Abstract

An optical tensiometer is a scientific instrument that measures contact angles by analyzing the shape of sample liquid droplets. Typically, the volume of droplets for such measurements lies within the microliter range. Therefore, the imaging system must be capable of obtaining images of a tiny object while maintaining a substantial contrast between the background and droplet. Ideally, a telecentric lens combined with a high-resolution camera and a collimated background light provides images with consistent magnification, low distortion, and high resolution at an optimum contrast level. However, using such components might lead to a higher production cost, and, as reported in this thesis, comparable results can be achieved with a zoom lens, high-resolution camera, and LED backlight.

This thesis describes the considerations and evaluations for selecting the correct optical components to build an efficient and cost-effective imaging system for an optical tensiometer. It dives deeper into the parameters that limit an imaging system's performance, describes an ISO (International Organization for Standardization) standard method used for evaluating optical components, and compares the evaluation for several objective lenses to illustrate the selection procedure in practice.