Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B

Supporting Information for

A WATER SOLUBLE FLUORESCENT POLYMER AS A DUAL COLOUR SENSOR FOR TEMPERATURE AND A SPECIFIC PROTEIN

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Table S1. The photophysical characterization of the fluorescent monomer (**2**) dissolved in various solvents (δ_t: Hansen solubility parameter of solvents at 25 °C, δ_d, δ_p, and δ_h: the dispersive, polar and the hydrogen-bonding term of δ_t, respectively, $\lambda^{abs}{}_{max}$: wavelength of maximum absorbance, $\lambda^{PL}{}_{max}$: wavelength of maximum emission intensity, φ: fluorescence quantum yield, τ: fluorescence lifetime)

Solvent	δ_t [a)]	δ_d	δ_p	δ_h	$\lambda^{abs}{}_{max}$ [nm]	$\lambda^{PL}{}_{max}$ [nm]	φ [%]	τ [ns]
Diethylene glycol dimethyl ether	18.0 [b)]	15.7	6.1	6.5	413	455	75.0	2.37
Toluene	18.2	18.0	1.4	2.0	413	436	71.0	2.50
Chloroform	19.0	17.8	3.1	5.7	420	449	76.0	2.80
Cyclo-Hexanone	19.6	17.8	6.3	5.1	417	458	62.0	1.79
Acetone	20.1	15.5	10.4	7.0	414	460	18.2	0.61
Acetonitrile	24.6	15.3	18.0	6.1	415	463	8.1	0.29
Dimethylformamide	25.0	14.3	11.9	16.6	419	466	8.8	0.31
Dimethylsulfoxide	26.6	18.4	16.4	10.2	422	471	9.4	0.34
Ethanol	26.6	15.8	8.8	19.4	419	465	6.6	0.28
Triethyleneglycol	27.5 [b)]	16.0	12.5	18.6	424	470	27.0	0.95
N-Methylformamide	30.1 [b)]	17.4	18.8	15.9	420	468	9.0	0.42
Water	47.9	15.5	16.0	42.4	423	473	4.5	1.00

[a)] in units of [$mPa^{0.5}$] from J. E. Mark, ed., *Physical Properties of Polymers Handbook*, American Institute of Physics, Woodbury, N.Y., 1996;
[b)] from C. M. Hansen, *Hansen Solubility Parameters: A User's Handbook, Second Edition*, CRC Press, Boca Raton, FL, 2007

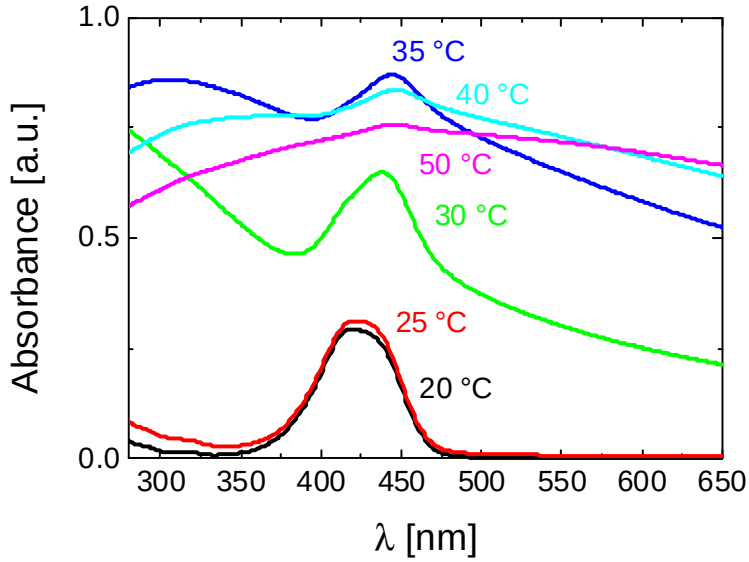


Fig.S1 Absorbance spectra of aqueous **P1** solution (0.5 g/L) at various temperatures.

