

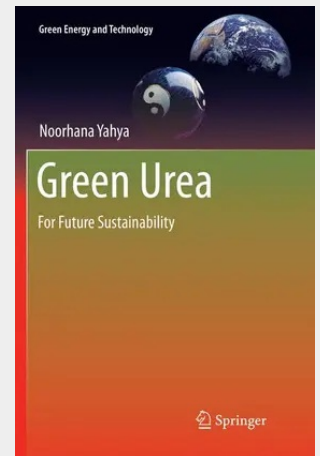
Green Urea

For Future Sustainability

This book presents a game changing technology of lower energy-intensive urea production of urea which is used as fertilizer. The technology, from a resource to a knowledge-intensive based industry, investigates a new synthesis approach employing electromagnetic induction and nano-catalyst at lower energy consumption. This clean and green method for a sustainable future might change the landscape of future chemical processes. It is made possible due to the enhancement in nanotechnology where quantum mechanical understanding is called into play. New reactor designs are elaborated on and discussed explicitly. Hematite and nickel oxide nanocatalysts are proposed for the green urea synthesis process, in the presence of static and oscillating magnetic fields. Strategies to increase single to triplet conversion rate are given for better understanding of the improved urea rate. The focus is deliberately on scrutinizing the greenhouse gas effect on the urea yield, in this case CO₂ flow rate. Coating techniques for slow release strategies are provided to reduce the volatilization of ammonia and leaching effect, hence offering a complete solution of Green Technology. Agriculture 4.0 that creates the new patterns and precision monitoring of crop rotation and livestock utilization will be able to pave the way for better crop yield. Development of advanced technology in agriculture is important for the implementation of Agriculture 4.0 and currently an inevitable trend of the socioeconomic development in the context of broader international integration for the sustainable future.

The author would like to acknowledge Ministry of Higher Education (MOHE) for the grant worth RM 12 million to accomplish Green and Economical Urea project and to have full understanding on Green Technology in Urea. This book is a collaborative effort by her colleagues, Ku Zilati, Khanif, Shahrina, Zainovia, Azizah, Zakaria, and who have carried out the research over the past five years which started in 2011. Their unconditional commitment had brought us together and we completed the project with success. I wish to also thank Dr Menaka Ganeson and all my PhD students, Dr. Saima, Dr. Bilal, Mr. Zia and Mr. Irfan for their commitment to assist me to complete the book. Last but not least, thank you very much to Professor Mike Payne (Cambridge University) and Professor Koziol (Cranfield University) for the comments.

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