From sewage sludge to syngas and biochar—new perspectives for small municipalities

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Dr. Olivier Lepez, coordinator of PYROCHAR, explains how the project team has developed an energy- and cost-efficient process to thermo-chemically convert municipal sewage sludge into useful biochar and synthetic gas.

Sewage sludge production from European wastewater treatment plants keeps increasing and, despite the organic matter and nutrients it contains, often ends up in landfills or incinerators. The PYROCHAR project has developed a technology that will enable the valorisation of this sludge in communities of less than 10 000 people—all this for a much lower cost than landfilling and incineration.

With soil degradation threatening arable lands across Europe and the EU increasingly looking into ways to valorise the sewage sludge produced by wastewater treatment plants, a solution to produce soil amendment from sewage sludge to the benefit of farmers would come in quite handy.

Now suppose you are part of a small community with no sewage sludge treatment plant anywhere close. Getting the sludge to the closest incinerator will likely turn out to be too expensive, and landfilling is less and less of an option for environmentally aware citizens and EU authorities alike. In such a scenario, the need for an alternative is even more pressing.

The PYROCHAR (PYROlysis based process to convert small WWTP sewage sludge into useful bioCHAR) project could be exactly what municipalities of less than 10 000 inhabitants have been looking for. Since 2013, the project has been developing an energy- and cost-efficient process to thermo-chemically convert municipal sewage sludge into useful biochar (charcoal from pyrolysis treatment) and synthetic gas (syngas).

Dr. Olivier Lepez, President and CEO of ETIA and coordinator of the PYROCHAR process, explains how this technology will address the current problem of small municipalities in managing their increasing amount of sewage sludge, while potentially providing farmers with a costless solution for land spreading.

What are, according to you, the main problems faced by small communities when it comes to sludge treatment plants?

Small communities with a population of 10 000 people or equivalent are often faced with the issue of sludge incineration plants being located quite far away, which means it costs a lot of money to transport the sludge and incinerate it. So these communities often resort to landfilling which is increasingly becoming a problematic option. Actually many countries already banned landfilling.

Helping these communities find an alternative to landfilling or costly incineration is a major issue. In France for instance we have roughly 18 000 water treatment plants, approximately 93 % of which are used by small communities of 10 000 or less inhabitants.

How does the PYROCHAR technology help solve this problem?

PYROCHAR technology is a full-fledged technology. Usually water treatment plants produce sludge which is then processed in a centrifuge. This results is a sludge with roughly 80% of moisture and 20% of dry matter, which is actually the only resulting feedstock.

In PYROCHAR however drying the sludge is only the first step. In 10 000 people or equivalent communities, the average flow rate is roughly 100 kw/h of wet sludge. This goes into a dryer so as to obtain 20 to 22 kg of dry matter, and the latter goes through a high pyrolysis process to help us quantify it. Around 50% of this sludge is turned into a syngas with a quality value of roughly 17 megajoules per cubic litre. Then, this gas is combusted to produce steam and supply the energy needed for the dryer. On the other hand we also produce a BIOCHAR which depending on the pollutants it contains can potentially be valorised into soil amendment or solid fuel.

Are there other options to valorise the syngas and biochar produced by the PYROCHAR technology?

There are two possibilities for the syngas. Apart from producing steam for the dryer, we can also use the syngas to feed a gas engine from which we produce electricity if the customer already has its own source of energy for the dryer.

For the biochar it depends on the pollutant. Sewage sludge can be polluted by heavy metals, pharmaceuticals or chemical products. Although the pyrolysis process allows us to create a biochar that is absolutely sterile (no odour, no pathogens) and where all organic molecules have disappeared, it may still contain some remains of heavy metals. In such scenario the biochar cannot be used for agriculture but it can be combusted: it still has a quality value of about 10 to 15 megajoules per kilogram.

Now in the case of small communities, which generally do not have industries connected to the waste water treatment plant, the sludge will most likely not be polluted by heavy metals so the biochar can make a very good fertilizer or soil amendment.

Would it affordable for small communities to adopt this kind technology?

One of our targets is to reach a competitive price. We want to provide a solution which costs roughly 50 to 60 euros per tonne of wet sludge. Today landfilling costs between 60 to 80 euros per tonne and incineration costs from 100 to 200 euros per tonne depending on the country.

How do you see your technology being of use to farmers? Would they have to pay to get this biochar?

It could be a great social action for the municipality to provide its farmers with the opportunity to use the biochar for their own farms, be it for free or under a negotiated price. Now this decision depends on the business model and the economic viability of the system. If the only other alternative for the community is to go for incineration at 200 euros per tonne, of course you have quite a considerable margin that makes it realistic to offer the biochar to farmers. If, on the other hand, the delta of current and potential price is much lower, then the community may have to put a price tag on this biochar.

Where do you stand with the development of the prototype?

We have almost completed all tasks foreseen under the work packages.

The only thing that is left to be demonstrated is the gas engine connected to the syngas. We have already conducted tests on dryers and on high temperature pyrolysis, we have already made analysis on the syngas and the biochar. Now we have to connect all the components, which will be done in August-September. Finally we will conduct the final tests including the gas engine in September-October.

Have you witnessed any interest from small communities so far?

We did not start to promote the process and will not do so until we have enough data but we are starting to witness some interest from small communities. Dissemination activities will start in October and they should tell us much more about the commercial potential of our technology.

What would be your plans after the project ends?

The idea if everything works as expected is to make a larger scale demo plant and to try to prepare a programme for industrialisation and commercialisation. We would like to apply for Horizon 2020 funding but only with a complete prototype that has already been validated.

More information: For further information, please visit PYROCHAR: www.pyrochar.eu/

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