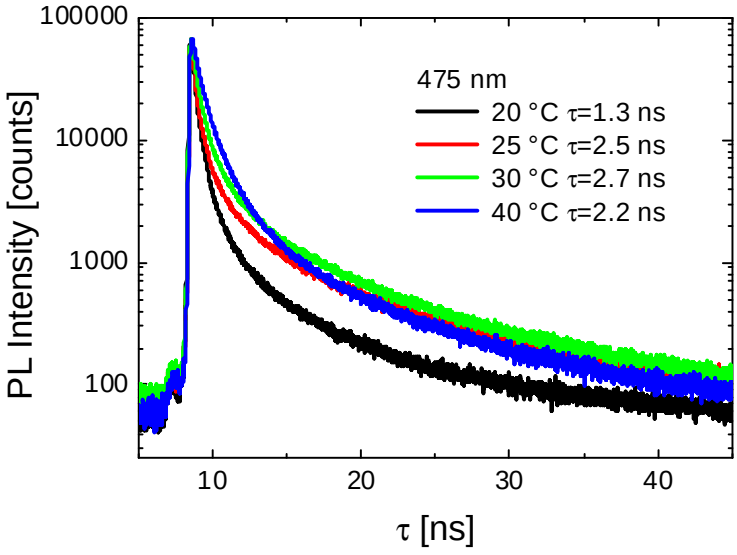


Fig.S2 Time-resolved PL traces of aqueous **P1** solution at 20, 25, 30 and 40 °C, with average lifetimes extracted according to Eq. 2. The sample is excited at 405 nm and the emission is detected at 475 nm.

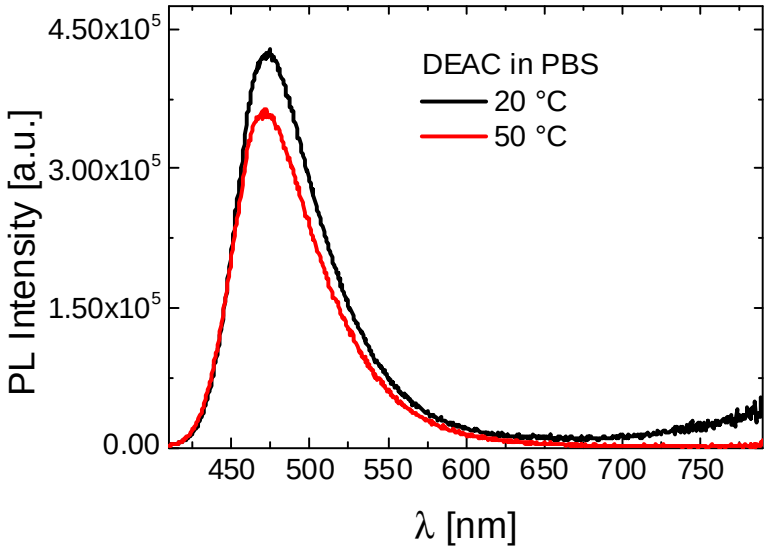


Fig.S3 Emission spectra of the DEAC-functionalized monomer (**2**) in PBS at 20 and 50 °C. Excitation wavelength is 400 nm.

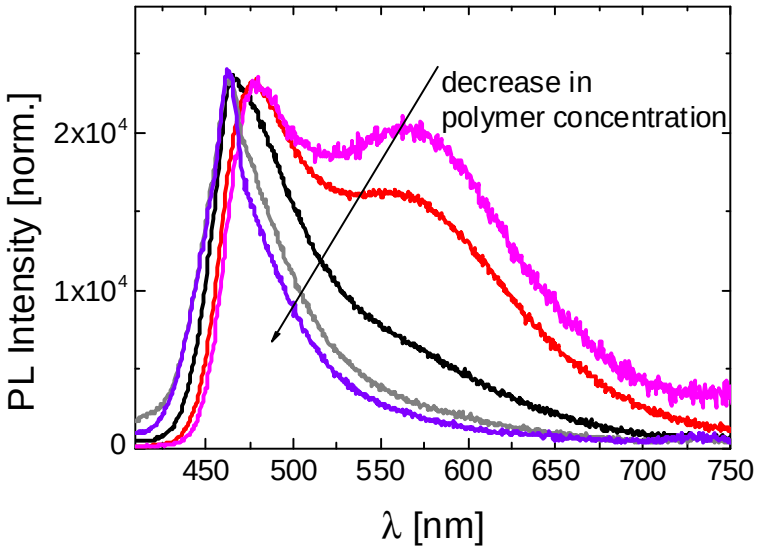


Fig.S4 The normalized PL spectra of aqueous solutions of **P1** at various concentrations at 20 °C. The direction of the arrow shows the decrease in polymer concentration from 0.1 to 0.0001 g L^{-1}.

