Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Semipermeable Enzymatic Nanoreactor as an Efficient Modulator for Reversible pH Regulation

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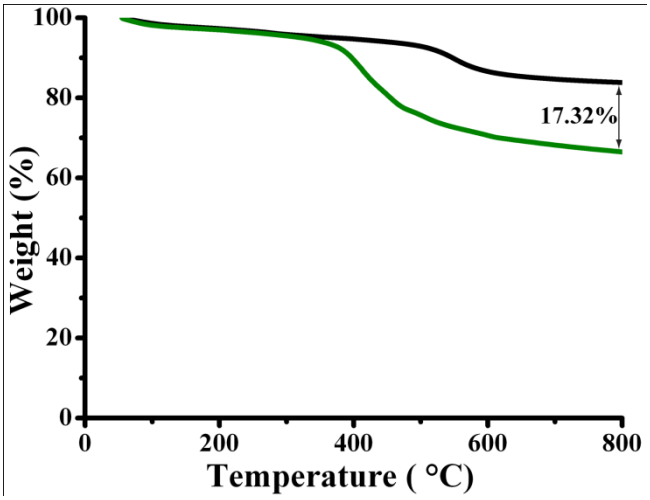

Fig. S1 TGA analysis of PEM-EMSN. The 17.32% weight loss up till 800 °C corresponds to the desorption and decomposition of the PEMs.

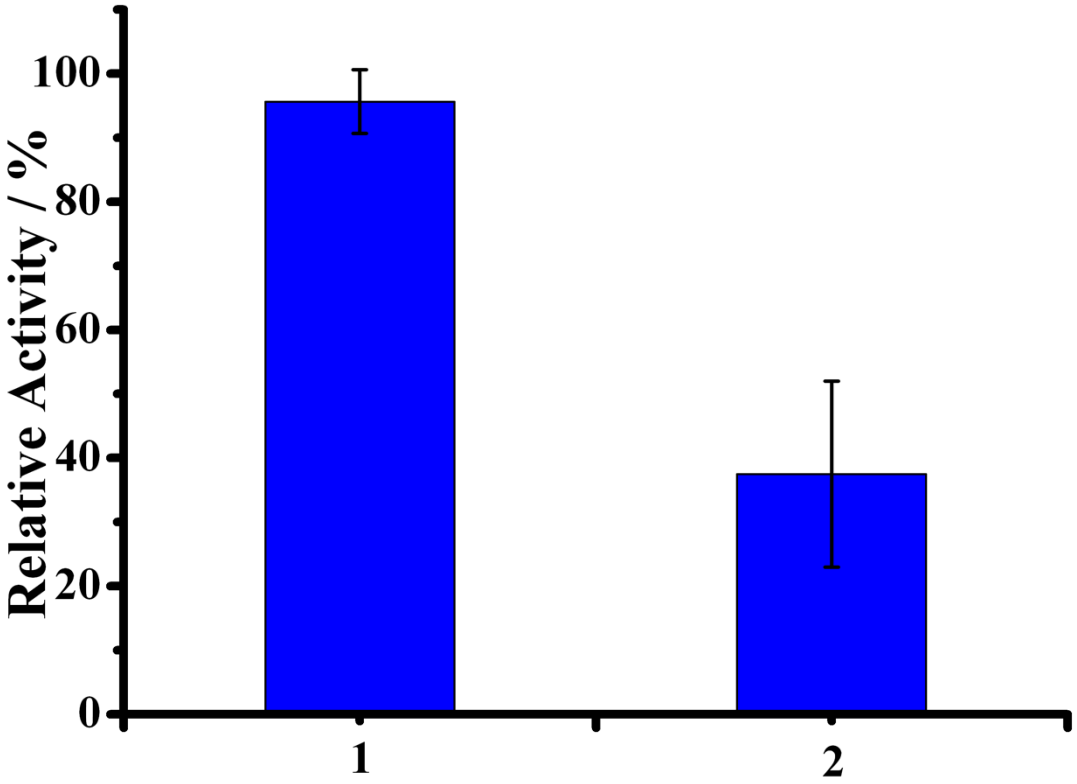

Fig. S2 Protection of GOx in PEM-EMSN-GOx nanoreactor against an externally added protease. Samples of PEM-EMSN-GOx nanoreactor (150 μg/mL) and free GOx (20 μg/mL) were incubated for 24 h at 37 °C in a solution with protease K (1 g/mL). Samples of PEM-EMSN-GOx nanoreactor (150 μg/mL) and free GOx (20 μg/mL) incubated for 24 h at 37 °C without protease K were used as controls, respectively. The activity of GOx was proved with the H_2O_2 detection after adding glucose. 1) PEM-EMSN-GOx nanoreactor; 2) free GOx.

