

Fabrication of a Chitosan/Alginate/TiO₂ Based Carrier System for the Encapsulation of Gibberellic Acid and Investigating their Release Profiles

D. N. A. Arachchi^{1,2}, R. M. De Silva¹, K. M. N. De Silva¹

¹*Department of Chemistry, Faculty of Science, University of Colombo, Sri Lanka*

²*Department of Limnology and Water Technology, University of Ruhuna, Sri Lanka*

This work aims the development of a novel chitosan/alginate based carrier system namely, chitosan/alginate/nanoTiO₂ (CS/AL/TiO₂) for the encapsulation of Gibberellic Acid (GA₃), a plant growth regulator, and the investigation of its pH-based release profiles. The carrier system with the same polymer blend was also prepared without TiO₂ nanoparticles to comparatively investigate the effect of TiO₂. Both carrier systems were prepared by gelation method, with each containing final concentration of 50 µg mL⁻¹ of GA₃. The releasing studies were carried out using a system with acceptor and donor compartments, where the donor compartment is a cellulose membrane with a 14 kDa exclusion pore size. Samples, including carriers and free GA₃, were separately placed in donor compartments. The acceptor compartment contained CaCl₂ solution (11 mM) for all the systems. Aliquots were periodically collected from the acceptor compartments, and cumulative releasing percentages were determined at room temperature, at two different pH (pH 2 and 8), using a UV-visible spectrophotometric method. After 6 hrs., CS/AL/TiO₂ system exhibited a 6.58%, and 13.16% release at pH 2, and pH8 respectively. In the same duration releasing percentages of the carrier without TiO₂ were recorded as 7.89%, and 14.21 % at pH 2, and pH8 respectively while that for the free GA₃ at the considered pH conditions were correspondingly 14.47%, and 19.74%. The CS/AL/TiO₂ carrier system reached a maximum after 96 hrs. at both the pH showing maximum release percentages of 91.27, and 96.29 respectively at pH 2, and 8. Both the free GA₃ and CS/AL reached a maximum release after 72 hrs. and that for the CS/AL blended carrier was 60.59% at pH 2 and 85.56% at pH 8 while those for free GA₃ were 74.94%, and 91.57% correspondingly at pH 2 and 8. Both studied systems exhibited an enhanced release in alkaline medium compared to acidic conditions, convincing the suitability of higher pH to facilitate the release. Moreover, results suggested that the carrier system incorporated with TiO₂ nanoparticles is better at achieving a slow release compared to the carrier without TiO₂.

Keywords: *Chitosan, Alginate, Gibberellic Acid, TiO₂*