



THE FUTURE OF FERTILIZERS

Thomas Lansdorf, EIRICH, Germany, explains the challenges for agriculture and offers solutions for individually designed fertilizers.

What do fertilizers and cars have in common? Both industries are undergoing a period of revolutionary upheaval, and major changes are imminent. Automobiles are becoming increasingly networked, they are self-driving and they are frugal when it comes to use of resources. Modern fertilizers have staked a similar claim. In order to meet the nutritional demands of the growing world population, fertilization needs to be demand-driven. New methods, such as so-called 'precision farming', can help here. Analogously to Industry 4.0 for automotive production, Agriculture 4.0 is now part of modern agriculture. This new approach continuously monitors soil quality, plant growth and fertilizer demand. This is enhanced by the new types of fertilizer granulate that

are now available – without which efficient and demand-driven fertilization would not even be possible.

In fine shape – free-flowing constituent granules

The best fertilizer is worthless if it cannot be correctly dosed. Granulates are a particularly good solution here. Modern centrifugal spreaders promise working widths of 24, 36 or 48 m. The individual particles are accelerated to 150 km/hr in fractions of a second. This means that the granulates need to be extremely stable to withstand the mechanical stresses and strains they are exposed to. As well as this, they also need to be as dense and compact as possible, plus they need to have

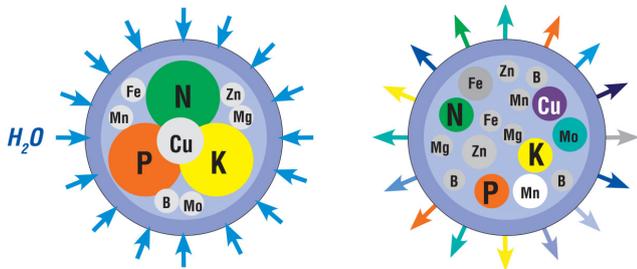


Figure 1. Nutrient release. Left: every fertilizer granule contains all the nutrients; the nutrients are dissolved by water. Right: a concentrated nutrient solution is created; the nutrients are released in a controlled manner.



Figure 2. EIRICH mixing and granulation equipment in operation at Hauert HBG Dünger AG. Source: Hauert HBG Dünger AG.

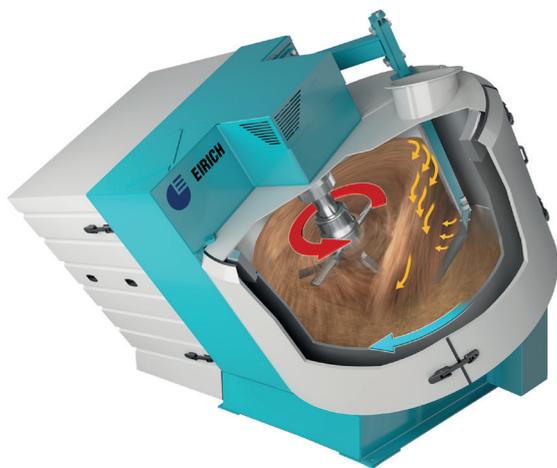


Figure 3. The EIRICH SmartMixer can also mix, granulate, and coat in a single process step.

a round shape and a smooth surface. In addition, there should be no risk of dust being generated or individual granulates clumping together. Last but not least, the grain distribution needs to be as homogeneous as possible. These criteria are met particularly well by free-flowing constituent granulates.

Demand is rising

Hauert HBG Dünger AG from Grossaffoltern, Switzerland, has been working successfully with an EIRICH fertilizer plant since 2017. All Hauert products that are

manufactured with the new technology carry the label 'GRANUTEC Swiss Granules'.

From first discussions to the complete system

Initial tests on the granulation of NPK fertilizer were carried out at the end of 2014 in the EIRICH test centre in Hardheim, Germany. Here, in collaboration with Hauert, the formulation, the preparation of the raw materials and the adjustment of the granulation conditions were all individually optimised.

The first trials were performed using small EIRICH intensive mixers (5 l capacity). It was then possible to transfer the parameters obtained during these tests directly to the EIRICH test centre mixer RV12 (400 l capacity). This made it much easier to design the plant configuration. In the process, sufficient granulate was produced to determine the required dimensions for a suitable fluidised bed drier.

Tradition

Grossaffoltern is a small local community in the canton of Bern. It contains many historical buildings, so the decision was taken to erect the production plant in an existing building. Based on the installation situation, this was a major challenge. EIRICH took care of the entire planning process, along with the complete engineering of the production line. In addition to the intensive mixers for mixing and granulating, the company also supplied the steel structures and all plant parts for transport and weighing of the raw materials. Similarly, the plant control, assembly/installation and commissioning were also part of the scope of supply. Of course, the experts from the test centre who performed the first tests were also on hand to assist with the first production campaigns.

From raw materials to the finished granulate – getting the blend right for the plants

The raw materials are chosen depending on the specific field of application, which defines the correct nutrient composition. This is carefully specified by the manufacturer. In the first step, the raw ingredients are ground. This ensures that all the nutrient salts are found in every granulate of fertilizer. EIRICH recommends the TurboGrinder for this, as it is suited to grinding and drying raw materials for the fertilizer industry.

