Environmental Engineering and Management Journal *March 2012, Vol.11, No. 3, Supplement, S130*
http://omicron.ch.tuiasi.ro/EEMJ/

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POTENTIAL FOR METHANE AND HYDROGEN PRODUCTION FROM WETLAND BIOMASS

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Abstract

Nowadays the improvement of manure management is a major option for preservation of environmental quality. At the same time it is necessary to find new perspectives for the development of marginal areas and the reuse of poor quality waters. Wastewater treatment with constructed wetlands represents an effective practice to cope with these needs. The exploitation of herbaceous biomass from wetlands for energy production may add further appeal to the adoption of this practice. In fact macrophyte species are well adapted to growing in wastewater and are often vigorous, high-productive plants. The objective of this research has been to evaluate the potential for methane production of macrophytes suitable for being used as wetland plants. Their exploitation for biogas production may permit to reuse the wastewater and, at the same time, to create a chain with alternative renewable energies.
Twenty five crop species were tested in laboratory reactors for their biomethanation potential (BMP). For 7 selected species two treatments were compared: biomasses obtained from a unique harvesting event (TU) and biomasses obtained by mixing plant tissues deriving from frequent cuttings (TF). Preliminary tests were conducted on a reduced number of crop species in order to identify the best plant tissue concentration (between 5 and 20% dry matter, DM) for the optimization of methane production. The inoculum included fresh pig slurry, cellulolytic bacteria and aceticlastic methanogens. The experiment was carried out at 35°C on dried, ground and 1-mm sieved plant tissues. Gas amount and composition were monitored in the first month following the inoculum.
According to the preliminary results, the higher the dry matter concentration, the more delayed and reduced was the methane production. In fact, for DM concentrations >5% or >10% (depending on the kind of tissue, if TU or TF), methane production was lower than that in the control, meaning a toxic effect of high solid concentrations. Great amounts of hydrogen tended to accumulate in the reactors at high plant DM concentrations. Remarkable differences were observed in BMP, depending on the crop species. Plant biomass deriving from frequent cuttings gave rise to a better BMP when compared with than from a unique harvest, even though this behavior did not represent the rule. The BMP results are discussed in relation to plant tissue composition. On the basis of these preliminary results crop biomasses from wetlands treating wastewater appear promising sources not only of methane, but also of hydrogen.