Abstract No: 201 ***Physical Sciences***

BIODEGRADABLE POLYMER-COATED UREA GRANULES AS A SLOW-RELEASE NITROGEN SOURCE

J.A.M. Dilhan[1*], R.M.G. Rajapakse[1,3] and N.M. Adassooriya[1,2]

[1]Postgraduate Institute of Science, University of Peradeniya, Sri Lanka
[2]Department of Chemical and Process Engineering, Faculty of Engineering, University of Peradeniya, Sri Lanka
[3]Department of Chemistry, Faculty of Science, University of Peradeniya, Sri Lanka
[*]malithdilhan0401@gmail.com

Urea is the most popular nitrogenous fertilizer due to its relatively low cost and high nitrogen composition. However, approximately 30-50% of urea is only utilized by plants resulting in low nutrient use efficiency (NUE). Several environmental issues originate *via* the loss of urea throughout various processes, such as direct volatilization, accumulation of urea via runoff, and leaching of urea as nitrates. Controlled-release fertilizers (CRFs) are one of the promising methods to increase NUE and minimize environmental impact. During this study, attempts were made to synthesize biodegradable polymers coated urea granules using cellulose acetate (CA) and polyvinyl alcohol (PVA). 4.5% (v/v) CA solution was prepared in acetone at room temperature with constant stirring at 800 rpm, and this solution was coated on urea granules by the solvent casting method. 3% (v/v) PVA solution was prepared by dissolving PVA in distilled water at 80 ℃ with constant stirring at 1,000 rpm. Then 30% (w/w) by polymer mass citric acid was added as a crosslinker to the PVA solution after it cooled to room temperature. This solution was sprayed on CA-coated urea granules to synthesize CRFs (UCPC30). Finally, CRFs were dried at 105 ℃ for 2.5 h for cross-linking. The successful polymer coatings were confirmed by Fourier transform infrared spectroscopy, powder X-ray diffraction, and scanning electron microscopy. The release behaviour of the prepared polymer-coated urea was investigated in the soil medium (pH=5.9), and it was observed that 92% of urea was released from the CRFs in a slow and sustained manner for up to 16 days. Meanwhile, 90% of urea was released from commercial grade within 8 days. The porous hydrogel matrix of the PVA regulates the penetration of urea molecules and extends the release time. Therefore, biodegradable polymer-coated urea granules are ideal candidates for slow-release fertilizer.

Keywords: Biodegradable, Controlled release fertilizers, Nutrient release efficiency, Release behaviour