

## Supplementary material

# CMOS-based optical detection system for fluidic cellular medium pH quantification

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In Table S1 and S2 below, we present the standard deviation of the transmittance values and the slopes, when using the commercial setup. The transmittance values and the slopes when using the proposed miniaturized system are presented in Table S3 and S4.

Both systems present low errors, showing that the proposed miniaturized system is able to detect and quantify the pH value in a culture medium.

**TABLE S1** Standard deviation of the transmittance values obtained at 500, 560 and 600 nm using the commercial setup.

pH	500 nm	560 nm	600 nm
8.1	0.0011	0.0005	0.0029
7.6	0.0012	0.0008	0.0037
7.2	0.0021	0.0015	0.0030
6.6	0.0071	0.0019	0.0039
6.2	0.0022	0.0020	0.0030
5.4	0.0014	0.0021	0.0031

**TABLE S2** Standard deviation of the slopes using the commercial setup.

pH	500-560	560-600
	Standard deviation of the slopes	
8.1	0.000014	0.000075
7.6	0.000014	0.000086
7.2	0.000022	0.000075
6.6	0.000013	0.000096
6.2	0.000038	0.000075
5.4	0.000013	0.000091

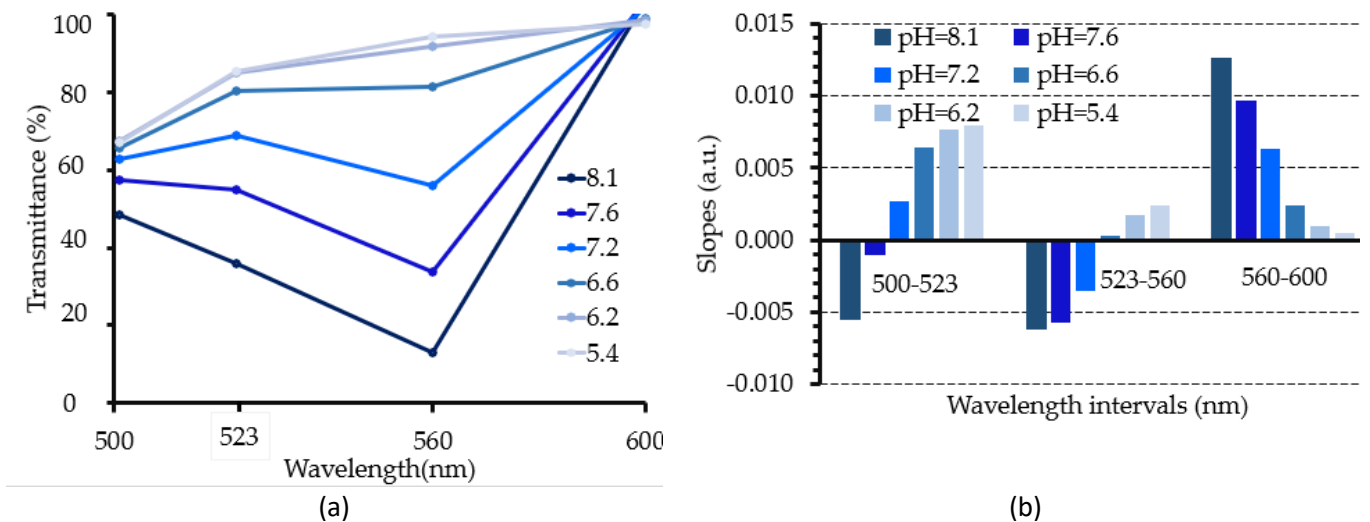
**TABLE S3** Standard deviation of the transmittance values obtained at 500, 560 and 600 nm using the proposed miniaturized system.

pH	500 nm	560 nm	600 nm
7.7	0.0039	0.0075	0.0026
7.3	0.0025	0.0111	0.0039
6.6	0.0020	0.0041	0.0175
6.2	0.0018	0.0047	0.0044
5.4	0.0153	0.0156	0.0039
4.4	0.0022	0.0018	0.0034

**TABLE S4** Standard deviation of the slopes using the proposed miniaturized system.

pH	500-560	560-600
	Standard deviation of the slopes	
7.7	0.000109	0.000200
7.3	0.000163	0.000217
6.6	0.000073	0.000340
6.2	0.000083	0.000071
5.4	0.000031	0.000319
4.4	0.000046	0.000084

Figure S1 (a) shows the transmittance of an additional wavelength (523 nm) that could be considered for the wavelength selection process, in an attempted to improve the obtained values. Figure S1 (b), presents the slopes between each wavelength (500-523 nm, 523-560 nm, 560-600 nm) and also shows that no improvements will be obtained with an additional selection. Moreover, if this additional wavelength was considered, four photodiodes would be required, increasing the size of the chip layout.



**Figure S1 (a)** Transmittance of the culture medium at different pH (8.1, 7.6, 7.2, 6.6, 6.2, 5.4) at the wavelengths under study (500, 523, 560 and 600 nm). **(b)** Slopes of the lines shown in figure S1(a), between wavelengths 500-523 nm, 523-560 nm and 560-600 nm. For each measurement  $n = 3$ .