SteamBio enabling sustainable carbon for industry

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There is much talk nowadays about "decarbonising" the economy, would it be more appropriate for us to use a greener form of carbon instead? Carbon has helped to shape the world we live in today, in fuels and in chemicals. In the modern world it is primarily supplied from unsustainable fossil sources; coal mines, oil wells and gas fields, creating environmental impacts in both extraction and use. With the majority of fossil carbon now imported into Europe there are assorted concerns relating to security of supply. To create a more secure and sustainable future we need to use carbon from nature: "biocarbon"; using it to create biodegradable bioplastics, other biochemicals and for renewable energy generation that is available when required. However,it is important that biocarbon is sustainable with functionalities, availability and costs comparable to the fossil carbon it displaces.

While biocarbon is an abundant natural resource, it is not always available in the appropriate condition or location. The infrastructure associated with fossil carbon has been developed over a number of years, based around centralised refineries. The biorefineries of the future

cannot ignore these existing infrastructures. For biocarbon to become established it must be able to be stabilised, stored, transported and used with cost and functional equivalence to fossil carbon. This needs to be achieved without expensive plant upgrades.

How big is the market?

The global chemical industry is worth about $3 trillion, of which biochemical production amounts to approximately $100 billion, a relatively small but growing proportion. Currently these biochemicals are mainly 1st generation, which means that they compete with available food supplies, either directly by using corn starch or sugar or indirectly through land use. This is not sustainable in the long term and has led to research and investment into 2nd and 3rd generation sources. The bioenergy market is more developed and is expanding. Since 2008 EU wood pellet use for energy generation has increased from 2.5 million tons of oil equivalence (Mtoe) and is projected to be 20 to 32 Mtoe or approximately 50 to 80 million metric tons, by 2020 (source: European Biomass Association). As the demand for bioenergy has grown, issues have arisen which will also impact on 2nd generation biochemicals.

Existing forestry resources in Europe are insufficient to meet market demand, resulting in significant imports from North America and other regions with competition for supplies emerging from East Asia and elsewhere. Concerns have been expressed on imported supplies, of ecological stresses where grown, on the environmental impact of shipments around the globe and competition from other users.

There are abundant biomass resources across Europe that are not currently being used to meet this supply gap. For instance, it had been estimated that there are potentially 100 Mtoe of agricultural residues alone. However, these residues are not in a form that can be readily collated and is usable by a large scale bioeconomy. There is a need to be

able to cost-effectively collate and present this material in a form that can be used.

Superheated steam torrefaction

Torrefaction is a thermal conditioning process that makes biomass water resistant, with higher calorific values and easier to store and transport, more suited to bioenergy (and biochemical) use than raw biomass. It has been developed by many teams over the years but has yet to fulfil its commercial potential. Superheated steam processing is an energy efficient means of heat transfer. It has been developed by the German Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB into a continuous industrial drying process that can recover valuable volatiles from the condensate stream. On a pilot scale this process has been used at higher temperatures for torrefaction of assorted biomass material. Feasibility studies have shown that it has potential to stabilise a variety of forestry and agricultural residues in a form that is economically viable.

Taking it to the next level

The next step involves taking this work to market. To make this happen, financial support was approved by the EU Horizon 2020 programme for the project SteamBio. Steambio is a collaboration of eleven partners from industry and academia with a common purpose: to create a viable business based on superheated steam torrefaction of forestry and agricultural residues. It will demonstrate economic viability in different rural locations recovery of usable biocarbon from indigenous forestry and farming residues in tonnage quantities. In SteamBio this torrefied biocarbon will be demonstrated as a coal replacement for an industrial lime kiln and as a carbon source in pilot scale biorefineries. Recovered condensate from the superheated steam process has already been shown

to contain commercially relevant quantities of biochemicals, additional to the torrefied biocarbon mass that can be used as a biofuel and in biochemicals.

SteamBio has already selected six different reference-materials that are abundant and available from European forestry and farming operations. A demonstration unit with a throughput of 500kg/hour is currently under design and construction and will be deployed at different rural locations by January 2017.

More information: For more details on the project, please visit www.steambio.eu

Provided by Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB