

“To make the change happen, the key is to work together in partnerships”

How does industry view the future of the bioeconomy? An assessment by Dr Marcel Wubbolts, Chief Technology Officer of the Dutch-based multinational company Royal DSM.

■ **Mr. Wubbolts, why does your company operate in the field of bioeconomy?**

By the year 2050, the world population is forecast to reach nine billion people. It will become increasingly difficult to meet the needs of so many for feed, food, energy and materials from this single planet. In order not to compromise the prosperity of future generations, DSM is convinced that today we must start finding alternatives for our long-lasting reliance on oil and other fossil resources, with their significant impact on the environment, and make the transition to renewable energy sources, chemical building blocks and materials. Switching our economic system to plant-based, rather than relying on – finite – fossil resources, will offer energy security, lower carbon emissions, sustainable economic growth and availability of resources. It opens opportunities for sustainable agriculture that will provide food, feed, energy and materials. DSM’s ambition is to take a leading position in a new bio-based economy by helping to realise the full sustainability and commercial potential of biofuels and bio-based chemicals and materials. We believe we can create brighter lives for people today and generations to come.

■ **What are the most important bio-based products in your range of articles?**

DSM is a biotechnology pioneer that has been acquiring knowledge and expertise in this area since the 1870s. In our work, we operate at the interface of energy and agriculture – the two largest industries in the world. At this crucial intersection, we have come to specialise in turning plant-based feedstock into chemicals and materials of all

kinds, and breaking brand-new ground in (ligno-cellulosic) biomass conversion. We are determined to reduce the world’s dependence on oil and fossil fuels, and in order to do so, we also collaborate with leading bio-entrepreneurs and industries. DSM is a full technology player in this sector, serving the needs of future bio-refinery owner-operators. We offer a designed cocktail of enzymes to break down (hemi-) cellulose from agricultural residues to simple C5 and C6 sugars. It also includes proprietary recombinant yeast, capable of co-fermenting the sugar mix for the production of cellulosic bio-ethanol, and advanced microbes for the production of microbial diesel. In the field of bio-based chemicals and materials, DSM works along the value chain with agriculture (feedstock providers), (petroleum based) incumbents and/or downstream users. For these customers, we have developed a novel low-pH fermentative route to produce Biosuccinium – a high quality, bio-based version alternative for conventional fossil chemicals such as succinic acid and adipic acid with a better environmental footprint. This product is manufactured and commercialised by a joint venture that has been created together with our business partner Roquette. In addition to Biosuccinium, DSM is exploring new bio-based routes for other bio-based platform molecules.

Another interesting product is the green polyamide EcoPaXX, with a bio-based content of about 70 per cent. It is a high performance engineering thermoplastic and is well suited to a wide range of, amongst others, automotive applications. Its combination of strength and stiffness, along with chemical and high heat resistance, makes it ideal for demanding under-the-hood components applications. With EcoPaXX, we’re bringing a new dimension



Photo: Royal DSM

Dr Marcel Wubbolts is Chief Technology Officer of Royal DSM.

to green motoring in the form of a bio-based material that is truly sustainable. Its blend of properties enables EcoPaXX to compete with (and in some cases surpass) not only metals but other plastics. Several interesting applications have recently been commercialised. For example, Mercedes-Benz chose EcoPaXX for the engine beauty cover of the latest version of its A-Class small family car, and the fuel vapour separator of Ferrari and Maserati is in EcoPaXX.

■ **How do you believe the demand for bio-based products is going to develop?**

In a number of years, we will all be using a mix of natural, renewable resources for our energy needs – think of biofuels, but also of wind, solar and geothermal as energy sources. For our materials, we will be able to rely on bio-based renewable resources to a large extent. Because of all this, the pressure on our environment will become less, and we will move to a brighter future

with nine billion healthy people on one healthy planet. For this transition to succeed, we need a world-wide approach where stakeholders all over the world work together and where policy-makers will have to support the use of renewable resources for energy, materials and chemicals – in addition to food and feed – and where policy-makers start to discourage the unremitting use of finite fossil-based products for which sustainable alternatives are now available.

