

## Progress of Biogas: opportunities for R&D

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Biogas, a renewable energy source composed essentially by methane (65%) and carbon dioxide (35%) is the final product of the anaerobic bio-conversion of organic matter. Although the application of the anaerobic digestion process is quite old, only recently the anaerobic technology was proven and accepted as a reliable method of wastewater (WW) treatment as well as a renewable energy production process from animal and organic waste. Although anaerobic digestion and WW treatment methods have found successful full-scale application for waste and wastewater treatment, there still is potential to improve these systems. Fat has a theoretical energy potential that doubles the one of carbohydrates or proteins. Because of that, owners of biogas plants treating animal waste in co-digestion processes, look for fat residues and pay for them most of times. The problem with fat is that no sufficient knowledge exists about the anaerobic biodegradation of these compounds. Several authors reported an acute and permanent toxic effect and even a bactericidal effect of Long Chain Fatty Acids (LCFA), the products of lipids hydrolysis. As a result of this insufficient knowledge several biogas plants lost their methanogenic activity due to excess of lipids in a very slow dead process induced by LCFA accumulation onto the anaerobic sludge. The co-digestion of animal waste with lipids can however be optimized by applying a suitable feeding strategy of fat residues to the biogas plant. Within WW treatment, fat has a special place because it is considered hard to treat with current biological systems. At IBB, CEB in the University of Minho, in Braga anaerobic degradation of Long Chain fatty Acids has become a research field of growing interest in the last years. The lipids research started from a common point but evolved towards two different target problems: Co-digestion of animal and organic waste with fat residues and development of a new high rate bioreactor for the treatment of complex wastewater with lipids (IASB reactor, patent pending).