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White Paper

More efficient Fertilizer Production: Reduced Product Penetration increases Productivity

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Phosphorus is one of the most important macronutrients in fertilizers. To cater for the worlds growing demand for fertilizers, producers all over the world expand their production capacity and modernise their existing processing facilities to enhance the effectiveness of their processes, e.g. the dehumidification of the production waste.

Producers all over the world are expanding production capacities and modernising existing processing facilities. (Picture: © GKD)

According to the United Nations, world population will exceed nine billion by the year 2050 – two billion more than in 2016. To feed them all, grain production will have to be increased over the same time period by 46%.But the UN Food and Agricultural Organization (FAO) calculates that the world’s available arable land for food production will only increase by 4% by the year 2050.

Growing Fertilizer Demand

Available arable land will therefore have to produce considerably higher yields. Experts of the German industrial association Agrar e.V. (IVA) are convinced that this higher demand can only be met through the use of mineral fertilizers. In fact, the FAO and the International Fertilizer Industry Association (IFA) both forecast an up to 40% increase in demand for fertilizer by the year 2030 alone.

Fertilizer demand may grow by 40 %
up to 2030. (Picture: © GKD)

For phosphorus in particular, the EU Commission even reckons with an increase in demand of around 50%. Phosphorus is used in both industrial and small-scale agriculture – to the tune of 40 million tons a year. But unlike potassium and

nitrogen, phosphorus is a finite resource whose worldwide exploitable reserves are steadily diminishing. And this indispensible fertilizer is irreplaceable by any other substance. For this reason, in May 2014, the European Commission placed phosphate rock on its CRM List of 20 critical raw materials.

Phosphorus Production requires Versatility

The basic material for phosphatic fertilizers is phosphate rock (apatite), which only occurs in a few regions on the planet. For the purpose of fertilizer production, the apatite is crushed and ground into rock flour. But, because raw phosphates are not readily soluble, this rock flour is only used directly on the fields as fertilizer in rare cases. Usually, through addition of nitric, sulphuric or phosphoric acid, the phosphate is dissolved and extracted from the rock flour. In this way, raw phosphate is converted into phosphoric acid of different grades of purity.The varying characteristics of the particular phosphate rock used is also reflected in the diversity of treatment processes. For example, particle size and process temperatures will vary depending on the particular raw material.Phosphoric acid production results in the creation of large amounts of phosphogypsum. This contains radioactive and toxic components like uranium and radium due to impurities in the raw material. For this reason, only 2% of this type of gypsum can be recycled. After dewatering on vacuum belt filters, the complete remaining volume is bunkered on piles near the fertilizer production facilities.

Demanding Process Conditions

The world’s largest producers of phosphate fertilizers include companies in Canada, the USA, Russia, Norway and Morocco. To be successful in global competition, their fertilizer production facilities must meet high standards of quality and reliability. At the same time, their efficiency needs to be continuously increased to be able to cater for the constantly rising demand.

Vacubelt filter belt from GKD for the dewatering of phosphogypsum. (Picture: © ThyssenKrupp Fördertechnik)

A crucial contribution to productivity lies in the stability of the filter belts used in gypsum dewatering. These must be able to withstand massive mechanical and

corrosive stress at high throughput rates around the clock in order to ensure the longest possible life cycles. For this reason, more and more companies are using filter belts of the Vacubelt 3354 type, made of polyester monofilaments for the dewatering of their phosphogypsum slurries.Due to its pore size of 150 µm and an air permeability of 200 cfm (5,67 m^3/min), the Vacubelt filter belt excels through efficient dewatering, a low tendency to clog, and very good cleaning properties. In addition, its smooth surface ensures optimal product detachment. Because it is manufactured on special, high-tech industrial looms, the belt mesh is guaranteed to have the required stability to prevent wrinkling, even in the case of extra-large equipment dimensions. Even belts with a length of more than 70 m and up to 4.5 m width maintain the requisite lateral stability to ensure the necessary degree of process reliability