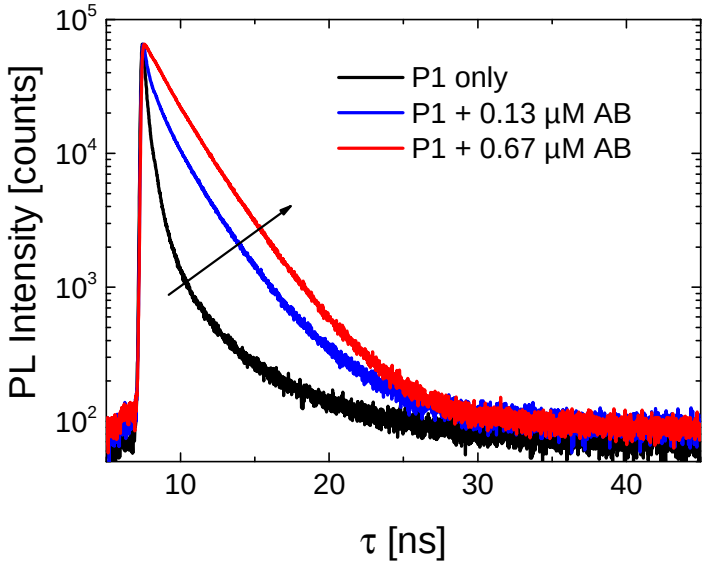
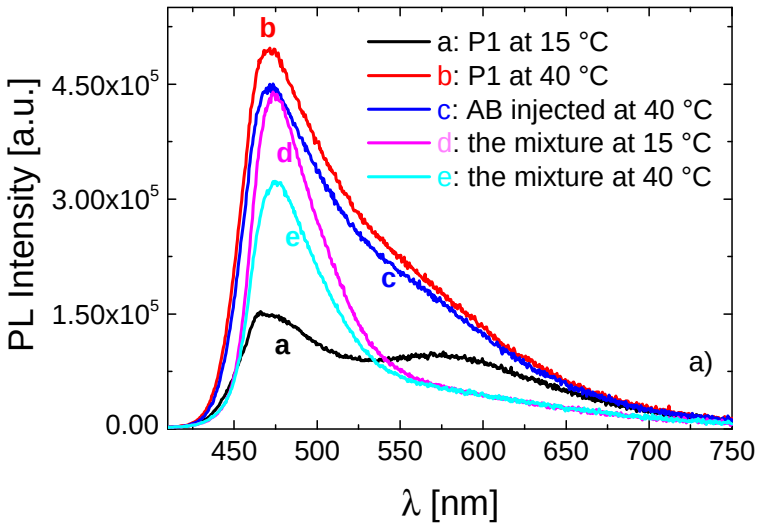


Fig.S5 Time-resolved PL traces of an aqueous solution of **P1** (0.005 g L^{-1}) with and without antibody (AB). The solution at 15 °C is excited at 405 nm and its emission is detected at 475 nm.



