

CONSTRUCTED WETLANDS FOR TREATMENT OF BIOGAS PLANT EFFLUENTS

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EXECUTIVE SUMMARY

Different combinations of microflotation, anaerobic treatment (EGSB) and constructed wetlands were tested in a pilot plant to treat wastewater of the starch industry within the scope of an ongoing Vietnamese-German joint research project (Pick et al., 2011), funded by the German Federal Ministry of Education and Research (BMBF).

In this paper the results of a treatment cascade consisting of the main elements microflotation, biogas plant (EGSB reactor) and a constructed wetland are presented. A second line using a simplified process consisting of a single-step pretreatment and a two-stage biological treatment via constructed wetlands (vertical subsurface flow), adapted to the possibilities of small and medium-sized enterprises, is also described as a low-tech alternative. In the last period of the continuing trials with increasing hydraulic loading and mass loading rates a mass removal rate for COD (chemical oxygen demand) of 96% for the first line (with technical pretreatment) and 98% for the second line (without technical pretreatment systems) has been achieved. A high performance of 79% COD mass removal rate of the settling pond covered with floating islands could be monitored using a mass loading rate of 2.2kg COD/m³d, thus reducing inflow concentrations from 10,600mg/l to 2,170mg/l.

Among a few other successfully tested plants like *Arundo donax*, *Cyperus ssp.*, *Typha angustifolia*, the common reed (*Phragmites communis*) performed best as it has been the case in numerous worldwide projects before.

Instead of a possible reuse of the treated wastewater in aquaculture systems (Northcott, 1991; Gruber 1998), e.g. a use of nutrition plants like bananas and sugar cane inside the final constructed wetland treatment cell, instead of typical marsh plants (helophytes), is shown as an option to recycle some of valuable nutrients.

As another example of using constructed wetlands to treat high-strength industrial wastewater from the food industry, the pilot plant has demonstrated its general suitability as final treatment stage downstream of a biogas plant or - without conventional treatment stages - for primary and secondary treatment of highly polluted wastewaters.

Key words: Constructed wetlands, treatment of biogas plant effluents, tapioca starch industrial wastewater, floating islands