Waste-free process using fluidised bed spray granulation

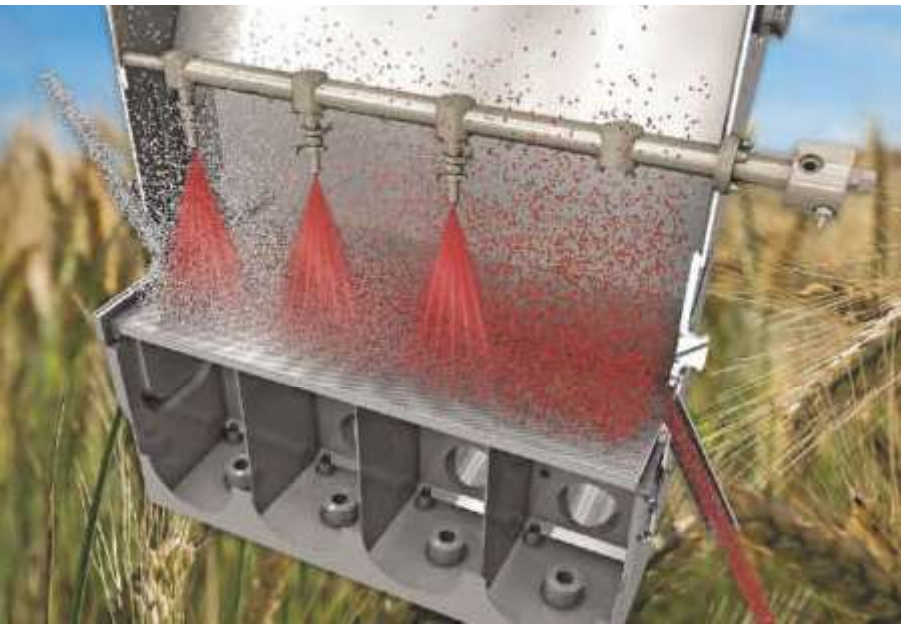
Fertiliser from phosphorus-containing ashes

More than 90 % of the world's phosphorus reserves are outside Europe. For this reason, Germany regulates the recovery of phosphorus by law. As the amended Fertiliser Regulation restricts direct soil-bound recycling of sewage sludge containing phosphorus, many disposal companies will be forced to establish alternative recycling methods. Phos4green is a two-stage method that extracts phosphorus from sewage sludge ash and converts it into ready-to-use fertiliser granulates.

Current phosphorus recovery processes have the disadvantage of producing large quantities of waste and being restricted to a certain raw material matrix. The German Fertiliser Regulation (DüMV) also places high demands on recycled fertilisers, which in many cases are not yet met. In cooperation with an industrial partner and the Material Research and Testing Institute at Bauhaus University Weimar (MPFA), Glatt Ingenieurtechnik has developed a highly efficient process: Phos4green extracts phosphate from sewage sludge ash, which is then converted into residue-free, ready-to-use standard fertilisers using fluidised bed spray granulation. The project was funded by the German Federal Environmental Foundation (DBU). The process is an ideal way to close the gap in the phosphorus cycle by combining recycling with manufacturing and creating an end product that can be sold directly.

Two-stage process

To initiate the conversion reaction, a suspension is prepared from the phosphate-containing ash with a mineral acid. This step is necessary to make the ash-based nutrients available to the plant. The suspension is always produced specifically for the desired end product and adapted to the available raw materials. Depending on the application, water and other solid or liquid nutrient components, including additional phosphate sources, can be added. To homogenise the raw material components, the phosphate conversion reaction is separated from the granulation process. This offers a number of advantages: the spontaneous, high-energy reaction that normally occurs when phosphate-rich ash and a mineral acid are combined takes place in a controlled manner because the free acid has already reacted in the suspension. In addition, the process is suitable for a variety of ash types. The subsequent spray granulation process refines the digested phosphate to create a marketable product.



Pictures: Glatt

Continuous fluidised bed process for products in organic and conventional farming

Granulation in the fluidised bed

When it comes to particle-forming, fluidised bed technologies are among the leading processes and are ideally suited for economical manufacture of tailor-made fertilisers. The process permits liquids to be dried while simultaneously producing dust-free granulates with a compact, homogeneous structure, a dense surface structure and high abrasion resistance. In addition, the solubility of such granulates can be easily adapted to the application. If required, the particles can then be coated with a functional layer to protect the active substances from storage, transport or application-related influences, mask unpleasant off-notes and facilitate both branding and the targeted release of active ingredients. The outcome is fertiliser granules with a pronounced depot effect and a defined nutrient supply to ensure optimum dosage and the

The fertiliser granules can be coated with a coloured branding or with a pH-controlled release profile

The spray granulated, ready-to-use fertilisers can be packed, marketed and dosed directly

reduction of any undesirable drift phenomena during application.

In the case of phosphate recovery for fertiliser production, the process duration can vary widely depending on the raw material(s) and the end product. In addition, the different formulations in the suspension also behave very differently; some substances tend to stick together, which can be compensated by adjusting the operational parameters. The mixture of solid and liquid components in the phosphate suspension is sprayed into the process chamber and the solvent evaporates immediately. The remaining solids serve as carrier germs for the formation of new fertiliser granules. In a cyclic process, the entire surface of each of these primary particles is wetted with spray liquid and subsequently evaporated to form a solid shell consisting of several layers. As soon as the required target size is achieved, the product is discharged and can be packed, marketed and dosed directly.

Complex fertilisers

Complex fertilisers (such as NP, PK and NPK) can be produced using the same process and an adapted recipe. Parameters such as particle size, residual moisture and solids content can be specifically manipulated to achieve a broad spectrum of product properties. Thanks to the high particle density and low specific surface area, this also applies to the subsequent application of a functional coating. Combinations can be easily integrated into the process and their product properties optimised. From an ecological point of view, the new fertilisers – with a phosphate content of up to 46 % – are suitable for both soil- and plant-specific fertilisers in organic and conventional farming. Fluctuations in the ash composition can be compensated without any problem by adjusting the recipe.

The Phos4green process is particularly economical and meets current market requirements for the production of ready-to-use standard and multicomponent fertilisers based on recycled phosphate (no raw phosphate is required). Compared with other recycling processes, this method is 100 % waste-free and the ash is completely reused. No harmful intermediate products or waste gases are created during the entire process. In addition, the fertilisers contain 92 % less cadmium and around 9 % less uranium than other recyclates; also, the pollutant content is well below the legal limit values.

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