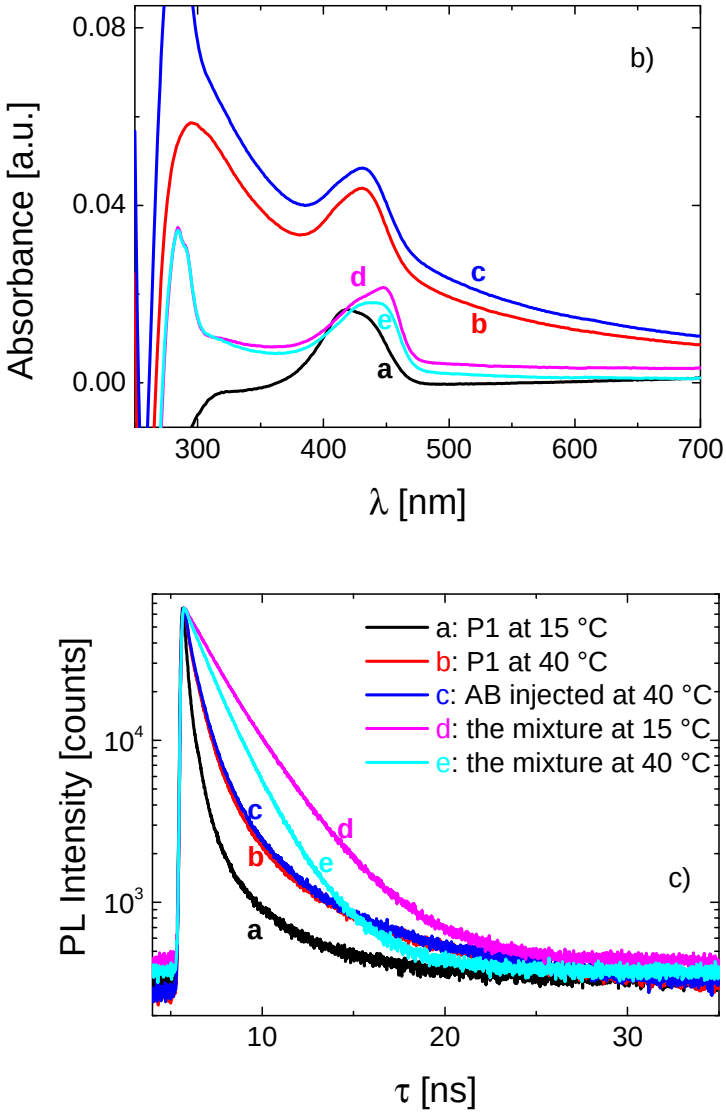


Fig.S6 Steady-state emission **a)** and absorbance **b)** spectra with the time-resolved fluorescence decay curves **c)** of **P1** solution in PBS (0.01 g L^{-1}) at 15 and 40 °C with and without the antibody. The letters rank the steps of the heating and mixing protocol: a: **P1** at 15 °C, b: **P1** is heated to 40 °C, c: 0.17 µM of Antibody (AB) is injected into the **P1** solution at 40 °C, d: this mixture is cooled down to 15 °C, e: the mixture is heated up to 40 °C.

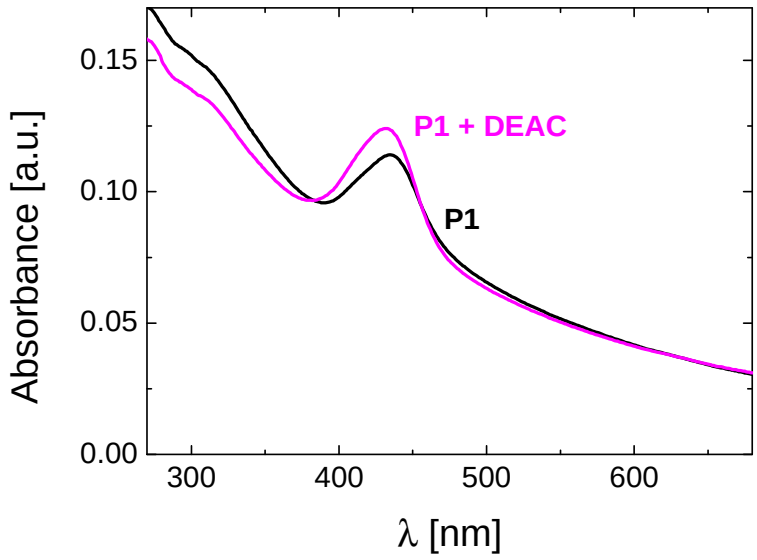


Fig.S7 Absorbance spectra of solutions of **P1** in PBS (0.01 g L^{-1}) recorded at 40 °C: pure **P1** solution (black line) and its mixture with DEAC (4 μM) (magenta line). Heating time after reaching the designated temperature, i.e., 40 °C was identical and lasted for 60 min.

