

# Organic waste

*A resource to be managed...*

**T**he development of new management tools and transformation technologies of organic waste are based on the integration of different areas of scientific, technical, social and economical knowledge. Consequently, the mitigation of the environmental problems generated by organic waste, and its conversion into useful by-products, require a comprehensive approach encompassing several fields of knowledge, such as chemical and process engineering, biotechnology, agronomy, animal production, social education or environmental law. In order to integrate such a diverse range of disciplines within an optimised methodology, the creation of common research platforms, where different research fields related to the organic waste can interact, becomes an obvious need.

In an attempt to cover this demand, the GIRO Technological Centre was founded in October 2005. As stated by the acronym GIRO (in Spanish, Integrated Management of Organic Waste), the mission of the centre is to integrate different areas of knowledge related to the organic waste management in order to decrease its environmental impact and to develop improved strategies to benefit from these materials as a resource, rather than just a waste. The strategic objectives are:

- Development of new knowledge and technologies on the sustainable management of organic waste by providing a holistic view;
- Transfer of the latest R&D results in order to contribute to the modernisation, compatibility and sustainability of the involved sectors;
- Cooperation with other public and private institutions to achieve the main mission of GIRO.

Cooperation with other centres is a key issue for solving transversal problems. With this respect, GIRO has signed a number of cooperation agreements with different institutions worldwide and nowadays is working with ABP (Denmark), TNO (the Netherlands), CRPA (Italy), EULA (Chile), INTA (Argentina) or ARS-USDA (the USA) on different projects.

GIRO was created as a joint research, development and technology transfer centre by the following Catalan institutions, from which the chief directive positions actually belong to the board of trustees of the GIRO foundation:

- Agrifood Research and Technology Institute (IRTA) is a public research institute of the Government of Catalonia and belongs to the Department of Agriculture, Livestock, Fisheries, Food, and the Natural Environment. The mission of IRTA is to contribute to the modernisation, competitiveness and sustainable development of agriculture, food and aquaculture, the supply of healthy foods and quality for consumers and, in general, to improve the welfare of the population. As an associated centre, researchers from GIRO participate in different IRTA research programmes related to environmental issues;
- The Technical University of Catalonia (UPC) is a public university with a consolidated worldwide reputation and an international vision towards scientific talent and technological innovation. As the Spanish technical university with the highest number of international PhD students and Master's degree students, the UPC has a strong global outlook. GIRO belongs to the Research and Development Park of the UPC, which

comprises all the research and technological centres related to the UPC;

- Ministry of Territory and Sustainability of the Government of Catalonia has the responsibility, among other things, of environmental quality and climate change policies, water and waste management, and the promotion of renewable energy. The Waste Agency of Catalonia (ARC) belongs to this department and participates in the board of trustees of GIRO. Its mission is to improve the quality of life and to protect the environment and its natural heritage by promoting sustainable waste management;
- The city council of Mollet del Vallès is the municipality where GIRO is located.

Since 2007, GIRO has been a recognised member of TECNIO, a network devised by the Government of Catalonia with the aim of bringing together the leading experts currently working in applied research and technology transfer. TECNIO is a technological partner for firms working side by side on RDI projects, providing technical solutions, grants and project management services. The mission of TECNIO is to consolidate and enhance the technology transfer model to generate a technology market that offers competitiveness to companies and to provide technology that gives added value to their projects in a globalised context. The accreditation process means that GIRO has implemented a quality management system following UNE-EN ISO 9001 as well as the requirements of the accreditation system of this network, based on the demonstration of excellence in research activities and the ability to provide services and projects that meet customers' requirements.

The GIRO Technological Centre was created with the vocation to encourage the progress in knowledge to become real applications, contributing to improvement in the technological offer of private companies, as well as to the setup of optimised management plans by the administration. GIRO provides consultancy services and technical collaboration to R&D projects, in accordance with standard quality parameters, always from an autonomous perspective, confidentiality and scientific independence. The services offer is:

- Advice on technology, organisational methods and management plans and programmes;
- Evaluation of organic waste and by-products as a potential agricultural and energetic resource;
- Evaluation and assessment of new and emerging environmental technology;
- Bioremediation of contaminated soils and ground waters;
- Contract research and technological development, with evaluation and optimisation of treatment processes at laboratory, pilot test and industrial scales;
- Laboratory analyses;
- Technological Observatory and Documentation Centre;
- Specialised training and made-to-measure courses for companies and/or public administration.

The current R&D projects are related to the following subjects:

- Anaerobic digestion: methods for overcoming inhibition by LCFA and ammonia, and development of new anaerobic reactor designs and pre-treatments for substrates with high solids content;
- Microbial ecology: characterisation and dynamics of microbial populations in biotechnological treatment processes;
- Microbial fuel cells applied to manure and other liquid organic by-products;

- Process for the recovery (stripping, absorption, precipitation of struvite) or removal (improved nitrification/de-nitrification via nitrite, anaerobic ammonia oxidation) of nitrogen;
- Biological gas treatment: control and treatment of gaseous emissions associated with the processing of organic waste, industrial activities and bioremediation processes;
- Bioremediation: evaluation of the application of organic waste and/or its transformed products to the soil;
- Methods to assist the decision-making process encompassing the use of technology and good management practices;
- Modelling and simulating biological and physicochemical processes.

To provide advanced consultancy/analytical services to public and private companies, and to successfully complete research projects, GIRO has a number of laboratories: Laboratory of Anaerobic Digestion and Composting; Laboratory of Process Innovation, to carry out the assembly and tests of new lab prototypes (currently, nitrification, heterotrophic and autotrophic denitrification, biofiltration, ammonia stripping, struvite precipitation, bioremediation of soils and ground waters); Environmental Microbiology Laboratory, supporting the work area of environmental biotechnology using molecular biology tools; Scientific and Technical Services Laboratory, providing analytical support to all research lines of the centre and offering external analytical services.

The researchers from GIRO cooperate with the PhD programme on Environmental Engineering of the UPC, which has the Spanish Quality mention since 2004 and the European MOY label. Master's and doctoral students can develop their thesis in the framework of advanced research projects and in connection with industries, challenged by real environmental problems. Currently, we have students working on the decision-making methods for adopting appropriate manure treatment technologies, anaerobic digestion



*Molecular profiling of complex microbial populations by DGGE (Environmental Microbiology Lab)*

reactor design, enrichment of ammonia anaerobic oxidisers cultures, inhibition of biological processes by long chain fatty acids, microbial fuel cells applied to liquid manure, anaerobic codigestion modelling and nitrogen recovery from pig manure, as representative examples.

In summary, the offer of GIRO comprises: scientific leadership within the sector of organic waste management; transversal know-how; total commitment to the needs of clients; the integration of fundamental research and practical solutions; collaboration with leading research centres worldwide; independent criteria based on the scientific analysis of problems and solutions; and a clear commitment to quality.



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