Reactor Design for Novel Green Urea Synthesis

Datenbank
TEMA, Copyright WTI-Frankfurt eG

Deskriptoren
Harnstoff; Syntheseverfahren; Reaktordesign; nachhaltige Entwicklung; chemischer Prozess; magnetisches Feld; Hämatit; Hochtemperatur; Nanotechnologie; elektromagnetisches Feld; Hochdruck (Mechanik); magnetische Feldstärke; Treibhaus-Effekt; Ammoniakproduktion; chemische Reaktion; Kohlendioxidemission

Abstract
Urea synthesis processes have been carried out at relatively high temperature (160-270 °C) and high pressure (120-250 bar). The use of high temperature and high pressure in urea synthesis is essential to increase production rate that would result in high profitability. New reaction method is proposed to produce the urea that requires lower pressure and temperature as compared to the conventional urea synthesis. This method is clean and green, used for the sustainable development that might change the landscape of future chemical processes. However, this is made possible due to the enhancement in nanotechnology where quantum mechanical understanding is called into play. New reactor designs are elaborated and discussed explicitly. Hematite nanocatalysts are used for this green urea synthesis process, in the presence of static and oscillating magnetic fields. Strategies to increase single to triplet conversion rate are performed for the better understanding on how to increase the urea rate of production. The focus on scrutinizing the greenhouse gas effect on the urea yield, in this case CO(ind 2) flow rate, is deliberated explicitly. The magnetic field strength and electromagnetic frequency are studied and empirically done for better understanding in singlet to triplet conversion. The highest urea yield of 17,472 ppm was obtained using a 1T static magnetic field, electromagnetic field of 5 GHz frequency, and 0.2 L/min CO(ind 2) flow rate. It is found that in the case of the pilot-scale reactor, urea yield has its optimum yield, 0.6 kg/hr, at 200 °C, 50 bar, and 3.25 GHz microwave frequency. This new method is a contender for urea and ammonia production that may change the landscape of chemical reaction in the future especially when zero carbon dioxide emission is required for the future sustainable development.

Autor
Yahya, Noorhana

Institution
Universiti Teknologi PETRONAS, Tronoh, MY

Quelle
Green Urea , For Future Sustainability, in: Green Energy and Technology * (2018) Seite 61-98 (38 Seiten), Paper-Nr. Chapter 3