

Multi-fluorescent particle sensor for optical sensing of pH and temperature of cell



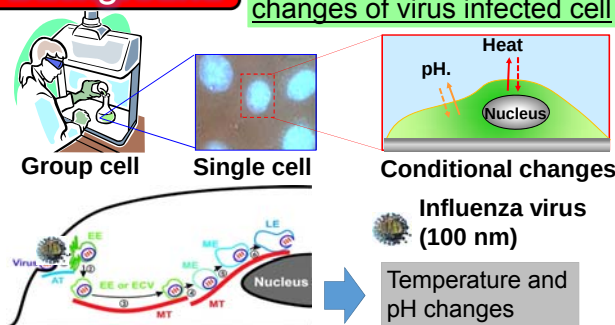
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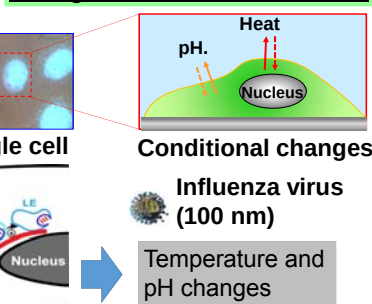


In situ measurement of pH and Temp. by multi-fluorescent sensor

Background

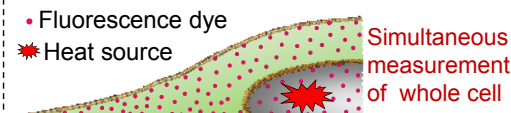


Analysis of Conditional changes of virus infected cell

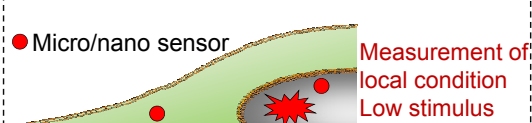


Cellular measurement

1. Staining cell by fluorescence dye



2. Fluorescent sensor based on microsphere



Advantages of fluorescent sensor based on microsphere

- ✓ Direct measurement of local condition
- ✓ Easy to be operate
- ✓ No damage to cell
- ✓ Low stimulus to cell

Our study is focused on the fabrication of fluorescent sensor

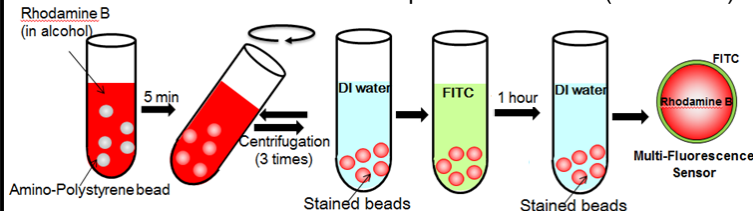
Concept

◆Microspheres:

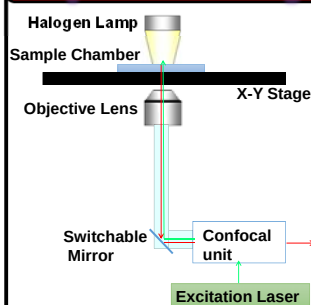
Amino-Polystyrene beads (Ps) (1μm in diameter)

◆Indicators

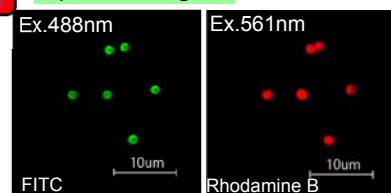
Rhodamine B: Temperature sensitive (Ex. 561nm)
FITC: PH and Temperature sensitive (Ex. 488nm)



