Alginate/cellulose beads as supports for slow-release of nutrient

Mailson de Matos[1], Bruno Dufau Mattos[1], Washington Magalhães[2]

[1]Universidade Federal do Paraná, [2]Empresa Brasileira de Pesquisa Agropecuária

e-mail: mailsondematos@gmail.com

A total of 9 billion inhabitants is estimated by 2050, which will put a heavy pressure towards an increased cereal yield of at least 40% [1]. The smart systems for nutrient delivery could be used to increase the cropland productivity and biodegradable supports are especially needed to decrease the bio-accumulation of the synthetic materials. Thus, alginate and cellulose were chosen to encapsulate nitrogen and further release it. Briefly, the encapsulated systems were synthetized as follow: solutions containing ammonium nitrate, sodium alginate, cellulose nanofibrils and nano-silica were prepared. Each mixture was dropwise added into the calcium chloride (50 wt%) crosslinking agent solution. After the bead-forming reaction, the obtained material was filtered and dried at 60°C. The characterizations were performed by using X-ray diffraction (XRD), energy-dispersive X-ray spectroscopy coupled to scanning electron microcopy (SEM-EDS), Fourier-transformed infrared spectroscopy (FT-IR) and release tests according to DIN EN 13266:2002. In general, the nano-silica was important for better handling the obtained beads; however, it changed the bead morphology and tended to increase the release rate of nitrogen. The best formulations were obtained with the presence of cellulose nanofibrils and few amounts of silica in the beads. At these compositions the systems follow the criteria of slow-release purposes, *i.e.*, 15% released after 24h and less than 75% after 28 days.

Acknowledgements:
We would like to thank Coordenação de Aperfeiçoamento de Pessoal de Nível Superior and Fundação Araucária for the scholarships

References:

[1] Maxmen A, Nature vol. 501 (2013)