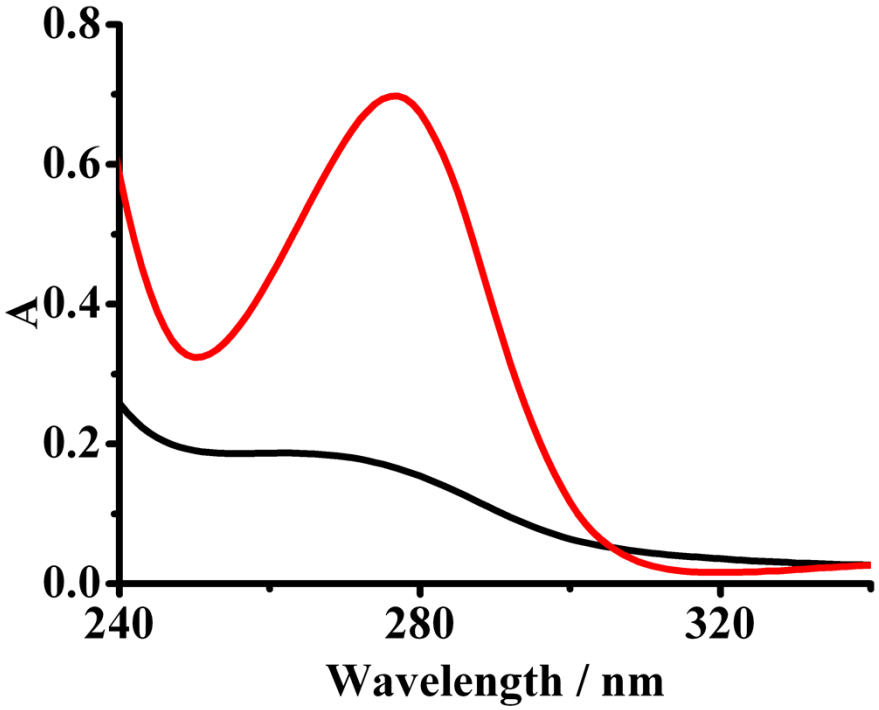

Fig. S3 The loading efficiency of GOx. The red line was free GOx (1 mg/mL) and the black line was supernatant of reaction solution.

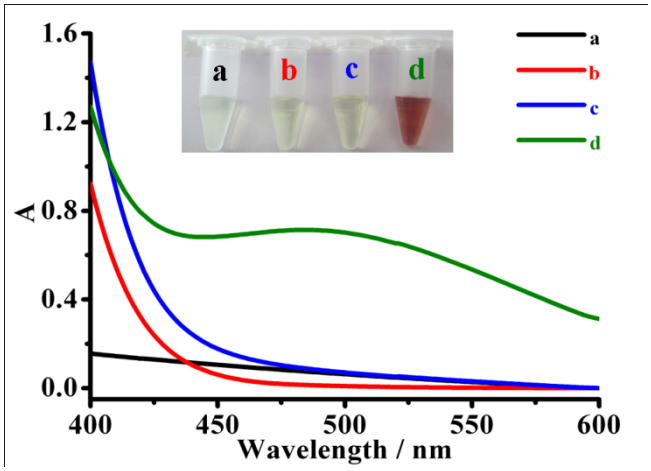

Fig. S4 The detection of product glucoinc acid after PEM-EMSN-GOx and glucose were incubated in 0.5 mM pH 7.4 phosphate buffer for 30 min: a) blank control; b) only glucose; c) 120 μg/mL PEM-EMSN-GOx alone; d) PEM-EMSN-GOx and glucose. The extinction spectra and visual color changes were recorded after 30 min incubation, inset were typical photographs of corresponding solutions.