Experimental system



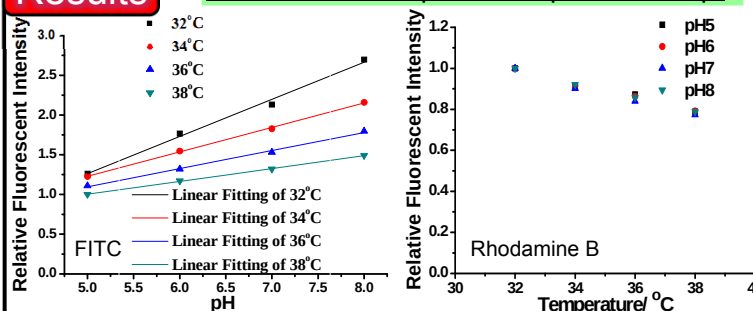
Optical images



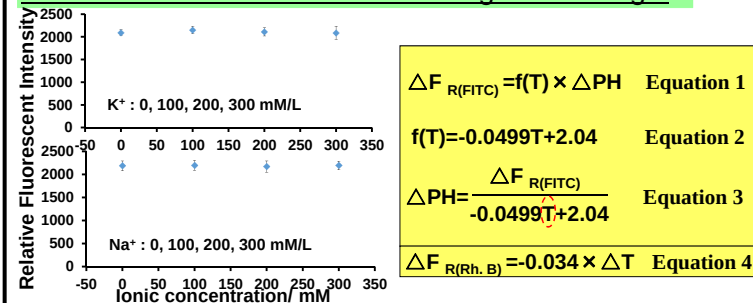
- Confocal microscopy: Ti-E (Nikon)
- Laser confocal scanning unit: CSU-X1
- Laser wavelength: 488/561 nm
- EM-CCD: Fluorescence detection
- Incubation chamber: ZILCOS

Results

Fluorescence responses to pH and Temp.



Fluorescent endurance to surrounding ionic strength



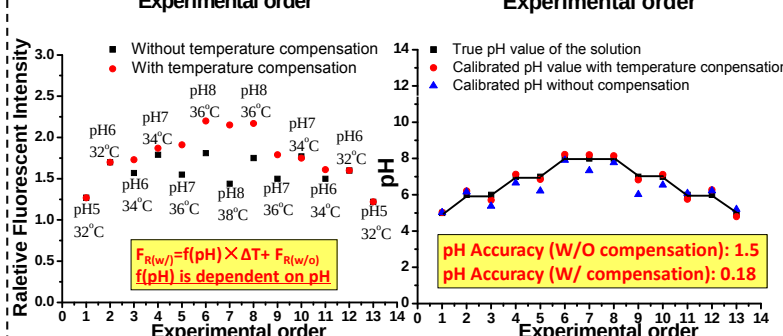
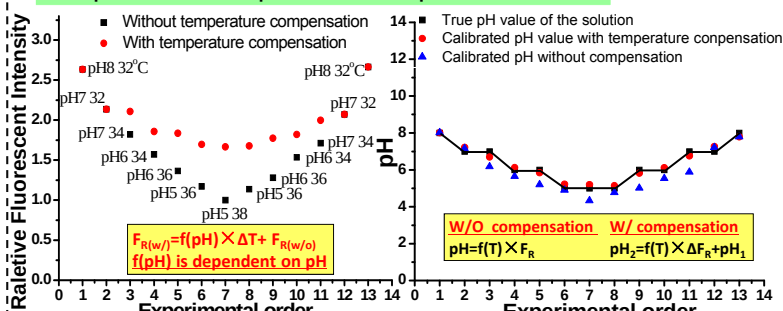
$$\Delta F_{R(FITC)} = f(T) \times \Delta PH \quad \text{Equation 1}$$

$$f(T) = -0.0499T + 2.04 \quad \text{Equation 2}$$

$$\Delta PH = \frac{\Delta F_{R(FITC)}}{-0.0499T + 2.04} \quad \text{Equation 3}$$

$$\Delta F_{R(Rh.B)} = -0.034 \times \Delta T \quad \text{Equation 4}$$

Temperature compensation of pH calibration



Conclusions

- The synthesized multi-fluorescent sensor which is based on microspheres can respond to both temperature and pH.
- The sensor possesses good stability, reversibility and endurance to surrounding ionic strength.
- The pH accuracy of our sensor has increased from 1.5 to 0.18 after temperature compensation.

Reference

- Hengjun Liu, et al, "Multi-fluorescent particle sensor for optical sensing of pH and temperature of cell", 2P08, 28th Cheminas

