

Controlled-Release Fertilizer Based on Cellulose Encapsulation

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Abstract. Phosphor is a main component in a triple super phosphate (TSP) fertilizer needed by plants. But, phosphor is very soluble in the water so it easily removed from the soil, flowed down the river, and caused algae bloom problem. The solution for this problem is by coating the conventional fertilizer with cellulose based material. Coated fertilizer is expected to have a phosphor controlled-released behaviour so the phosphor is available for a longer time in the soil. The research deals with studying mass and phosphor release behaviour of cellulose based fertilizer and also the effect of water content on the media. The commercial granular fertilizer NPK 21-22-21 was coated using cellulose acetate. The coatings were formed by spraying technique. The concentration of the cellulose acetate solutions used for spraying 7 %wt. Comparing to commercial fertilizer, the cellulose acetate encapsulated fertilizer was releasing the phosphor in a slower manner. From the experiment, the lower water content on media also give lower mass and phosphor release. So, the conclusion was cellulose based coating could improve the performance of the commercial fertilizer by maintaining the higher amount of phosphor in the soil. The mass release behaviour follows Non fickian or anomolous transport with the release exponent is 0.5772

Introduction

Nowdays, providing food for people all over the world becomes one of challenges in the agriculture field. Significant increase in the world population gives problem on agricultural production. Unfortunately, the resources such as land and water are limited and tend to decrease both quantity and quality. To increase the quality of soil health, farmers tend to utilize high doses of fertilizer and they hope that the crop per hectare will increase. However, this practices not only decrease the quality of soil but also they limit the plant growth, give bad impact in environment and economic losses. Because of the negative effects, there is a need to manage the fertilizer utilization by using environmental friendly and also effective nutrient released fertilizers. [1] Encapsulation of fertilizer can be alternative to promote sustainable agriculture by providing controlled release fertilizer. By using controlled-released system, the macronutrient can be released at a slower rate during specified time so that it can be absorbed by the plant as its need without eutrification. [2] The controlled release system enhanced the effectiveness of nutrient delivery to the plants. A slow controlled release fertilizer by coating have been recently developed by different polymer based materials. Han et. al used starch/polyvinyl alcohol as coating on slow controlled-release fertilizer. [3] Another research used poly(acrylic acid-co-acrylamide)/kaolin composite to developed a controlled -release fertilizer. [2] In