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LIMESTONE AND DOLOMITE POWDERS FOR COATING OF AMMONIUM NITRATE PRILLS

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It is a common practice to use fertilizers in the form of granules. Due to high nitrogen content (35%) ammonium nitrate (AN) is one of the most widespread nitrogen mineral fertilizers used in agriculture [1]. AN granules have poor strength and hence they are breakable both during storage, transport, and distribution, which makes them dusting and hard to handle. Furthermore, AN dust as such is a risk for health. Thermal instability of AN makes its handling and storage unpredictable which has led to several catastrophic explosions [2]. Using combined TG-DTA-FTIR technique, it was found by us that limestone and dolomite coating stabilize AN due to interactions between AN and Ca, Mg - carbonates with the formation of Ca, Mg - nitrates excluding exothermic explosive decomposition of AN [3]. Coating is also aimed to increase a particle size in order to achieve better blending with other fertilizers and offering protection from moisture.

This study aims to investigate the formation of lime-containing covering on AN prills surface. Limestone and dolomite samples from different Estonian deposits (previously ground to a particle size $<160\ \mu\text{m}$ in a ball mill) were used as covering materials. The experiments were carried out on a laboratory plate granulator with a diameter of 0.55 meters, angle of inclination between $30\text{-}45^\circ$, and rotation velocity 23 or 28 rpm. Saturated solution of AN (47.3 wt. %, density $1,086\ \text{g/cm}^3$) was used as a binder. The surface observations of cross-section of coated AN prills were carried out with a scanning electron microscope Jeol JMS-8404 (Fig. 1). Used granulation technology allowed to create a homogeneous covering of the set thickness.

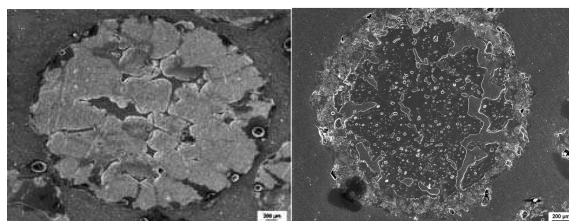


Fig.1. SEM pictures of the cross-sections of neat AN prill (left) and AN prill coated with Anelema dolomite powder (right) (magnification $\times 10$)

The yield of granules with diameter between 2-5 mm and with covering thickness between $200\text{-}300\ \mu\text{m}$ reached up to 91 mass%. The strength of the covered granules exceeded the strength of the neat AN prills in 4 - 8 times. Results of experiments showed that coalescence of powder particles occurs better at lower rotation velocity and bigger angle of inclination of plate.

References

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3. I. Rudjak, T.Kaljuvee, A.Trikkel, V.Mikli, *J. Therm. Anal. Cal.*, (2010) DOI 10.1007/s10973-009-0391-y.