ManurUSe: manure processing for maximized nutrient recycling in US

Cristina Pintucci[1], Joop Colsen[2], Merijn Picavet[2], Siegfried E. Vlaeminck[1,3]*

[1]Center of Microbial Ecology and Technology, Ghent University, Belgium; [2]Colsen Adviesburo voor Milieutechniek BV, The Netherlands J.Colsen@colsen.nl ; [3]Research group of Sustainable Energy, Air and Water Technology, University of Antwerp, Belgium, Siegfried.Vlaeminck@uantwerpen.be

ManurUSe represents a high-end biorefining concept for livestock waste recycling in the US. The ManurUSe proposal integrates well-known manure processing technologies in a holistic manner. Large amounts of nitrogen (>90%) and phosphorus (>60%) are recovered as fertilizers in combination with a dried organic soil enhancer and a liquid K-fertilizer, thus satisfying the existing fertilizer market. The recovery technologies are combined with thermophilic digestion which ensures a complete energy autonomy, with external use of the electricity surplus. Re-use/retrofitting of existing infrastructure ensures costs reduction for operating the system.

One of the novelties of ManurUSe is the use of the POUL-AR® technology that combines the **ammonification** of raw manure with a simple **ammonia stripping** process. This technology, developed and demonstrated by Colsen, ensures >90% of N recovery and the production of N fertilizers, i.e. ammonium nitrate or ammonium sulfate. Another feature of this proposal is the use of a BIDOX® for the desulfurization of the biogas generated during the anaerobic digestion step, with the production of sulfuric acid, which is internally looped thus reducing the chemicals addition and maximizing the P release into the liquid fraction.

The manure liquid fraction is treated in an ammonia stripper followed by **struvite** crystallization (Anphos®) in which 50-75% of the P is precipitated as struvite, a well-known slow release fertilizer. A thermophilic digester processes the combined solid and liquid fraction (after the struvite recovery step) of the manure and converts 70% of the carbon into biogas. Thereafter the digestate is separated in a liquid K-fertilizer and a solid fraction. The latter can be further dried into an organic soil enhancer. The drying step can be omitted, which reduces the overall operational costs and produces a P- and N-poor digestate.

The economy of the process is very much depending on the dry matter (DM) content of the raw manure. When DM content is < 5% (i.e. hog manure) the total cost (Capex + Opex) per ton manure is around 26 $/ton. For manure containing about 10% DM (i.e. cow manure), the benefits equal the total costs of the installation, while in case the DM content is about 35% (e.g. poultry manure) the benefits are 5 times higher than the total costs. Colsen operates a 1 ton/day demonstration plant for Poultry manure in the Netherlands with the ammonification and ammonia stripping. Colsen has also several thermophilic digesters, Anphos® and Bidox® plants running. The integral technology chain or individual parts of it can be demonstrated in the US on short term.

The consortium is represented by the industrial leading partner Colsen Adviesburo voor Milieutechniek BV, represented by the founder Joop Colsen, and the academic leading partner University of Antwerp – University of Ghent, represented by Prof. Siegfried E. Vlaeminck. The ManurUSe is proposed by a multidisciplinary consortium (academia and companies)

representing the core technology partners engaged in the 3-year project “ManureEcoMine” (www.manureecomine.eu), financially supported by the European Commission.