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Environmental effect of constructed wetland as biofuel production system

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Being as a renewable energy, biofuel has attracted worldwide attention. Clean biofuel production is an effective way to mitigate global climate change and energy crisis. Biofuel may offer a promising alternative to fossil fuels, but serious concerns arise about the adverse greenhouse gas consequences from using nitrogen fertilizers. Waste-nitrogen recycling is an attractive idea. Here we advocate a win-win approach to biofuel production which takes advantage of excessive nitrogen in domestic wastewater treated via constructed wetland (CW) in China. This study will carry on environmental effect analysis of CW as a biomass generation system through field surveys and controllable simulated experiments. This study intends to evaluate net energy balance, net greenhouse effect potential and ecosystem service of CW as biomass generation system, and make comparation with traditional wastewater treatment plant and other biofuel production systems. This study can provide a innovation mode in order to solve the dilemma between energy crops competed crops on production land and excessive nitrogen fertilizer of our traditional energy plant production.

Data both from our experimental CWs in China and other researches on comparable CWs worldwide showed that the biomass energy yield of CWs can reach 182.3 GJ ha^{-1} yr^{-1}, which was two to eight times higher than current biofuel-production systems. Energy output from CW was ~137% greater than energy input for biofuel production. If CWs are designed with specific goal of biofuel production, biofuel production can be greatly enhanced through the optimization of N supply, hydraulic structures, and species selection in CWs. Assuming that 2.0 Tg (1 Tg = 1012 g) waste nitrogen contained in domestic wastewater is treated by CWs, biofuel production can account for 1.2% of national gasoline consumption in China. The proportion would increase to 6.7% if extra nitrogen (9.5 Tg) from industrial wastewater and agricultural runoff was included. This approach is also suitable for use in other countries, and can help promote sustainable development for energy and environment.