We are currently involved in a number of partnerships and joint ventures, in which we bring in our unique platform of conversion technologies. Our partners contribute their own expertise on biomass logistics, processing and market distribution. The challenges towards realising the change that we are after are enormous, and one company, institution or country cannot do this on its own. The key is to work together in partnerships to make the change happen.

■ **One of these partnerships is the Bio-based Industries PPP project with the European Union. What are you expecting of your membership in this initiative?**

The BBI is a new public-private partnership dedicated to breaking Europe's dependence on fossil fuels by converting biomass and wastes into greener everyday products. Innovative technologies and advanced bio-refineries are at the heart of this initiative, which focuses on deployment and the creation of new markets for bio-based products such as food, feed, chemicals, materials and fuels. I am Chairman of the Bio-based Industries Consortium, the private part in the PPP, and vice-chairman of the governing board of the PPP. As the private partner in this new endeavour, we are thrilled about having been able to translate the ambitions of multiple sectors into one coherent vision; and now, into concrete actions that place sustainability at the heart of all business activities. Without this partnership with the EU, industries across sectors wouldn't have taken the risk to invest in this emerging sector in Europe. The BBI is

an achievement as such, but only the start of a long-term project where the combination of European, national and regional financing instruments will be essential to realise its full potential.

■ **Have politicians chosen the right course regarding the bioeconomy, or do you believe there are things to catch up on?**

When looking at the global market, Brazil and the US have policies in place – and already for years – that really aim to speed up the transition from fossil to bio-based. Other regions are catching up or at least are trying to catch up. The EU published its strategy 'Innovating for Sustainable Growth: A Bioeconomy for Europe' in 2012. A step in the right direction that is also reflected in the BBI-EU partnership. The next moves have to be to create policies that will help creating market pull. In this respect, US industry was able to speed up developments on biofuels when the US government put the RFS in place. The 'Renewable Fuels Standard' is a USA federal programme that requires transportation fuel sold in the US to contain a minimum volume of renewable fuels. Increasing amounts each year, escalating to 36 billion gallons by 2022. Each renewable fuel category in the RFS programme must emit lower levels of greenhouse gases relative to the petroleum fuel it replaces.

■ **Do you procure the raw materials for your bio-based products exclusively from Europe?**

Biomass is available around the globe, and we buy the raw materials for our bio-based products locally – close to our production sites. One example is cellulosic bio-ethanol: Our joint venture with the US ethanol producer Poet intends to globally license an integrated technology package that converts corn crop residue to cellulosic bio-ethanol to third parties, as well as the other 26 existing corn ethanol plants in Poet's network. Our Poet-DSM Joint Venture sources the raw material for Project Liberty – a commercial-scale,

cellulosic ethanol plant in Iowa/USA for which preparations for start-up have begun this summer, from within a radius of about 30 miles around the facility. The plant is designed to produce approximately 25 million gallons per year.

■ **Bioeconomy critics are concerned about negative impacts on food security. Do you also see this conflict?**

The future is about food and fuel. Project Liberty is an example of this: it will make use of corncobs, leaves, husk, and some stalk that passes through the combine during harvest. The process uses about 25 per cent of the available corn residues, leaving 75 per cent on the soil for erosion control, nutrient replacement and other important farm management practices. Looking to the future of renewable energy, it's clear that the world's most abundant organic compound, cellulose, is most promising. It provides the cellular structure for trees, grass and all things organic. The plant will share infrastructure with the adjacent Poet Bio-refining in Emmetsburg/Iowa. Roads, land and other features will be shared, and the co-product from the cellulosic ethanol process will be energy, enough to power Liberty and send excess to the adjacent corn grain-based plant.

If you look at our EcoPaXX bio-based example, we are pleased to share that the three grades of EcoPaXX polyamide 410 from DSM have been given the 'Certified Bio-based Product' label awarded by the United States Department of Agriculture. The grades of this high-performance engineering thermoplastic have a proven bio-based content of around 70 per cent. This is because the polymer incorporates building blocks derived from castor oil obtained from plants that grow in tropical regions and which are not used for food products. Furthermore, EcoPaXX has been shown to be 100 per cent carbon neutral from cradle to gate, which means that the carbon dioxide which is generated during the production process of the polymer is fully compensated by the amount of carbon dioxide absorbed in the growth phase of the castor beans.