Release of metals from wastewater residue at different pH : an ultrafiltration investigation.

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Vertical flow constructed wetlands (VFCW) are worldwide used ecological technologies designed to treat wastewaters. During their operating time, a sludge layer is formed at the surface of the first-stage filters by the retention of wastewater's suspended solids. The deposit constituting this layer is now known to accumulate and degrade a large variety of contaminants during regular conditions of operation. The resilience and potential release of these contaminants during varying operational conditions is therefore of major concern. When the sludge deposit is subject to water flows, elements can be released under dissolved form or associated to colloidal carrier phases. This study investigated the influence of pH variations on the speciation and transport of toxic metals and major elements bound to VFCW surface sludge deposits.

The acid/base neutralisation capacity (environmental assessment procedure ANC/BNC) (according to C*EN*/TS 14429) was carried out to assess the release at different pH values. Samples of sludge deposits were put in contact with solutions in a wide pH range; the suspensions were filtered through 0.45 µm acetate cellulose filters an were subsequently analyzed. In addition, the suspensions were also treated by ultrafiltration using successively membranes of decreasing pore size (30 kDa, 10 kDa and 3 kDa). The permeates were analyzed for major and trace elements and organic molecules.

Depending on their affinity with the organic and/or mineral colloidal carrier phases and the different pH conditions, three groups of elements were defined : (i) As, P, B, V, Na, K were mostly present in solutions as free species, (ii) Co, Cu, Ni, Cd, Zn were partially affected by colloidal transport and (iii) Cr, Ba, Mn, Ca, Li, Mg, Sr were strongly affected by colloidal co-transport. Accompanied by geochemical modelling tools, these results provide important information on the speciation of released pollutants. The quantity of released pollutants, their mobility and potential toxicity help to define critical pH ranges that should not be exceeded in order to limit the impact of pollutant release on the environment.