UNIVERSITI TEKNOLOGI MARA

MOISTURE FORMATION IN UREA COMPOUND VIA BALL MILLING TECHNIQUE

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ABSTRACT

Moisture formation in urea calcium phosphate fertilizer were synthesized by using ball milling technique. Prolonged milling time can cause moisture formation in the presence of water that makes the mixture wet and sticky. In this study is to find the best optimum milling time to avoid moisture formation of urea compound and to investigate the moisture formed in the compound during milling at 2 to 14 minutes. Physical observation and sample characterization were analyzed by X-Ray Diffraction (XRD), Thermal Gravimetric Analysis (TGA), and Fourier Transform Infrared (FT-IR) spectroscopy. It is observed that the product is in solid powder form at 2 minutes and become clumpier from 4 to 12 minutes. However, wet and sticky mixture was observed after milling for 14 minutes. The X-ray diffraction pattern of urea calcium phosphate shows the matching peaks with urea calcium hydrogen phosphate with a chemical formula of $Ca(H_2PO_4)_2.4CO(NH_2)_2$. TGA result shows that the moisture starts to develop at 4 minutes, become clumpier until 12 minutes and produce wet and sticky condition at 14 minutes. FTIR analysis shows that the moisture development in urea compound correspond to the reaction between urea and monocalcium phosphate monohydrate due to higher temperature in ball milling. From these results, the moisture formation in urea compound during ball milling was investigated and the optimum milling time to avoid moisture formation was determined.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Fertilizers are materials containing the chemical elements that enhance growth and productivity of plants. Fertilizers plays an important role for preserving and improving agricultural output by way of retaining soil fertility, increasing yields and improving harvest satisfactory.. Urea is one of the most important of all solid nitrogen fertilizer. Urea fertilizers are the primary fertilizers that have been commonly used (Sahrawat, 1980).

In the past four decades, increase in demand of chemical fertilizer worldwide has cause increase in agricultural activities in which the impact of global production growth. Urea by definition is a fertilizer which also call as carbamide, an organic compound with the chemical formula $CO(NH_2)_2$ (or $H_2N.CO.NH_2$) in which the molecule has two amine ($-NH_2$) groups joined by a carbonyl functional group (-CO-). Urea is classified as highly hygroscopic due to its strong ability of absorbing and bonding water. According to (Frazier, Lehr, & Smith, 1967), urea reacts with monocalcium phosphate monohydrate in concentrated superphosphate to form the adduct $CaH_2PO_4.4CO(NH_2)_2$.

According to (Kieback, Kubsch & Bunke, 1993), high energy ball milling (HEBM) is referred to as a simple, effective and economically method for the manufacturing of amorphous and nanostructured substance. Non-equilibrium intermetallic compounds and supersaturated solid solution are form resulting from longer milling time. According to (Suryanarayana & An, 2006), milling conditions for different systems and composition of the powders determine the products that produce during high energy ball milling.

It was also reported that prolonged milling time can cause clumpy and wet sticky condition of the mixture that are cause by the hydrate water released from monocalcium phosphate monohydrate in the reaction when milling for a longer time. In this study is to find the best optimum milling time to avoid moisture formation of urea compound. The