

Coating contact angle as a predictor of fertilizer stability in highly humid conditions

Colin Rivers¹, Shervin Kabiri², Roslyn Baird¹, Ashleigh Broadbent¹, Rodrigo da Silva¹, Fien Degryse¹, Bogumila Tomczak¹, Mike McLaughlin^{1,3}

¹Fertilizer Technology Research Centre, University of Adelaide, ²School of Chemical Engineering, University of Adelaide,

³CSIRO Land and Water

The critical relative humidity (CRH) is the relative humidity at which a fertilizer begins to absorb moisture from the atmosphere. A relatively high CRH is advantageous for a fertilizer, because products with low CRH may become wet in storage or transport resulting in bridging and caking when exposed and handled under highly humid conditions. One way to increase the CRH of a fertilizer is to apply a hydrophobic coating which will resist water ingress. There are a large range of hydrophobic coatings which may meet this criteria. Screening coatings for efficacy in raising the CRH involves spraying coatings evenly over the fertilizer surface, which sometimes requires heating, followed by replicated moisture uptake measurements at five relative humidities between 50 and 80%RH in constant humidity chambers. Instead of this elaborate method, a fast accurate screening method for coatings would be useful. Here we present a rapid technique based on measurement of water droplet contact angles on microscope slides, and their use to quantify the degree of hydrophobicity of a range of water-repellant coatings, and hence their potential utility in raising the CRH of fertilizer granules. This angle is measured between the edge of a water droplet in contact with the surface of interest. A high angle indicates a low degree of wetting of the coating, representing a high degree of hydrophobicity. A diverse range of coatings including biopolymers, waxes, fats and resins produced angles ranging between 20° and 114°. The CRH of fertilizers coated with these materials will be compared to CRH measurements on the same products to determine if contact angle measurements serve as a useful screening method to select coatings that increase CRH and reduce fertilizer caking.