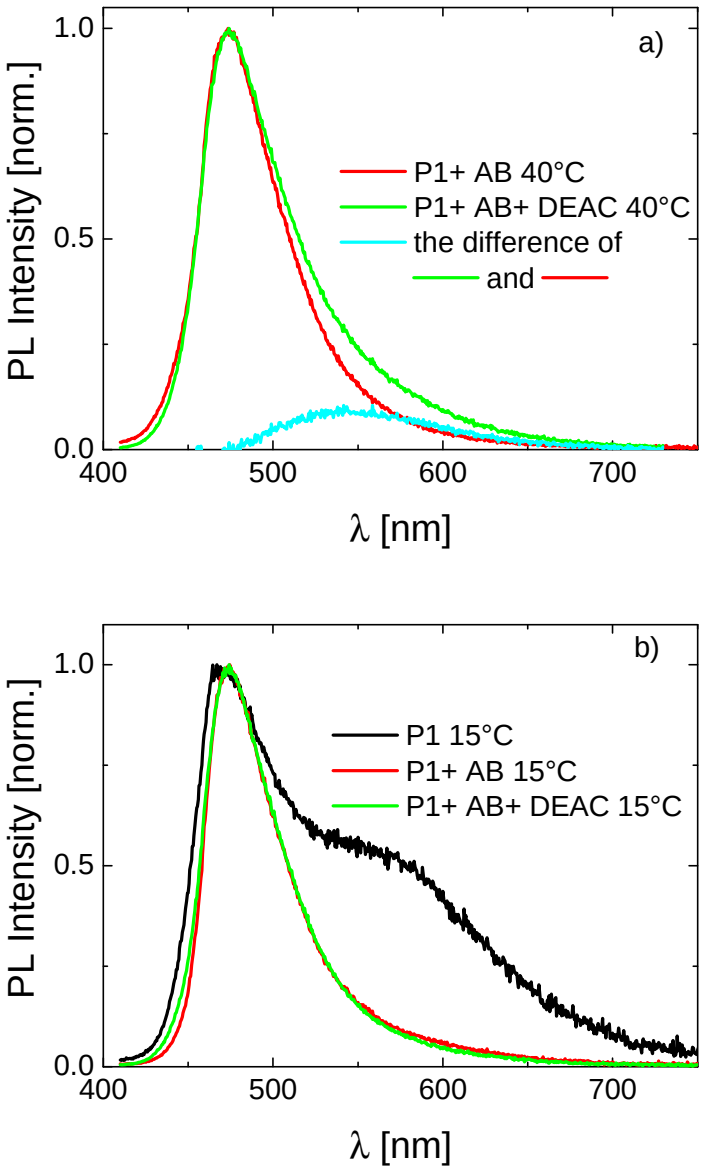


Fig.S8 Normalized steady-state PL spectra of various solutions of **P1** (0.01 g L^{-1}) at 40 °C **a)** and at 15 °C **b)**. The mixture of **P1** with 0.17 µM of antibody (red line), ternary mixture including DEAC (4 µM) (green line), the contribution of the free DEAC calculated by subtracting the spectrum of the binary mixture from that of the ternary (cyan line).

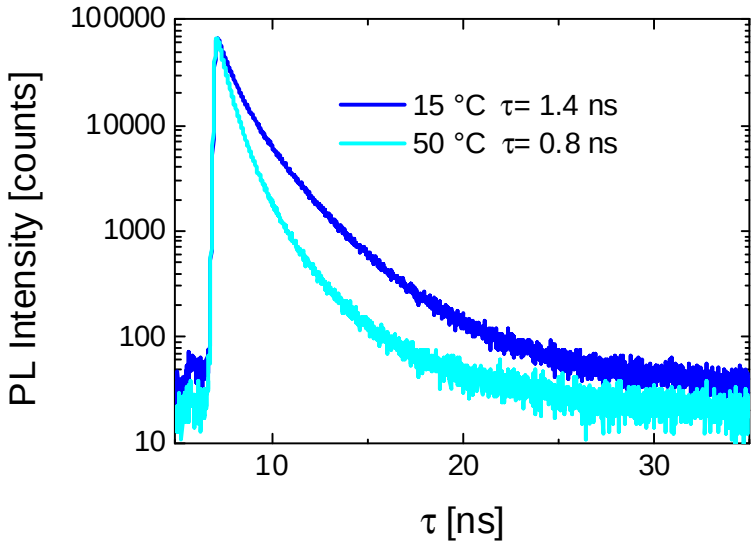


Fig.S9 Time-resolved PL traces of an aqueous **P2** solution at 15 and 50 °C with average lifetimes extracted according to Eq. 2. The excitation wavelength is 405 nm and the emission is detected at 475 nm.

