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Fabrication of graphene oxide/polymer latex composite film coated on KNO_3 fertilizer to extend its release duration

Di An, Boyang Liu, Ling Yang, Ting-Jie Wang* and Chengyou Kan

Department of Chemical Engineering, Tsinghua University, Beijing 100084, China

*Corresponding author: Phone: +86-10-62788993. Fax: +86-10-62772051. E-mail: wangtj@tsinghua.edu.cn.

Abstract: The application of a polymer film coated fertilizer can increase nutrient utilization efficiency and reduce environmental pollution, and polymer latex is an environmental friendly coating material with a promising future. However, because of the hydrophilicity of the film formed from polymer latex, it is difficult to achieve film coated fertilizer with a long release duration and a low consumption of the coating materials. Through spray coating in a fluidized bed, the sandwich structure of a composite film, i.e., polymer film/graphene oxide membrane/polymer film, was coated on KNO_3 granules. Because of the longer diffusion path for the hydrated K^+ and NO_3^- diffusing within the graphene oxide membrane and the slower diffusion rate caused by cation- π interactions between the hydrated K^+ and graphene oxide, the release duration of the film coated KNO_3 fertilizer was extended. For the pure polymer film coated KNO_3 granules, the release duration was 24 days, while the release durations of the composite film coated KNO_3 granules were extended to 26, 29, 34 and 38 days when the amounts of graphene oxide in the coating were 0.18%, 0.72%, 1.43% and 2.86% of the film, respectively. It is shown that graphene oxide has great potential in applications in the field of controlled release fertilizers.

Keywords: Graphene oxide; Polymer latex; Coated fertilizer; Release duration; Potassium nitrate

1. Introduction

The application of polymer film coated fertilizer can increase the nutrient utilization efficiency and reduce environmental pollution [1-4]. The polymer film coated on the fertilizer granules acts as a physical barrier to slow down the release rate of the nutrients to reduce the loss of the fertilizer nutrient in the environment. The release duration, i.e., the time the coated fertilizer takes to release a specified

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