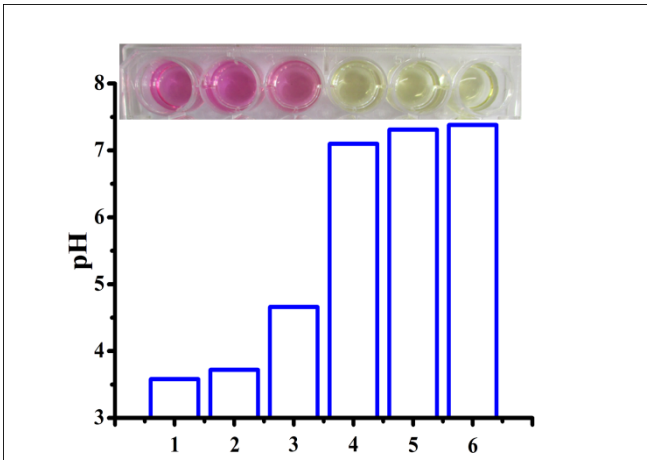

Fig. S5 The influence of buffer concentrations on enzymatic reactions. 1) water; 2) 0.5 mM pH 7.4 phosphate buffer; 3) 5 mM pH 7.4 phosphate buffer; 4) 25 mM pH 7.4 phosphate buffer; 5) 50 mM pH 7.4 phosphate buffer; 6) 100 mM pH 7.4 phosphate buffer. The top photograph was the corresponding solutions after adding methyl red.

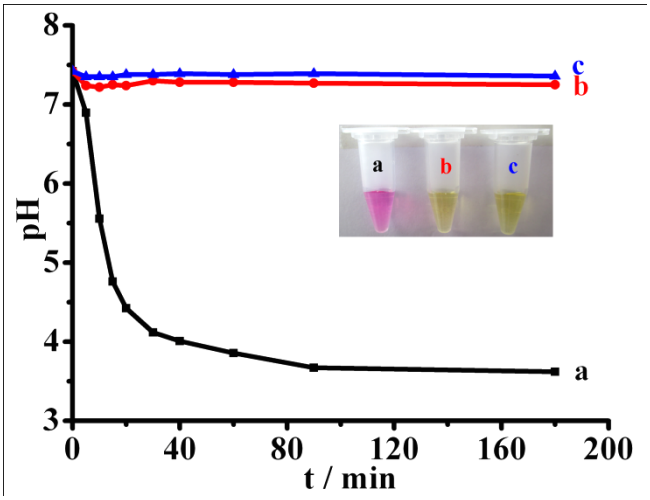

Fig. S6 Time-dependent pH changes as a result of the catalyzed oxidation of glucose to gluconic acid, producing a red complex after adding methyl red: (a) 4 mM glucose and 120 μg/mL PEM-EMSN-GOx; (b) 120 μg/mL PEM-EMSN-GOx alone; (c) only 4 mM glucose. All the reactions were carried out in 0.5 mM pH 7.4 phosphate buffer.

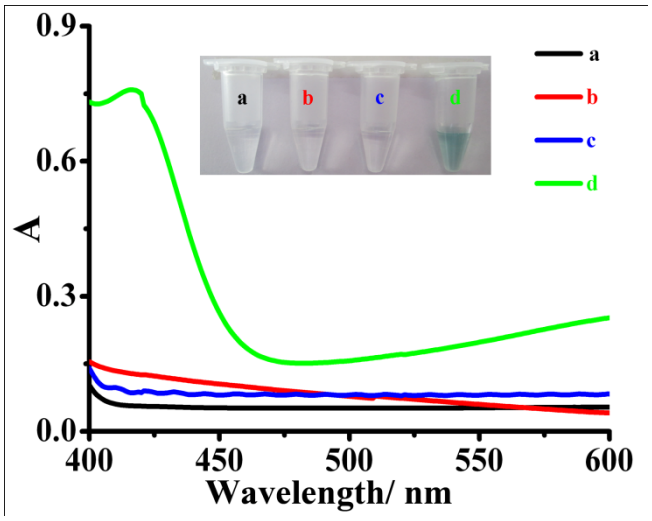

Fig. S7 The detection of H_2O_2 in the presence of ABTS and HRP: (a) blank control; (b) only 120 μg/mL PEM-EMSN-GOx; (c) 4 mM glucose alone; (d) 120 μg/mL PEM-EMSN-GOx and 4 mM glucose. The extinction spectra and visual color changes were recorded after 30 min incubation with 1 mM ABTS and 0.05 μg/mL HRP, inset were typical photographs of corresponding solutions. All the reactions were carried out in 0.5 mM pH 7.4 phosphate buffer.