Mixing, granulating, and coating in a single process step

The ground raw materials are weighed and dosed. Afterwards, they are transferred to the intensive mixer. Here, the components are initially mixed dry in a process that normally takes no longer than 30 – 60 sec. Then, water or an aqueous solution is dosed. The aqueous solution can, for example, contain binding agents or nutrient salts. The process of dissolving the nutrient salts enables better distribution of very low concentrations. Dosing of the liquid can be performed quickly in the mixer, and it becomes perfectly distributed in a short

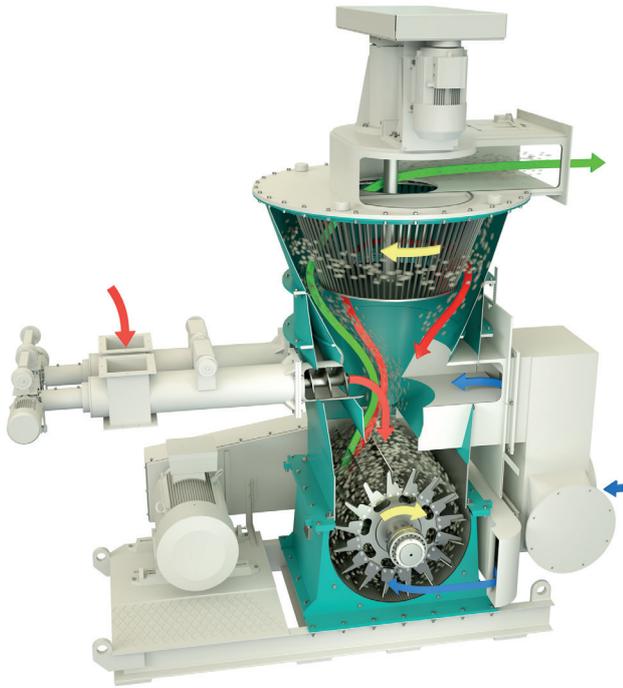


Figure 4. EIRICH TurboGrinder – a special mill for grinding and drying of raw materials for the fertilizer industry.

space of time. Afterwards, the tool speed is reduced with the aid of the frequency inverter to granulate the completely wetted-through particles. After a few minutes, the mixer is full of uniform granulates. The granulates can then be coated if required. The coating process only takes approximately 30 sec., after which the mixer is emptied. After only approximately 6 min., the mixer is ready for the next production batch.

Optimised granulates

Utilising its unique mixing principle, the EIRICH SmartMixer enables the complete production of fertilizer granulates in one process step. Independently of the speed of the primary tool (rotor), the moving mixing pan always ensures optimised mixing. By altering the rotor speed, it is possible for different processes to be performed at different times. Mixing is performed first dry, then wet – followed by granulation and coating at the end if required. This system can be easily upscaled. The layout and design of the smallest mixer EL1 (1 l capacity) is identical to the largest mixer in this series, the RV24 (3000 l capacity). The mixing times and circumferential speeds can be transferred directly, making the development of new fertilizers particularly easy.

The correct coating – the key to countless opportunities

A layer of paint measuring just a few micrometers thick protects your car against corrosion and environmental effects. There are hardly any modern products that would be conceivable without a coating. The potential scope for applications of granulates can be widened in similar fashion with the aid of coatings. Fertilizers primarily serve as a mechanism for delivering nutrient salts, which need to be supplied to the roots of the

plants. The ideal scenario is a continuous supply of small amounts of nutrient salts. However, the solubility of the nutrients used can vary greatly. Nutrient salts that are very easy to dissolve often make their way into the groundwater. Similarly, there is also a risk of decomposition products being released into the atmosphere. Particularly when using nitrogen compounds such as urea, where climate-damaging nitrous oxide (N_2O) can be easily formed through denitrification. These effects can be significantly reduced by slowing down the release of the nutrient salts. This is made possible by coating the granulates. As a result, the amount of fertilizer required is reduced – saving money and helping the environment. In addition, fertilizer does not need to be re-applied as frequently, which significantly reduces the workload for farmers.

Bacteria and enzymes that keep us healthy

When we think of bacteria, we usually think of sickness and disease, but 90% of the cells in the human body are bacterial. In one handful of topsoil, you will find more bacteria than there are people on earth. The bacteria and enzymes convert ammonium compounds into nitrate. The so-called nitrification process is necessary in order to make many nitrogen fertilizers available to the plant. However, in many cases, we want the nutrients to be released more slowly. To do this, ammonium stabilisers are used to delay the nitrification process. Manufacturers use different active ingredients to do this, e.g. 3,4-dimethylpyrazol phosphate (DMPP) or dicyandiamide (DCD). Urea often uses a urease inhibitor to inhibit the activity of the enzyme, which is richly abundant in the soil. This prevents overly rapid release, which otherwise leads to nitrogen losses. Alternatively, it is also possible to use natural neem oil for this, for example. These substances can be selectively applied to finished granulates or urea prills. Many such production processes have already been successfully implemented with EIRICH mixers. In the process, the gentle impact of the EIRICH mixing system has proved to be very successful. The active substances are quickly and completely fixed on the fertilizer granulate.

We need better fertilizers – not more

The world of fertilizers is changing constantly. Just like with most other resources, we are too wasteful in terms of how we use them. For example, waste waters containing high levels of fertilizers lead to the formation of a thick layer of algae that blankets the coastline every year in Qingdao, China. This is an environmental catastrophe of alarming proportions. Similarly, climate-damaging nitrous oxide is formed during uncontrolled decomposition of nitrogen compounds. Many nutrient salts, e.g. phosphorus compounds, are lost because of dilution. New sources increasingly also contain radioactive uranium isotopes. This is a clear indication that fertilizers are our most valuable and most important raw materials. Fertilizers must be manufactured that are coordinated much more efficiently with the needs of the plants. **WF**