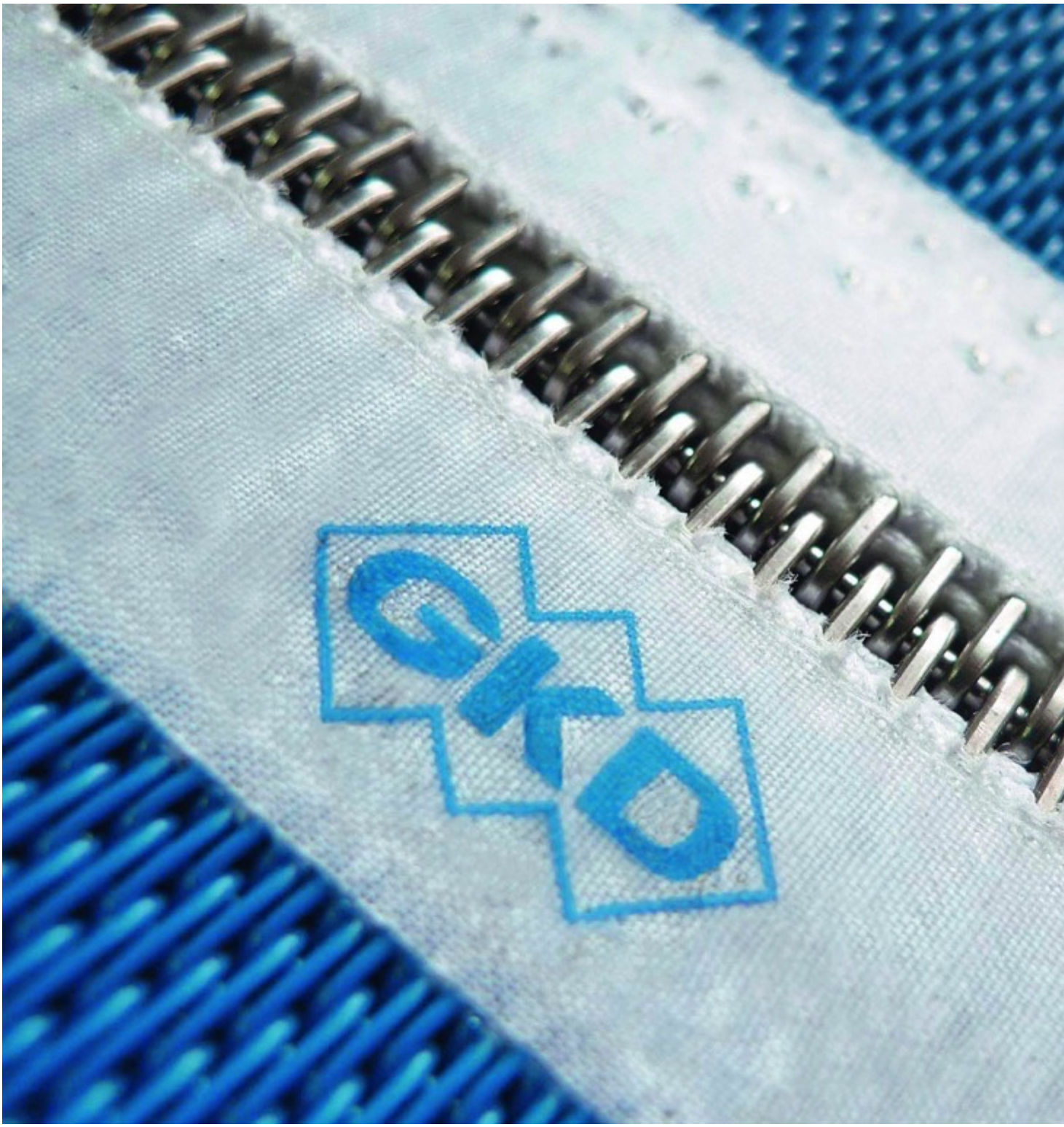
Extending the Filter Belt Service Life

As a rule, the up to 105°C hot phosphogypsum slurry is spread onto the belt with a cake thickness of about 30 mm and a moisture content of about 80%. In a continuous process, the vacuum belt filter dewaters the gypsum slurry down to a residual moisture content of 15 to 20%.

The woven polyester Vacubelt filter belt is said to offer a longer service life, thus ensuring more process efficiency in the production of fertilizers. (Picture: © FLSmidth)

The producers regularly check that the target dryness is being maintained. If the residual moisture is too high, the respective equipment operator reduces the belt

speed in order to increase the moisture being extracted under negative pressure. However, because the aim is to achieve the highest possible throughput of gypsum, the belts have to run at the maximum permissible speed for effective dewatering. The process therefore puts heavy demands on the mechanical, thermal and chemical resistance of the filter belt being used.Product penetration through the belt in the seam zone is another challenge, as it can lead to irreparable damage to the vacuum pumps as well as destroy the filter belt through abrasion on its bottom side – an issue that may cause a several months downtime for vacuum belt filters.



The Vacubelt filter belt’s patented PAD seam 5 significantly reduces product penetration. (Picture: © GKD)

The Vacubelt 3354 type filter belt offers a solution to this problem. The woven polyester belt is manufactures with a special version of **GKDs** patented PAD seam 5, which significantly reduces product penetration, as the PAD seam is extremely flat and ensures extra grip and easy handling for the company’s process belts.In a

hot melting procedure, a special pad is melted into the belt mesh and pressed together with specially formed seam staples. Hastelloy steel staples ensure the required corrosion resistance of the seams in such an aggressive environment. Thus, the special seam version helps to significantly extend the service life of the vacuum filter system.

Utilisation in all Fields of Fertilizer Production

The potash fertilizer sector also benefits from the Vacubelt filter belts' efficiency improvements. (Picture: © K + S Aktiengesellschaft)

Due to their versatility Vacubelt filter belts are used by the fertilizer industry in more than just phosphoric acid production. They also demonstrate their outstanding efficiency in the potash fertilizer sector in the dewatering of the salt solution. Here, rock salt is separated from the potassium chloride to be used for the fertilizer. High temperatures and corrosive media are characteristic of the process conditions the filter belts have to withstand during dewatering of the salt. Filter belts of the type Vacubelt 5060 with a pore size of 490 µm are deployed here because – also in this application – the single-layer construction excels through its longer service life and its optimal dewatering efficiency.This track record has earned the trust of fertilizer producers all over the world who utilise Vacubelts for their vacuum belt filters to meet the growing demand for their agricultural nutrients.