# Using bio-adhesive and bio-inert surfaces to stabilise and influence microbial growths in Anaerobic Digesters.

Dorota Dobrzanska[1,2] D.A.Dobrzanska@warwick.ac.uk

Supervisors: Dr Andrew Marsh,[1] Dr Paul C. Taylor,[1] Prof Christopher M. Dowson[2]

Email: a.marsh@warwick.ac.uk

1. Department of Chemistry, University of Warwick, Coventry CV4 7AL

2. School of Life Sciences, University of Warwick, Coventry CV4 7AL

In the UK renewable energy sources contribute only in 4% towards global energy production. European Union directive 2009/28/EC on Promotion of the Use of Energy from Renewable Sources regulates the target for share of energy from renewable sources to reach 15% in 2020. The target uses a slightly different definition of renewable and total energy than has been used to date and includes the use of electricity and heat (and other fuels used for heating) by final consumers and energy for transport.

Development of new technologies is crucial to meet this goal. The most popular renewable energy sources are biomass, wind energy and solar energy. Using energy from biogas is not widely developed due to difficulties in control of the process and limited efficiency of current technologies.

Figure 1 shows the integrated approach used to control and enhance the anaerobic digestion process. The Anaerobic Digestion model No. 1 (ADM1) developed by the Mathematical Simulation Group from the University of Lund will be used to predict the most important process parameters, such as the volume of biogas produced under certain conditions and with given composition of the substrate. The enhancement of the process will be achieved by implementing the selection of adhesive surfaces to influence microbial growth and stability. Molecular biology techniques and studies on biofilm formation were carried out to reveal the best surfaces for microbial colonization. The prediction from the model will be validated by real time data collection using sensors fitted to the laboratory scale reactors.

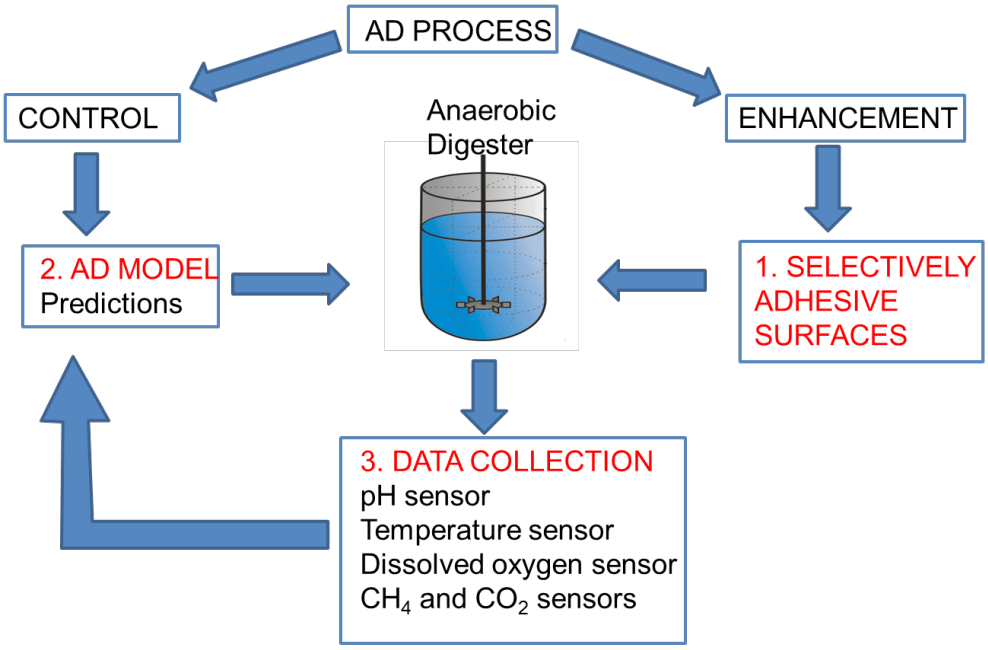


**Figure 1** The most important steps involved in the process optimisation.

## Project aims

The aim of this research was development of cost effective commercial scale approaches to bacterial adhesion and biofilm formation that can be applied to pilot and full-scale reactors, by:

1. Understanding which factors can be modified in order to enhance the stability and efficiency of AD reactors.
2. Developing integrative models for biochemical reactions and microbial growth within a typical reactor
3. Understanding what range and incidence of *Bacteria* and *Archaea* reside in a typical farm-scale digester.
4. Developing both fundamental and practical understanding to aid the selection and adhesion of key microbial populations to produce defined 'fixed film' reactors for AD. This is seen as helping in three ways:

    (i) preventing 'wash out' by retaining slow growing populations within the reactor,

    (ii) protecting organisms from physicochemical stress and shocks by enabling their growth in biofilms and

(iii) increasing the effective reaction volume enabling the production of smaller scale plant with significantly reduced cost.

## Dorota Dobrzanska – short bibliography

Final year PhD student at the University of Warwick, Department of Chemistry and School of Life Sciences. Graduated with Bsc in Biotechnology from the Warsaw University of Technology in 2010, where I worked on the synthesis and analytical profiling of micro-particles for brachytherapy and controlled drug release. Currently working on a project involving optimization of laboratory and farm scale anaerobic digesters.

Laboratory team (from left to right): Caroline, Justine, Sio-Lan, me and Mariah