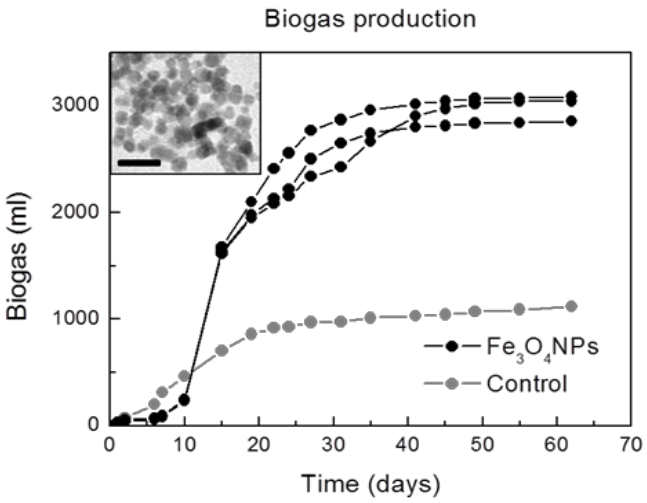
BioGAS+BeTA

Inagurating the nanomicrobiology era

(patented and registred)

BioGAS+ is the first ready to use additive based on safe and sustainable engineered iron based nanoparticles directed to the optimization of anaerobic digestion processes which increases the production of biogas and concentration of CH_4. Thus, the process that converts organic waste into raw matter for energy production is optimized by simply adding a small dose of iron based nanoparticles to either a large waste treatment reactor, a septic tank, or a homemade digester: you just spike the nanoparticles solution onto it.



BioGAS+ is a disruptive technology because it obtains the highest ever-reported improvement of biogas production: it triples (200% increase of production) the biogas yield with cellulose as feedstock in laboratory conditions and obtains over a 30% methane ratio increase in real industrial settings, with real feedstock and with optimal concentrations below then 0,1% (with respect to the Volatile Solids). Such a methane production increase is far above any known technology aimed at increasing biogas production. Many existing technologies as pre-treatment of the biomass, thermalization of the waste, combination of feedstock and inoculums only obtain modest production increases. Moreover, many tend to be costly to implement since they usually require structural changes in the biogas production process. **The BioGAS+ technology is effective and easily implementable to any of the current waste treatment technologies and any of the previous. I**t is a solution that can be simply applied when the digester is fed or at any other convenient moment.

Biomass transformation into CH_4 is one of the potential solutions to the pressing problems of mankind facing a decrease in mineral fuel resources, political instability, pollution and climate change. Global increase in (clean) energy demand, the need to improve organic waste processing towards a sustainable scenario and the Circular Economy are driving this transformation. Additionally it enable distributed solutions in situations or places out of the energy grid, favoring the implantation of tailored-size reactors fed with local biomass in isolated areas independently of sun shines or wind blows.

The beginning of the nanomicrobiology era. Nanomaterials can be designed to supply essential nutrients to the microbiota. Microbiota has the ability to extract ions from the mineral world and bring them to the biological world. By providing the essential ions in the pre-biotic form of a nanoparticle, we offer them an essential nutrients reservoir, so the microbiota can serve itself as much as it needs. This is critical in the case of iron. Such ionic dosing of iron from an instable mineral form is the base of *Feraheme, a* new already commercially available drug based on superparamagnetic iron oxide nanoparticles to treat anemia in humans[1].

The beginning of the end of the organic waste. Applied Nanoparticles SL aims at promoting the use of organic waste as raw material for the production of biomethane and fertilizers, a contribution to prevent methane greenhouse gas emissions and obtaining green energy: Organic matter waste will rotten anyway, and this may send large amounts of methane to the atmosphere, a molecule with a 20 times greater greenhouse effect than CO_2. Therefore, it is the responsibility of everyone, in order to create a cleaner planet with a more stable atmosphere, to prevent CH_4 emissions and rather to introduce it into our cars and stoves?[2]

The beginning of sustainability era. Nanotechnology should drive us through the economy of the atom, the catalytic energy harvesting, the nanoengineered conversion and storage of energy and the catalyzed transformation of matter. All this taking us to an efficient and intelligent use of resources.

The unprecedented methane production increase, the universality of the technology –any microbe/any feed/any condition, iron always welcome- and its simplicity of use are the most appealing advantage of BioGAS+, but it also offers additional differential advantages, including:

i.- Better mass balance. As more carbon is transformed into CO_2/CH_4, also increases the CH_4 ratio indicating a preference for recalcitrant matter and allowing to expand the available feedstock and rescue digesters in trouble.

ii.- Better energy extraction As there is more biogas, richer in biomethane, there is a reduced more degraded and more inert digestate with lower chemical potential after stronger digestion, enriched in iron, making it a nice fertilizer.

iii.- Beneficial chemical interference Capturing S, P, OH and tensioactive species improves and increases the stability of the process, After a delay time, likely for acclimatization, an acceleration and stabilization of the process has been recurrently observed.

iv.- Beneficial consortium fitting. While the dosing of iron makes the anaerobic consortium more robust, it also works well degrading other bacteria and therefore energy can be extracted from the consumed digester by adding BioGAS+ at later times (as far as it is still alive) and sanitation, elimination of pathogens is improved.

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[1] https://www.accessdata.fda.gov/drugsatfda_docs/label/2009/022180lbl.pdf

[2] Please read our Carbon-cycle chapter page 3 a 7 from "*Starting up under RRI principles"* by Nanowiki Editions.