

Fertilizer Focus



**Complex innovation:
The future of
facility design**

- Asia focus
- Zero-waste production
- Blockchain network



Zero-waste biorefinery to provide fertilizer for organic farming

Fertilizer Focus takes a look at Afyren's first factory that will turn sugar beet by-products into seven biobased organic acids and a potassium-based co-product. Terrial will complete the circle by providing farmers with potassium-rich fertilizer blends specifically recommended for sensitive crops.

The European Commission's Green Deal seeks to cut fertilizer use by 20% and develop organic agriculture to the point where it would represent 25% of the market. Broad, ambitious policy goals like these present both challenges and opportunities.

Whether or not all of the proposals in the Green Deal are enacted, farmers will have to optimise their production processes and put in place actions to limit their environmental impact if they wish to maintain access to EU subsidies. Waste management, green

fertilizers, biodiversity preservation and animal welfare will be taken into account.

One opportunity - providing organic farmers with compliant and competitive fertilizer in industrial quantities - presents a tangible challenge, and a recent supply deal between Terrial and Afyren in France shows that a circular-economy mindset combined with innovative technology can lead to new sources of organic agricultural inputs.

Under the deal, announced in May 2021, Afyren, a green-tech start-up that produces chemical building blocks from agricultural by-products, agreed to supply a potassium-rich by-product from its process to Terrial, the leading French producer of organic fertilizer.

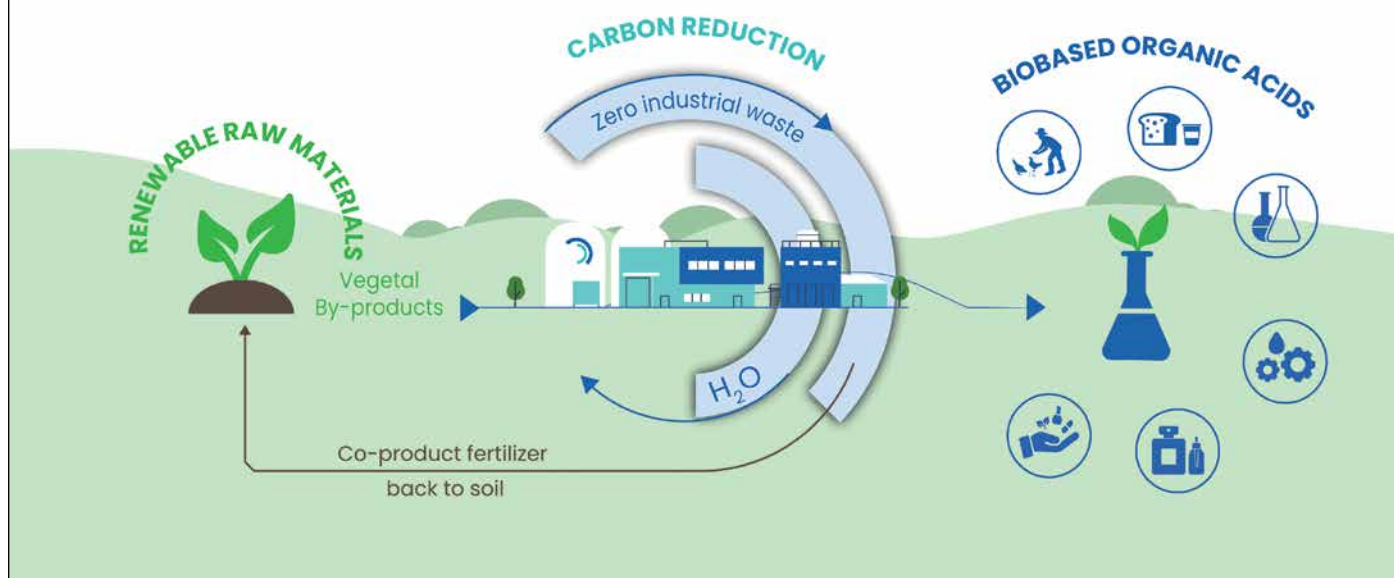


Afyren fermentation tank. The company is building its first factory at the Chemesis industrial platform in Carling – Saint-Avoid, in France. From 2022, the biorefinery will produce Afyren's family of seven 100% biobased organic acids (production capacity 16000 tons), serving a global market that is worth USD 10 bn. The factory will also produce a potassium-rich co-product that can be used in certified organic fertilizer.

A circular, low-carbon process, inspired by nature

Afyren's patented technology transforms non-food biomass into 100% bio-based organic acids - chemicals that will be competitive with the petroleum-based products that currently dominate the market.

Figure 1. Afyren's patented fermentation process turns agricultural by-products into chemicals that are usually produced from petroleum feedstock. The potassium-rich residue left over can be used in organic fertilizer.



These natural organic acids and their derivatives are used in the food, feed, flavours, fragrances, lubricants, material sciences and life sciences sectors.

