Coating variation at the edge of a tablet: An experimental study of droplet impact behavior.

The behavior of a single liquid droplet impacting on a solid surface is a complex phenomenon and is a basic component of various industrial processes. One such process is the film coating process in the pharmaceutical industry, where coating uniformity is important especially if the coating is for functional purposes. Coating variability on a single tablet could occur anywhere on the tablet surface; however, the points of maximum variability are often at the edge of the tablet. To understand this phenomenon, a series of experiments was conducted to capture the impact behavior of a single 60-micron droplet on edges of a tablet. Both sharp and round tablet edges were investigated. A high-speed camera, with a capability of capturing up to 2000 images per second and a microscope with 10x magnification were used to record the spreading and penetration behavior of the droplet. On the round edge of a tablet, the spreading and penetration rates were found to be almost identical to the rate on the flat surface. However, on the sharp edge of a tablet, the penetration rate was found to be much faster than the spreading rate. This is believed to be due to the non-homogeneous packing at the sharp edge that gives rise to a porous region around the edge. A series of experiments to measure the impact behavior of 2-mm droplets on identical tablet edges was also conducted. Due to the tablet and the droplet size ratio, these two droplet sizes demonstrated different impact behavior especially when impacting on the higher curvature (sharper) edge. For the bigger droplets, surface tension becomes important at the impact and helps to hold the droplet shape before it slowly penetrates into the tablet. For the smaller drops, the impact is similar to that on a flat surface.