Extended Abstract Polymer Sciences 2020
Vol.6 No.1

Euro Green Chemistry 2019 -Development and Implementation of Flexible Technology of Granular Slow Release NPKS/PKS-Fertilizers with Controlled Dissolution Rate- Andrey Norov- JSC "NIUIF"

Andrey Norov

JSC "NIUIF", Russia

Introduction:

JSC "NIUIF", the old and the solitary industry learning scientific research and plan institute in Russia for phosphorus-containing fertilizers, has developed an inventive stretchy technology of granular gradually release PKS- and NPKS-fertilizers with forbidden dissolution rate and limited nutrient supply into the soil solution.

Method Description:

The method of obtain PKS-fertilizers involve neutralizing of wet phosphoric acid (WPA) or its amalgamation with sulfuric acid by calciumum carbonate, follow by prelude of potassium chloride into the ensuing neutralized slurry. Sulfuric acid is used as a sulfur cause and can be replaced with calcium sulfate from phosphogypsum or semiproduct of WPA production-WPA result without separation of phosphogypsum. To construct NPKS-fertilizers, ammonium sulfate is added to the neutralized slurry in addition up to potassium chloride, or additional entirety neutralization with ammonia is performed. one time all raw materials are introduce, the slurry is sent for granulation and drying to a special drum combining the stages of granulation and drying-Drum Granulator Dryer (DGD) . Granulation in DGD means spraying of slurry onto the drape of particles of dry material declining from the blades installed inside the drum (Figure 1). Drying of slurry on the top of the particles occurs due to hot flue gases. Maintaining the required amount of dry material inside DGD is ensured by its external and internal movement (external and internal recycle).

Results:

The process non-concentrated WPA, slurry from WPA production without separation of phosphogypsum, as well as a number of various wastes from mineral fertilizers and salts production, for example, conversion chalk (which is a waste of compound fertilizers creation by decomposition of phosphate raw materials with nitric acid), phosphogypsum, a variety of phosphorus-containing sludges, for example, from production of sodium tripolyphosphate, etc. into the popular grades of fertilizers. In adding up, it is probable to use a variety of natural phosphate raw materials as one of the sources of phosphorus. In this case, the procedure includes the stage of decomposition of the phosphate raw material by a combination of WPA and sulfuric acid. Complex PKS- and NPKS-fertilizers are of high quality physical and mechanical properties, the granules are spherical, firm and uniform as per particle size and chemical composition with lower tendency to filthiness and caking. Due to that, complex PKS- and NPKS-fertilizers are of higher quality compare to similar products obtained by dry combine method. The costs for overture of fertilizers into the soil are significantly reduced; the uniformity of distribution is increased, as well as release rate of nutrients available for plants. Besides the major nutrients (nitrogen, phosphorus, potassium), granular PKS- and NPKS-fertilizers also include sulfur and calcium in plant accessible form. It is also likely to manufacture fertilizers that additionally hold magnesium and trace elements (zinc, boron, copper, manganese, molybdenum, etc.). These fertilizers are environmentally safe, as they are formed from the purest phosphate raw materials the apatite concentrate from Khibiny, Kola Peninsula. It is not radioactive and almost does not contain impurities harmful elements arsenic, mercury, cadmium, lead, etc. According to the consequences of vegetation and field agrochemical tests, carried out by Russian Agricultural Academy in honor of K.A.Timiryazev and the International Plant Nutrition Institute, it was establish that blended fertilizers based on complex PKS and NPKSfertilizers are of viable quality compared to like products based on triple superphosphate and mono ammniumphosphate (MAP), and even superior .Those are found that PKS-fertilizers are of intense slow release effect and continue to give plants with nutrients even the subsequent year after being introduce into the soil. The deliberate release effect of PKS-fertilizer occurs due to an intense frame of poorly soluble dicalcium phosphate (DCP) and calcium sulfate in the structure of the granule that prevents premature leaching of soluble fertilizer components. The liberate rate of nutrients can be attuned by altering the amount of calcium carbonate complete for neutralization of acid mixture, also by altering the result particle size composition and by introduce nitrogen-containing additives into it. An enhance in amount of calcium carbonate leads to an increase in the content of poorly soluble dicalcium phosphate (DCP) in the product, which is well plant accessible. Figure 4 shows the characteristic curve of relative content of phosphorus in water soluble and plant available forms, depending on amount of calcium carbonate introduced. You can see that with an enhance in amount of calcium carbonate, the content of a water soluble form of phosphorus decrease and the content of plant-available form stays almost the similar. The stoichiometric amount of calcium carbonate is designed so that to neutralize a mixture of WPA and sulfuric acid ensuing in calcium sulfate and monocalcium phosphate (MCP). For comparison, here is given the data for NPK-fertilizers of the majority popular grades. You can see that an enhance in the average diameter of the granule of PKS- and NPKS-fertilizers leads to an reduce in its dissolution rate. According to the consequences of lab vegetation tests, it is also

This work is partly presented at 10th World Congress on Green Chemistry and Technology, July 10-11, 2019, Paris, France.

proved that bigger granules are of a further slow-release effect. Beginning of nitrogen into the composition of PKS-fertilizer give to an improve in its dissolution rate due to increase of extremely soluble salts into the structure of the granules. NPKS-fertilizers, with nitrogen content of more than 2-3%, almost do not have a deliberately release effect and in terms of conclusion rate tend to be like the standard NPK-fertilizer grades.

Conclusion:

The planned technology is restricted by three patents of the Russian Federation and was efficiently implemented at one of the Russian plants in 2014. Nowadays, upgrading and modernizing of this manufacture unit is ongoing, with JSC "NIUIF" taking active part in it, both regarding capacity and give way raise, as well as product range improvement.

This work is partly presented at 10th World Congress on Green Chemistry and Technology, July 10-11, 2019, Paris, France.