Abstract

Early development of real-time antibody detection system using quartz crystal resonance sensor device

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With the global introduction of the Covid-19 pandemic contributing to hospital logistical systems becoming dangerously overwhelmed, it has become necessary for diagnostic systems to become faster, cheaper, and more accurate to face the complex avalanche of modern patient care. To help solve these concerns, we have performed this study in early development for an enhanced antibody detection and quantification tool to detect blood serum coronavirus antibody levels. Our ultimate goal was to test the prediction that a plug and play mobile device using similar quartz crystal resonance sensors would provide a suitable foundation to improve on current rapid test covid antibody detection capabilities with the added capability of antibody quantification data. We have been running nano-mass sensor test runs using the openQCM Q-1 quartz crystal microbalance. This device can accurately detect molecular mass variations to serum applied which are bound to its copper sensor surface. To test the detected mass difference when antibody is bound we have performed test runs with both receptor binding domain and whole spike protein. When each component is added to the sensor, the resonance produced can be converted to mass data. The difference in mass measured from addition of the antibodies compared to when Receptor Binding Domain or spike protein are added alone can provide data used to calculate the number of antibodies bound. The potential application of a device similar to this is with real time covid antibody quantification and diagnosis. Based on the consistency of data collected and the speed of data collection this study supports the hypothesis. Future experiments would determine optimal protocol enhancements to further increase speed of data collection as well as determine data ranges for whole blood serum for detecting antibody presence accurately and potentially save the lives of Covid-19 patients' worldwide.