

METROLOGICAL EXPERTISE ON BD500

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Contents

Executive Summary	3
1. General	4
1.1. Single fluorescent particle	4
1.2. Basic considerations on fluorescence	5
2. Photodetector	6
3. Geometrical parameters	8
3.1. Field-of-view	8
3.2. Path length and flow time in detection zone	9
4. Thermal effects.....	11
4.1. Dark count effects	11
4.2. Thermal velocity effects	12
References.....	12
APPENDIX 1	14
APPENDIX 2	16



Executive Summary

The present report includes metrological evaluation of the specifications of device model Biodetector BD500, invented by IKO Science OÜ. The evaluation was conducted based on data (design principles, datasheets etc) provided by IKO Science OÜ and by performing site visits for device operation. The device with serial number 500000408 was observed in operation.

In the present work the performance of the device against the specifications was evaluated considering

- Photodetector in use,
- Geometrical parameters of radiation source location, air-channels and detection zone,
- Thermal effects in the device.

The main findings are:

- Minimum concentration of particles has been estimated to be in the range from 5 to 14. In addition, the minimum concentration of particles can depend on the properties of fore-optics, noise arising from associated electronics, instability of excitation sources ao.
- Maximum concentration of particles is evaluated up to 5 000 000.
- The claimed optical excitation power of 4 combined LED-sources is estimated to be high enough to fluorescence of Trp-molecules for concentration determination.
- The photon counting head device model H12386-110 from Hamamatsu used in the BD500 is functioning in linear regime up to maximum concentration specified.
- The field-of-view of the device BD500 is appropriate for detection of fluorescence providing path length of 46,1 mm. The selected air flow in the device $V=5$ L/min makes for flow time $t_{\text{det}}=28$ ms in the detection zone.
- Considering most probable thermal speed, the lightest particle which can be detected can have molar mass of approximately 9 kDa.
- When assuming the particle (protein) has a shape of sphere, the corresponding minimum diameter of that sphere could be $D=3$ nm even in the case if the air flow speed is added to the most probable thermal speed.
- The ambient temperature has an effect on the dark count rate of the photodetector used: according to the datasheet in the temperature range from 10 °C to 30 °C the dark count rate can change around one order of magnitude, which can have an effect on the minimum concentration in measurements.
- The specified operation temperature range has negligible effect on the minimum detectable size of a particle.

The list above can be extended by performing additional tests to include repeatability and reproducibility of concentration determination in certain ambient conditions following appropriate procedure, long-term stability of device properties and further evaluation of those contributions regarding achievable accuracy.