3rd MatER Meeting

Innovation & Trends in Waste Management

May 22nd - 23rd 2017

Politecnico di Milano - Campus PIACENZA

Short Abstracts Collection of the presented Works

Available on-line at:

www.easychair.org/smart-program/MatER-2017/index.html

Session 3

PROCESSES AND TECHNOLOGIES FOR ENERGY RECOVERY

Wood combustion ash for the upgrading of biogas from anaerobic digestion

E.A. Carnevale[a], L. Lombardi[b], E. Nincheri[a], D. Papurello[c], S. Silvestri[c], L. Tomasi[c]

[a] *Industrial Engineering Department, University of Florence, via Santa Marta 3, 50139 Florence, Italy*

[b] *University Niccolò Cusano, via Don Carlo Gnocchi 3, 00166 Rome, Italy*

[c] *Fondazione Edmund Mach, Biomass and renewable energy Unit, via E. Mach 1, 38010 San Michele a/A (TN), Italy*

Corresponding author's e-mail address: lidia.lombardi@unicusano.it

Abstract

Several technologies are available for the upgrading of biogas produced during the anaerobic digestion (AD) of biowaste. The main aim is the gas cleaning from CO_2 with subsequent concentration of CH_4 up to minimum 95-96% to obtain biomethane for grid injection or/and transport use. Biomethane substitutes natural gas and can contribute to the EU objectives of 10% of biofuel for transport within year 2020.

Generally the upgrading technologies available on the market are economically sustainable only for large plants (>300-500 Nm^3/hour of entering biogas), thus the development of low cost solutions devoted to small biogas plants - or for processing the surplus biogas which cannot be converted to power - seems to be a topic of interest.

Previous projects carried out by the University of Florence since 2010 showed the capacity of bottom ash from a municipal solid waste incineration (MSWI) to capture the CO_2 present in the landfill gas (Mostabuer et al., 2014; Lombardi et al., 2016). As an alternative to MSWI bottom ash, in alpine regions the availability of ash deriving from the combustion of wood biomass, generally carried out in district heating plants, represents an opportunity to better use this kind of waste before final disposal.

In the present work wood ash (WA) generated by the combustion of wood in a central heating plant was used to capture CO_2 from laboratory simulated biogas, with the aim to evaluate its application for biomethane production.

The results of preliminary tests carried out by at laboratory scale are presented. The process was realized in a static single-stage reactor, made of a fixed bed of WA crossed by a gas flow rate of simulated gas, as a mixture of 45-48% CO_2 (in volume) and N_2 as remaining amount, to simulate the composition of biogas from AD (N_2 substituting CH_4 for safety reasons; CH_4 does not react with ashes as neither N_2 does).
The results showed a very good removal of CO_2, which was about 100% in the first 30 hours of the tests. With respect to other typologies of ash used in the cited previous projects the capacity of WA to capture the CO_2 seems to be higher, reaching in the reported test values higher than 120 g of captured CO_2 per kg of dry WA.

References

Mostbauer, P., Lombardi, L., Olivieri, T., Lenz, S., 2014. Pilot scale evaluation of the BABIU process - Upgrading of landfill gas or biogas with the use of MSWI bottom ash. Waste Manage 34, 125-133.
Lombardi, L., Carnevale, E.A. , Pecorini, I., 2016. Experimental evaluation of two different types of reactors for CO_2 removal from gaseous stream by bottom ash accelerated carbonation. Waste Manage 58, 287–298.