Green Urea Towards Agriculture 4.0

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Abstract

The global food demand and pace of agriculture industry is expected to grow in exponential manner with the estimated increase of human population of 9.8 billion by 2050. One of the highlighted sustainability issues here is the production and utilization of fertilizer in the context to feed the world population. Urea or the nitrogen-based fertilizers are essential yield determining factor at early stage of crop growth. The conventional production of nitrogenous fertilizers highly depends on Haber-Bosch method. Haber-Bosch is one of the world's greatest inventions and has tremendously made synthetic nitrogen fertilizer vastly available and affordable. Nevertheless, the production process has caused unintentional population booms and serious environmental blue prints due to high consumption of temperature and pressure. In the current time frame, many studies have embarked on the need to provide a possible solution for the global nitrogen challenges. The novelty in our research lies through integration of electromagnetic and nanotechnology in synthesizing ammonia for urea production. Ammonia gas was synthesized using novel in-house designed urea reactor in a magnetic induction zone, which reduced the conventional reaction temperature (400-500 °C) and pressure (150-300 bar) to about 50 %. In spite of this new technology, urea still faces solubility constraints when applied in agriculture field whereby only 40 % is efficiently utilized by crops and the rest are lost through volatilization and ground water leaching. Therefore, in order to provide a complete solution of Green Technology, coating technology with slow release properties has been initiated. Integration of Green Urea via vertical farming and digital technology for smart farming techniques would place Green Urea to be in line with Agriculture 4.0. Therefore, the direction of Green Urea towards Agriculture 4.0 would definitely make a great impact on the socio-economic development in the context of sustainability.