A Highly Selective and Sensitive Novel Biosensor Capable of Quantifying and Monitoring a Clotting Factor Elevated in Severe COVID-19 Cases

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In order to prevent blood clots in severe COVID-19 cases, a highly selective and sensitive biosensor capable of quantifying trace levels of thrombin using the combination of a single stranded DNA (ssDNA) aptamer (TBA) and a complementary probe of thrombin was developed. TBA rapidly binds with thrombin in the presence of the complementary probe, whereas it binds with the complementary probe to form a double stranded DNA (dsDNA) in the absence of thrombin. SFC (or Chamel) green, luminescent dyes, inserted into dsDNA cannot emit light in a 1,1'-oxalyldiimidazole chemiluminescence (ODI-CL) reaction, whereas they emit bright light in the presence of G-quadruplex and the complementary probe. Thus, the brightness of the light from the biosensor with ODI-CL detection was proportionally enhanced with the increase of thrombin in a sample due to the increase of G-quadruplex and reduction of dsDNA. The limit of detection (LOD) of the biosensor operated with a good linear calibration curve (0.01-0.32 U/ml) was as low as 0.003 U/ml. Also, the biosensor quantified trace levels of thrombin with good accuracy, precision, and reliability within a statistically acceptable error range. In conclusion, the principle and concept applied for the first time to develop the biosensor can be used in various research fields for the diagnoses of human diseases and the monitoring of toxic materials existing in food and nature.

Awards Won:

Third Award of $1,000

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