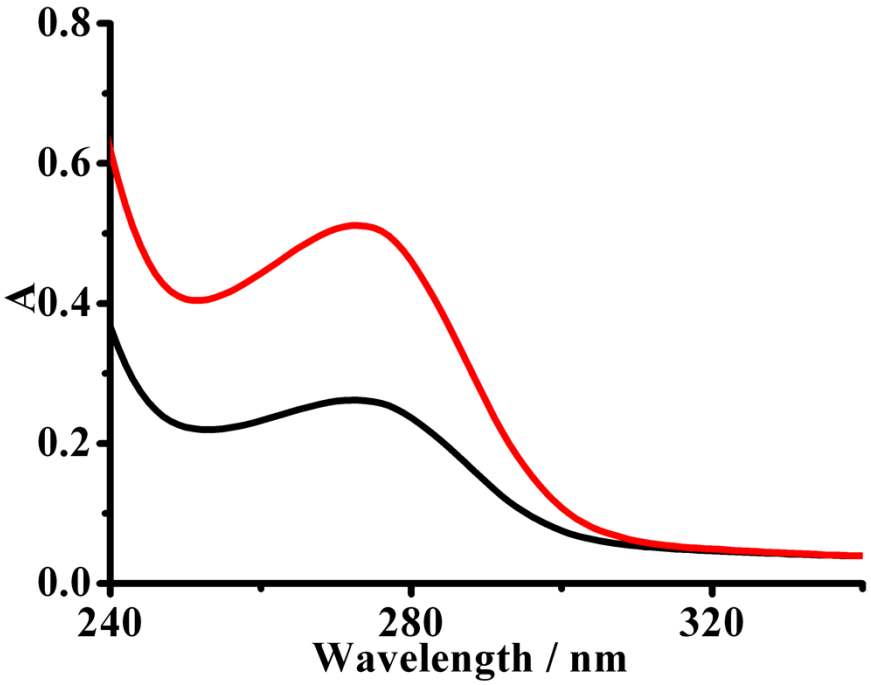

Fig. S8 The loading efficiency of Ur. The red line was free Ur (1 mg/mL) and the black line was supernatant of reaction solution.

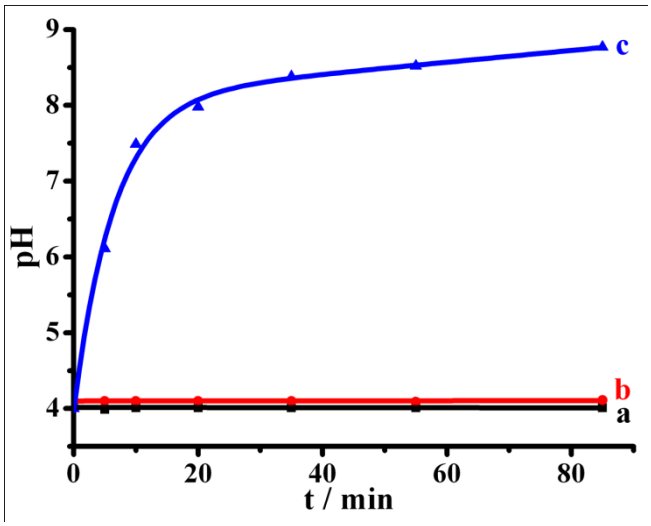

Fig. S9 Time-dependent pH changes as a result of the hydrolysis of urea: (a) only 5 mM urea; (b) 120 μg/mL PEM-EMSN-Ur alone; (c) 5 mM urea and 120 μg/mL PEM-EMSN-Ur. All reactions were carried out in 0.5 mM pH 4.0 phosphate buffer.

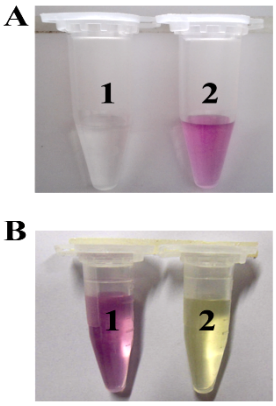

Fig. S10 Typical photographs of (1) urea and (2) urea and PEM-EMSN-Ur: (A) colorimetric detection with phenolphthalein. (B) colorimetric detection with methyl red. All reactions were carried out in 0.5 mM pH 4.0 phosphate buffer.