LESS IS MORE

TEXT **ANNETTE LOCHER**

The amino acid methionine enhances the sustainability of livestock farming. Evonik is now using an extension of its production facilities in Singapore to also significantly reduce the CO_2 footprint of this animal feed additive

The noise of construction machinery is ushering in the future at the production plant of Evonik's Animal Nutrition business line on Jurong Island. Here in the southwestern district of the city-state of Singapore, excavators are leveling the earth's surface at a site on the outskirts of the plant. Plans call for a steam turbine to be installed here in the near future. At another site, stakes mark the place where a new plant building will stand in a few months' time. And a patch of lawn will soon give way to an electrolysis unit that is expected to produce green hydrogen starting next year. The aim is to make the production of methionine, an important amino acid for animal feed, more climate-friendly.

"We're using an upcoming expansion of our methionine production plant's capacity to optimize the entire process at our Singapore location—and paying particular attention to our energy and raw material efficiency," says Dr. Jan-Olaf Barth, who heads the Essential Nutrition product line at Animal Nutrition. In the future, power from renewable sources is to be used preferentially in these processes instead of fossil fuels. According to Barth, that makes Evonik a pioneer in this Southeast Asian country. "We will be one of the first major companies in Singapore to utilize green hydrogen," he says. To date the company has mainly used "gray" hydrogen, which is extracted from natural gas, coal or petroleum.

In order to make production on Jurong Island more environmentally friendly, Evonik is cooperating with the German-American industrial gas company Linde, which is building the electrolysis unit. "We decided in →

Starting in the 1990s, seven islands located near the main island of Singapore were connected to form Jurong Island (in the center of the photo) by means of land reclamation. Many petrochemical companies, including Evonik, have established facilities here

Singapore is one of three locations where Evonik produces methionine for animal feed. Up to 300,000 tons of methionine leave the plant on Jurong Island every year

favor of a technology that is especially fit for the future and will bring us cost advantages in the long run, "says the project director, Dr. Christof Grüner, who is in charge of making sure the technology Evonik uses on Jurong Island is state-of-the-art. Evonik uses green hydrogen to produce methyl mercaptan, a DL-methionine precursor product.

HALVING CO_2 EMISSIONS

Within an international project team, Dr. Henning Kaemmerer and his colleagues Poh Leng Teh and Foo Chay Chong are responsible for the implementation of the various construction plans. The three process experts are facing some tough challenges. "Not only the electrolysis unit but also all the other subprojects must be so far advanced by next winter that we can integrate them into the process during a maintenance shutdown of our methionine production," says Kaemmerer. To make sure this happens, they need to coordinate very closely with the site manager, Kevin Kennedy.

Evonik has high hopes for the modification of its methionine production. The additional 40,000 tons of MetAMINO® per year should then be produced with a specific CO_2 footprint that is only half as big as it was previously. In terms of the total volume of 340,000 tons of MetAMINO® from two plants, this means a six-percent decrease in emissions.

The project in Singapore is part of the green transformation known as Next Generation Evonik, which the company initiated in 2022. Its two key aims are to make production at the locations more climate-friendly and to increase sales by means of sustainable innovations. MetAMINO®, the DL-methionine from Evonik, has already been playing an important role in sustainable agriculture for decades. Farm animals take in methionine with their feed. If this essential amino acid is missing, other components of the animals' feed cannot be optimally metabolized. The plant-based components of the feed often contain insufficient amounts of methionine by comparison with other amino acids. As a result, the animals excrete all of the feed components they were unable to metabolize. This is neither environmentally friendly nor cost-efficient.

Adding a small amount of methionine to animal feed can significantly reduce the amounts of other raw material feed components that are needed. This reduces the amount of agricultural land needed for cultivating soybeans or legumes and decreases the nitrogen emissions due to animal farming. It thus has a positive effect on sustainability, as is shown by several certified life cycle assessments. "If we want to provide a growing world population with high-quality animal protein under conditions of limited natural resources, we need to operate as efficiently as possible," says Barth.

Evonik's Animal Nutrition business line is part of its life sciences division, Nutrition & Care. It is completely oriented toward improving the lives of human beings and animals—by means of solutions that also offer advantages in terms of sustainability.

ONGOING IMPROVEMENTS

In order to conserve resources during production, Evonik is continually improving the production process of MetAMINO®. As a result, the Animal Nutrition business line has always stayed ahead of the global competition in terms of technology, production volumes, and efficiency. Its methionine plants are located in Antwerp (Belgium), Mobile, Alabama (USA), and Singapore.

The basic conditions for this are developed by people like Dr. Martin Köstner, a member of Evonik's research and development team, where he is responsible for innovation and technology at Animal Nutrition. For a number of years, his team has been working to reduce the CO_2 emissions generated during methionine production. "We conduct analyses to find out at which points in the production process we can achieve significant savings with existing technologies quickly and with minimal resources," says Köstner.

"Steam is a key element of energy integration at the methionine plant in Singapore"

HENNING KAEMMERER, PROJECT RESPONSIBLE

Work is already under way on the expansion of the methionine plant. Plans call for the new components to be integrated into the existing process next winter

The conversion to green hydrogen is only one of many measures that are now being implemented in Singapore. Another measure is the improvement of the unit's energy and raw material efficiency. Instead of simply building an additional production plant, the process itself is being intensified. "In the future, one part of the process stream will be running through an extra loop," Köstner explains. "That way we receive more product and fewer byproducts." As a result, the specific energy and raw materials requirement of the end product is reduced.

POWER FROM STEAM

However, major changes cannot be carried out during day-to-day production. That's why the team uses time slots during which the plant's operations are shut down for regular maintenance work. The prolonged downtime of the methionine production that is needed for building the extension is enabling Evonik to make additional alterations in parallel. For example, a process unit that is used in part of the methionine production process is being replaced with a new unit in an innovative design that generates fewer byproducts and requires less steam for heating.

"Steam is a key element of the energy integration at the methionine plant in Singapore," says Kaemmerer. In addition to methionine, the plant produces all of its important precursor products: methyl mercaptan, acrolein, and hydrogen cyanide. Whereas steam is generated during the production of acrolein and hydrogen cyanide and the thermal use of secondary process streams, steam is needed to run the methionine production process.

"Sometimes we already have a small surplus of steam today," Kaemmerer says. "When we generate more steam in the future during the production of acrolein and hydrogen cyanide for the additional quantities of methionine, and when the methionine process itself consumes less steam, this surplus will grow." In the future an extraction steam turbine will generate additional electric power from the steam that is not needed, so less energy will have to be purchased.

The thermal aftertreatment system at the location will also be modified. Feeding certain waste gas flows into it in a different way will make it possible to reduce the combustion temperature. As a result, less natural gas will be consumed, less CO_2 emitted, and less surplus steam generated. The new electrolysis unit and the green hydrogen are also expected to provide an additional benefit: The oxygen generated during the reaction will help to reduce the amount of natural gas that is needed to operate the furnaces.

Köstner's team is already thinking in terms of the far future and working to develop brand-new processes that use innovative raw materials. Meanwhile, Kaemmerer and his colleagues are focusing all of their attention on making sure that the modifications and expansions are all ready to go into operation by next spring. After that, the methionine plant on Jurong Island should go back into operation with a bigger production capacity and a smaller specific CO_2 footprint.

Annette Locher has a degree in biology. She has been working at Evonik since 2012. She writes primarily about health, nutrition, and sustainability