The technology is biomimetic, based on the kind of fermentation that happens in nature. In the first step, microbial communities that are not genetically modified directly convert, without pre-treatment, complex biomass by-products into bio-based platform intermediates. The second step consists of the separation and purification of the organic acids and the potassium-rich co-product which is certified for use as fertilizer in organic farming.

The process is circular in several ways: Afyren's first factory, set to start production in 2022 in the Grand Est region of France, will use renewable sugar beet by-products from Südzucker factories in and around the region. The manufacturing process approaches zero industrial waste, not only are the fermentation residues returned to the earth as potassium-rich fertilizer,

The potassium produced by Afyren will enrich Terrial's range



Sugar beet harvesting. Afyren's first factory will use sugar beet co-products as feedstock, but the process can work with other forms of biomass. The idea is to use raw materials that are renewable and that do not affect food production. Residue from the fermentation process is put back into the ground as fertilizer.

but the process also requires very little water because it operates in a closed loop and maximizes the water present in the biomass used as raw material.

What is more, by using locally supplied renewable raw materials (which sequester CO₂ during their growth) in a low energy consuming process, the carbon footprint of the organic acids Afyren will sell is 81% lower than existing petro-based equivalents, according to a life cycle analysis.

Nicolas Sordet, CEO of Afyren, said the deal with Terrial was “an important step in consolidating our circular economy approach by ensuring a local outlet and a robust supply chain for this valuable resource.”

Taking a green technology innovation to industrial scale in 2022

Afyren was selected for the French Tech 120 in February for the second year running, and its AFYNERIE technology is one of the 1,000 sustainable solutions recognized by the Solar Impulse Foundation. The company has raised more than EUR80 million in total funding from public and private sources.

Afyren's first operating company, Afyren Neoxy, is currently building a plant that will start producing biobased acids by 2022, with a production capacity of 16,000 t per year.

Along with the biobased carboxylic acids, the zero-waste and low-carbon biorefinery will also produce the potassium rich fertilizer at industrial scale, an efficient alternative to the synthetic or extraction-based production of potassium.

Certified for organic farming in Europe and of premium quality, it will be delivered in powder form to Terrial, which will then incorporate it into its various mixtures and formats.

Note: AFYNERIE® is a registered trademark of Afyren

Fertilizer Focus spoke with Ollivier Péan, Managing Director at Terrial, about the Afyren deal and about the market for organic and sustainable fertilizers...



Fertilizer Focus (FF): How is the Afyren ingredient different from products that were on the market before?

Olivier Pean (OP): This is a product that provides potassium that can be directly assimilated. It's of premium quality compared to potassium chloride, which is not suitable for all crops. Plus, the fact that it comes from an innovative process that involves natural fermentation using sugar beet co-products is in line with Terrial's mission to give co-products new value.

Terrial specializes in the recovery of organic co-products, adding value to and reusing more than 800,000 t of co-products each year. Terrial's agreement with Afyren reaffirms its desire to work with sustainable, traceable bioresources from the circular economy, produced in France. And of course, the product is certified for organic agriculture.

FF: Could you explain the market needs you will be addressing with fertilizers containing the Afyren co-product? What are the segments that Terrial is targeting with these products?

OP: Terrial is going to use the Afyren's potassium-rich co-product in its preparations for its essential role as a nutrient. Potassium strengthens cell walls (preventing lodging), improves resistance to abiotic stresses (drought, frost) and promotes the migration of glucides to reserve organs.

The potassium produced by Afyren will enrich Terrial's range with innovative formulations for crops requiring potassium (beet, potato, canola, corn) and crops that cannot receive potassium in chloride form (vineyards, vegetable crops, etc). All these segments are already addressed today by Terrial. This product also has the added advantage of providing sulphur, an important element for protein synthesis, as a complement to nitrogen inputs.

FF: How does this help balance your portfolio?

OP: Terrial already has a very diversified range of organic or organo-mineral fertilizers and uses more than 60 raw materials. This new bioresource allows us to supplement our range of customized products to meet the diverse demands and specifications of French agriculture.

The product will be incorporated in various mixtures and can also be delivered in different physical formats such as granules and powder.

FF: What are the key marketing messages for potential customers?

OP: Choose products with high quality inputs that are great for crops and good for the planet. And also choose sustainable fertilizers produced in France.

FF: What are the key messages for 'green stakeholders'?

OP: This project is a perfect reflection of Terrial's DNA. We have been a major player in the circular economy for 25 years - a leader on the French market in organic fertilization and the recovery and reuse of bioresources.

FF: What are your thoughts on the outlook for organic and sustainable fertilizers in Europe? Is the market going to continue to expand rapidly?

OP: Demand for organic products is still growing. This is a dynamic market in France (+13% in 2020) and internationally, affecting all crops. Approximately 8.5% of exploitable agricultural land in France has been converted to organic farming. The organic and bio fertilizer market is growing, following this trend. To meet this demand, our major challenge for the future is to capture new sources of renewable and sustainable raw materials, which is the reason for the partnership between Afyren and Terrial. ■