"Evaluation of hygroscopic salts and drying beads to effectively dry corn during ambient storage"

In the humid tropics, approximately one third of the total food produce is lost prior to reaching the consumer. High commodity Moisture Content (MC) at harvest, and high Relative Humidity (RH) during storage enable the growth of fungi that produce toxic compounds, such as aflatoxins. Over 4.5 billion people are chronically exposed to aflatoxins in their food. Therefore, we evaluated the use of seven desiccants (treatments), including six widely available hygroscopic salts (ammonium nitrate, magnesium chloride, potassium carbonate, sodium bromide, sodium carbonate, and sodium iodide), and a powerful custom desiccant (drying beads http://www.dryingbeads.org/) to study their effectiveness in dehydrating corn (water weight removal). These desiccants achieve their hygroscopic properties through their ability to form stable hydrates in contact with water. The desiccants attract the lone pairs on water oxygens through the formation of hydrogen bonds. This allows the desiccants to adsorb the surrounding moisture.

For each treatment and the untreated control (no desiccant), a group of 12 mesh bags (samples) holding 50 g of corn containing approximately 20% MC were placed at 3 different levels (approximate bottom, centroid and top) in a 20 lt bucket, surrounded by 11.5 kg of corn. This enabled the creating of a double-sack treatment, where a larger group of corn from the same treatment surrounded the samples of corn. In the centroid of each bucket, 1 kg of desiccant packaged in a permeable film (Tyvek®, DuPont, Inc.) was placed before sealing the buckets. During ambient temperature (25 °C) storage (12 days) and to validate the drying process, the RH and temperature of each treatment was recorded at 3 different locations (bottom, center and top) using capacitive sensors (ZSeries wireless probes, Omega Engineering, Inc.). After data analysis, it was determined that the salts magnesium chloride, potassium carbonate, and sodium iodide were most effective in removing water from the centroid of the experiment, with an average of 3.75 grams, 2.16 grams , and 2.23 grams subsequently. The projects long-term goal is to empower food producers and packagers to better dry and store their produce, while minimizing the energy and infrastructure required to preserve their quality and safety.