NuReDrain Highlights and Achievements – Update March 2020

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. Long term column experiments showed that some filter materials can be used for more than 600 days before P saturation occurs.
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. In the following months, removal yields dropped due to lower phosphate concentrations in the raw water and lower water temperatures. However, the ortho-phosphate concentrations of the treated water were generally kept < 0.2 mg PO4-P/l.

With respect to N removal, the 'moving bed bioreactor' is currently being tested on drainage water and greenhouse effluent. N-removal efficiency amounted up to 70% when applying MBBR on greenhouse effluent. A secondr 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. A third 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 in particular cases beneficial because less weed was prevailing. The addition of Phosphate Solubilizing Bacteria to the substrate unfortunately did not stimulate P release. Nevertheless, it has been demonstrated that 40% of the P can be released from the saturated filter material by chemical treatment. This desorption treatment can be cost-effective in terms of enabling the reuse of filter material rather than recovering the P as such.