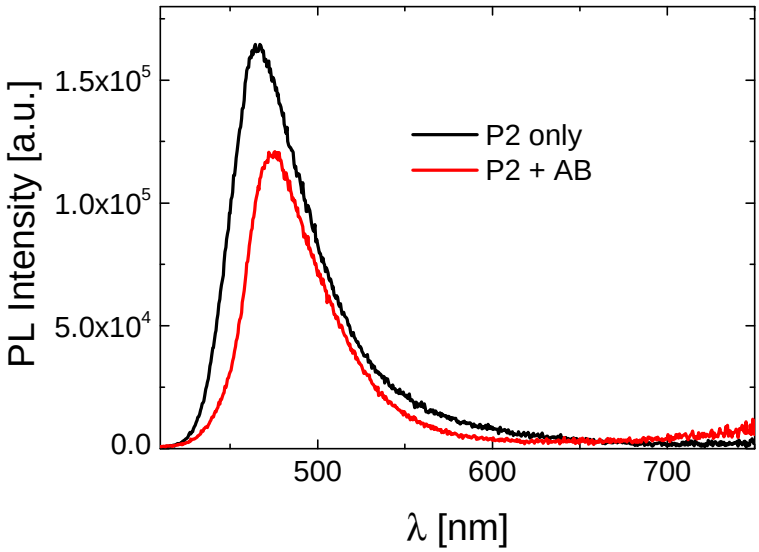


Fig.S10 PL spectra of the aqueous solution of **P2** (0.01 g L^{-1}) in the presence and absence of 0.17 µM of antibody at 20 °C. The excitation wavelength was 400 nm.

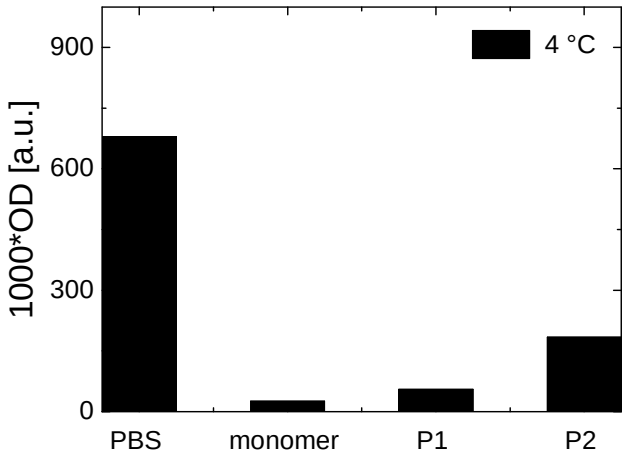


Fig.S11 ELISA tests showing the antibody binding efficiency of the monomer and the polymers at 4 °C. When DEAC is bound to a polymer backbone, its availability to the antibody drops, in the order of **P1**>**P2**.

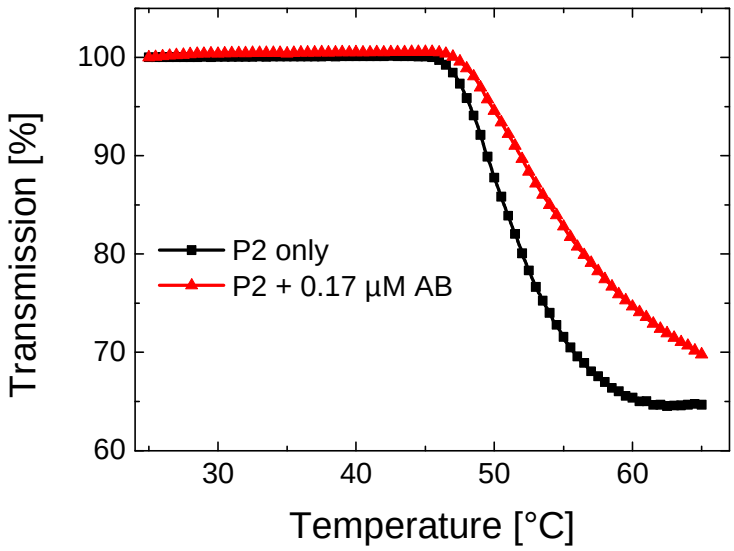


Fig.S12 The temperature-transmission profile of **P2** (0.05g L^{-1}) with (red triangles) and without the antibody (AB) (0.17 µM) (black squares)