340nm UV LED excitation in time-resolved fluorescence system for europium-based immunoassays detection

In immunoassay analyzers for in-vitro diagnostics, Xenon flash lamps have been widely used as excitation light sources. Recent advancements in UV LED technology and its advantages over the flash lamps such as smaller footprint, better wall-plug efficiency, narrow emission spectrum, and no significant afterglow, have made them attractive light sources for gated detection systems. In this paper, we report on the implementation of a 340 nm UV LED based time-resolved fluorescence system based on europium chelate as a fluorescent marker. The system performance was tested with the immunoassay based on the cardiac marker, TnI. The same signal-to-noise ratio as for the flash lamp based system was obtained, operating the LED below specified maximum current. The background counts of the system and its main contributors were measured and analyzed. The background of the system of the LED based unit was improved by 39% compared to that of the Xenon flash lamp based unit, due to the LEDs narrower emission spectrum and longer pulse width. Key parameters of the LED system are discussed to further optimize the signal-to-noise ratio and signal-to-background, and hence the sensitivity of the instrument.