Renewable P-fertilizer from livestock effluent to prevent water eutrophication

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POWER

Water is a non-renewable resource which quality is strongly affected by human activities. Agriculture i.e. the excessive use of fertilizers and livestock manure, have contributed in recent decades to generate a pollution process known as eutrophication. The main causes of this phenomenon is the uncontrolled input in water bodies of nutrients, manly nitrogen (N) and phosphorus (P).

Long-term manure application to agricultural land leads to soil P accumulation and to a massive transfer of phosphorus to water bodies. In 2013 the European Commission has published a Consultative Communication on the Sustainable Use of Phosphorus that pointed out for the first time at EU level, the issues around the sustainability of phosphorus use, both in terms of losses to the environment and supply for crops.

As consequence of that the develop of techniques able to remove P from animal manure became a urgent research topics. This fact is more significant if it is takes into consideration, also, that P resource are finite and that for the future P recycling assumes priority in the research agenda.

The POWER project aims to develop an useful system to recover phosphorous from animal slurry by anaerobic digestion pre-treatment, with the double goals to reduce soil and water P-pollution, and to recovery two renewable fertilizers: 1. organic-mineral fertilizer (solid stabilized separate fraction of digestate) and 2. mineral fertilizer - "struvite" -, by successive treatment of the liquid fraction of digestate.

Project is organized in 4 main activities that represented a well distinct, but cascade-modality related activities.

- Investigate the effect of AD on P-form by studying by chemical and spectroscopic techniques, (31P-NMR, X-ray powder diffraction –XRD- and by scanning electron microscope –SEM- equipped with energy dispersive X-ray probe (EDS), P speciation in ingestate, digestate, and solid and liquid derived fractions, coming from full scale process;

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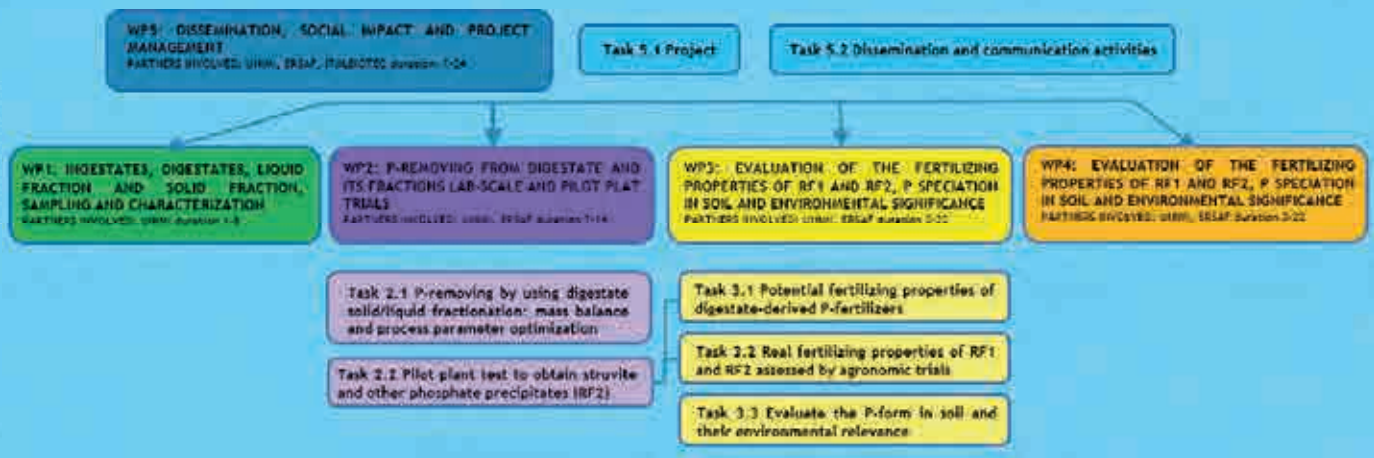

- Optimize P removing from liquid digested fraction by insoluble P-salt formation, i.e. struvite. Lab-scale trials, varying process parameters and using different co-reagent will be tested getting optimal combination to remove not less than 90% of total P-slurry. Struvite represents the second P fertilizer;
- Test the two fertilizer produced: both agrochemical approach and vegetative tests, will be performed to display agronomical properties of fertilizers. . In addition P speciation in soil treated with P-fertilizers produced, will be completely studied by both chemical and spectroscopic approach in comparison with soil that had received an excess of P as consequence of the animal slurries misuses. The aims is to better understand P fate in soil and its potentiality pollutant activities, i.e. P-form vs. P leaching and/or P-run-off;
- Life Cycle Analysis (LCA) will be performed by considering full scale farm that implemented AD and successive P removing.

The **POWER project** is characterized by a **multidisciplinary approach** that involve chemists, agronomists, mineralogists, biologists from research institution (UNIMI) and technical body supporting Lombardy Region activities in the agricultural sector (ERSAF). The POWER project management will be planned to identify, even in its scientific approach, solutions with prospects for industrial use, relying on a partner (Consorzio Italbiotec) expert in the most advanced technologies to communicate results of scientific research. A prove of it is the large consensus received in terms of endorsement from private and public entities. Results of **POWER project** will be publically available to stakeholders and public administration through an online data suite and dissemination activities.

RESEARCH TEAM:

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