In addition samples were characterized by e.g. pH, grain size distribution, oxalate extractable P, Fe and Al, specific surface area.

Our data were used in a mass balance calculation that resulted in evidence for a much lower long term removal capacity (~5 %) than indicated by earlier I/O studies. The processes involved in the removal seemed to be primarily P adsorption and/or precipitation induced by Al compounds. The P adsorption capacity of most natural sands is expected to be low and of limited value for P removal when loaded with large amounts of P (Figure 1).

For the determination of long term P removal the mass balance approach has much strength compared to the I/O approach. However it has a limited value for evaluation of the actual eutrophication impact of the environment. With respect to this, the Swedish guidelines are not appropriately designed. This will be further discussed in the presentation.



*Figure 1. Estimated P load for soil treatment systems designed in line with Swedish guidelines and the sorption capacities of two characteristic sands given by Del Bubba et al. 2003.*