

# Monitoring and Controlling the Operation of Solid State Anaerobic Bioreactors via an Arduino Electronic System

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## 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, commercially available, sensors for accurate monitoring of temperatures (inside the bioreactor, as well as ambient and heating water temperature) and acidity (pH). Data logging of all measured values in an SD card was included, for further, post-experiment, analysis. Real time remote monitoring in a mobile phone or tablet, via Bluetooth connection, was developed, using a customizable Human-Machine Interface (HMI) platform. Moreover, active control of the bioreactor pH, by the microcontroller, was achieved by using a peristaltic pump for injection of small quantities of acidic solution, in order to maintain the desired pH level, for optimum performance.

**Keywords:** Anaerobic Bioreactors ,Arduino, electronic system

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