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Protease Assay on QCM (Quartz Crystal Microbalance)

Quartz crystal microbalance (QCM) technology allows for the measurement of small mass changes on its surface by relating these mass changes to changes in frequency of an oscillating quartz crystal. Consequently, the QCM is able to quantify the interactions between small biomolecules such as proteases or enzymes that catalyze important physiological reactions. Proteases also play important roles in industry, food processing and medical treatment, but ironically, they can also be weaponized and used in biological and chemical warfare. Consequently, safe, accurate, and efficient protease assays are needed to determine the activity of various proteases. The QCM offers the possibility of protease activity detection by relating a mass change on its surface caused by protease cleavage to a commensurate frequency change. This work investigates the immobilization of gelatin utilizing protein absorption to gold as a substrate for trypsin cleavage. Two methods were performed in developing this assay. In the first method, gelatin attached to the crystal surface had a certain mass and frequency. The protease trypsin was introduced to the crystal surface to cleave or release gelatin from the crystal surface and cause a frequency increase. In the second method, trypsin and gelatin were incubated together then applied to the crystal surface and expected to produce a larger frequency decrease than a control solution with no trypsin. It was concluded that the QCM is able to detect protease cleavage using both methods.