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**Converting Animal Waste into Added Value Products and Energy -
Treatment of Animal Waste and Management of Land and Water Resources: Sustainability**

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The problem of stockbreeding manures and excrements in general and of pig farms in particular is a question of surpluses. It is thus a complex and in many senses interdisciplinary problem, since any question of surpluses means relating diverse problems with different origins, from bothersome smells to the emission of gases accentuating the greenhouse effect, not forgetting the waste of energy involved in the overall power balance of the inter-connected industrial processes. At the same time this means a challenge, a great possibility for providing solutions (alternatives, processes and technologies) which, tying in with the need to foster sustainable development, help to create a new technological culture able to use stockbreeding waste with appreciation, recycling and usage criteria, from obtaining renewable power to the more efficient recycling of nutrients valuable for agricultural production.

The technological process is based on the integral appreciation of the resulting fractions and not only on purifying effluents, which means the coexistence of a double closed cycle, on one hand harmless for the environment and on the other economically feasible. Putting all these research and innovation endeavours into practice is the final objective of this work, started in October 1993 and conceived.*

Our approach to animal waste and in particular manures and liquid manures has been to increase the possibilities of our technological process in order to come to technically and operatively effective treatment(s) that are economically affordable and beneficial for the ecosystem. It goes without saying that the traditional systems of mechanical separation, pooling and fertirrigation do not satisfy either the needs or the interests of intensive stockbreeding nor its own sustainability. Neither has the alternative (in Spain) of thermal drying and cogeneration under Royal Decree 2818/98 for preventing environmental impact and making use of biomass in special systems been an effective alternative and this is far from being the solution defending the interests of stockbreeding in Spain.

Modern animal production is a highly sophisticated business and the treatment and appreciation of its waste has to match this and be traceable =(biosafety, health, animal well-being, ethics and the

environment). This work puts forward an approach which allows traceability of animal waste treatment to be consolidated and at the same time allays three serious economic, ecological and farming-stockbreeding problems: the sustainability of the treatment in cattle farming, the capture of carbon dioxide and retention of gaseous emissions of nitrogenated and sulphurous forms and the rehabilitation and productivity of the soil.

We have concentrated on intensive pig and milk cow operations where the systems of cleaning, removal and storage cause serious problems through foul smells, lack of biosafety, land and water contamination. In this type of operations we need better technologies for separating solids and liquids so that the solid fraction can be easily and economically collected and transported to a secondary treatment and appreciation unit, where it can be efficiently processed and marketed. At these tertiary installations, the solid fraction is mixed to obtain balanced forms, applicable to the edaphology of the receiving soil, with indices allowing the accelerated accumulation of organic material in the ground with the associated improvements in its productivity. If the waste is applied under the surface in conservation farmland additional benefits are obtained, as this type of agricultural maintenance alone has been shown to increase the carbon in the soil even in soils and ecosystems which stand out for their low organic carbon content (Hunt et al. USDA 1999); (Frederick and Bauer, 1996) ; (Frederick et al. 1998); (Jenkison 1991). The liquid fraction is made use of at the operation itself as cleaning water with biosafety guarantees, as irrigation water for agronomic benefits or even poured into public channels. The mixed alternative consists in the concentration of SSV until reaching the optimum range allowed by the appropriate anaerobic digestion via acetogenesis and methanogenesis for thermal-electric use of the biogas produced.

The effective management of animal waste, along with greater and better capture of carbon, reduction of emissions, protection of continental waters and increase in productivity of soils and energy generation must show the public authorities involved that there are proven technological alternatives to face future challenges for stockbreeding with every guarantee of success and sustainability criteria. The final aim of all these efforts is to reaffirm the commitment to solve the problems of intensive stockbreeding waste with a winning spirit and to confirm the potential leadership of any operations which assume these principles and processes.

* Key words: economic growth, sustainable development, water contamination, clean technologies, power balance, mineral balance , research, innovation, manure, biosolids, by products, added value, good practices, energy.