

Development of an Arduino-based electronic monitoring system for the operation of Solid State Anaerobic Bioreactors

¹E. Viskadouraki, ²A. Maragaki, ³N. Papastefanakis, ³C. Tsompanidis, ⁴G. Stavrakakis and ²T. Manios

¹*School of Electrical and Computer Engineering, Technical University of Crete, Kounoupidiana University Campus, 73100 Chania, Crete, Greece; ENVIROPLAN SA, 23 Perikleous & Iras Str, 15344 Gerakas Athens, Greece*

²*Department of Agriculture, School of Agricultural Science, Hellenic Mediterranean University, 71401, Crete, Greece*

³*ENVIROPLAN SA, 23 Perikleous & Iras Str, 15344 Gerakas Athens, Greece*

⁴*School of Electrical and Computer Engineering, Technical University of Crete, Kounoupidiana University Campus, 73100 Chania, Crete, Greece*

Abstract

Energy production from residues produced in the arid or semi-arid regions of the Mediterranean basin, as well as from food residues, is a major field of research with promising results. A main objective of this research field is the development of a dry anaerobic bio-reactor (Solid State Anaerobic Bioreactor), which will be able to manage all the residues of the Mediterranean countryside (agricultural, livestock, agro-industrial and urban origin) in an automated and optimal way, in order to produce the maximum possible volume and optimal composition of biogas. The main operational parameters of such a bioreactor need to be closely monitored and actively controlled in order to be both safe and optimally tuned for maximum biogas production. The development of an electronic circuit, based on the Arduino platform, for monitoring and controlling the Solid State Anaerobic Bioreactor was the main subject of our work. The system was based on the Arduino nano microcontroller (ATmega328), coupled with various sensors for accurate monitoring of temperatures (inside the bioreactor, as well as ambient and heating water temperature), pH, and data logging of all values in an SD card for further analysis. All data can be remotely monitored, in real time, in a mobile phone or tablet, via Bluetooth connection, using an application. Moreover, the pH can actively be controlled by the microcontroller, using a peristaltic pump for injection of small quantities of acidic solution, in order to maintain the desired pH level in the bioreactor, for optimum performance.

Keywords: Solid State Anaerobic Bioreactor, monitoring, arduino

Acknowledgments: This research has been co-financed by the European Union and Greek national funds through the Action 1.b.2 "Business Partnerships with Research and Dissemination Organizations, in sectors of RIS3Crete", of the Operational Program "Crete" 2014 - 2020 (project code: KPHP1-0028938).