NuReDrain Highlights and Achievements – Update May 2019

Plants need nutrients, such as nitrogen (N) and phosphorus (P), to grow. Therefore, nutrients are used in agriculture. The excess of nutrients end up in the water and deteriorate the water quality. The NUREDRAIN project wants to tackle this problem by testing filter technologies which can trap N and P.

Filters need to be filled with a material which can adsorb P or remove N. These materials have been provided by Nuredrain partners from Belgium and Denmark or have been purchased. A serie of lab tests revealed which materials are suitable for an efficient P removal. Noteworthy is the fact that filter materials used to remove low concentrations of P can later on be reused to remove high concentrations of P.

Several filter materials have already been tested in the field. Iron coated sand, a waste product from drinking water production, was tested to adsorb P. In drainage water, the material was able to remove 59 to 92% of P. In water discharged from greenhouses, the material was able to remove 99% of P. Granules derived from iron sludge from drinking water production, have been used in a filter set up filtering surface water from a water reservoir for drinking water production. Initially, a 85% P-removal was obtained. Later on, the filter system was clogged due to algae blooms in the surface water. A suitable prefiltration and backwash of the system has been established and now the filter is working well. In the near future, another filter material derived from drinking water sludge will be tested.

With respect to N removal, the 'moving bed bioreactor' is currently being tested in the field at several locations. The reactor contains bacteria which convert nitrates to nitrogen gas. In drainage water, N-removal varied between 30 and 73%. The filter system can also be installed in remote areas by the use of solar panels and batteries. The filter remains operational at lower temperatures. Another N removal system is the 'zero valent iron' filter. This filter configuration achieves a 80% N-removal on drainage water in lab conditions. Scale-up of the system to allow for field trials is currently ongoing. Another N-removal system under study concerns a 'transportable constructed wetland'. This will be tested for N-removal in surface water.

Saturated filter materials are intended to be reused as fertilizers. A pot trial with Azalea revealed that P is strongly adsorbed to the Fe-based filter materials. As such, P cannot be released and taken up by the plant and plants show an inferior quality. However, substituting 30% of the substrate with saturated filter material was beneficial for Boxwood plants because less Liverwort was prevailing. Additional alike tests will be performed to test the protective effect of saturated filter materials against phytotoxicity. Besides, several biological treatments have been tested to investigate the capability of bacteria to release P from the saturated material. Unfortunately, no effect could be observed. Nevertheless, it has been demonstrated that P can be released from the saturated filter material by chemical treatment. The methodology will now be tested on a larger scale. At the same time, several fertilizer companies have been contacted to ask for their interest in the saturated filter materials. This will be further explored in the future.