Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Development of glucose oxidase-based biocatalyst adopting both physical entrapment and crosslinking and its use in biofuel cell

Yongjin Chung[&][a], Yeonjoo Ahn[&][a], Marcelinus Christwardana[a], Hansung Kim*[b] and Yongchai Kwon**[a]

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Table S1. Atomic percentage of catalyst's surface measured by XPS

GOx concentration	Catalyst Structure	Atomic percentage(%)		
		C	N	O
2mg/ml	GOx/PEI/CNT	84.96	6.21	8.83
	GA/[GOx/PEI/CNT]	82.13	5.33	**12.54**
	TPA/[GOx/PEI/CNT]	83.52	**8.31**	8.17
4mg/ml	GOx/PEI/CNT	80.36	9.19	10.44
	GA/[GOx/PEI/CNT]	77.78	9.01	**13.2**
	TPA/[GOx/PEI/CNT]	78.74	**10.56**	10.7
6mg/ml	GOx/PEI/CNT	77.8	9.67	12.52
	GA/[GOx/PEI/CNT]	76.85	9.31	**13.84**
	TPA/[GOx/PEI/CNT]	75.62	**11.89**	12.49

Table S2. Results of C1s Peak analysis (%)

GOx concentration	Catalyst Structure	C-C (285 eV)	C-N C=N (286.1 eV)	C-O (287 eV)	C=O (288 eV)	COO (289 eV)
2mg/ml	GOx/PEI/CNT	61.1	12.2	18.2	3.4	5.1
	GA/[GOx/PEI/CNT]	50.5	26.7	9.4	8.8	4.4
	TPA/[GOx/PEI/CNT]	50.4	22.5	15.3	6.1	4.0
4mg/ml	GOx/PEI/CNT	53.8	12.3	21.7	4.0	8.0
	GA/[GOx/PEI/CNT]	43.0	19.9	16.9	12.2	4.4
	TPA/[GOx/PEI/CNT]	43.5	18.5	19.8	6.2	7.1
6mg/ml	GOx/PEI/CNT	45.5	22.4	12.9	13.3	4.4
	GA/[GOx/PEI/CNT]	**43.0**	19.0	**13.6**	**22.6**	1.7
	TPA/[GOx/PEI/CNT]	**39.4**	27.6	11.3	15.5	6.0

Table S3. Results of N1s Peak analysis (%)

GOx concentration	Catalyst Structure	C=N (398.5 eV)	C-N (399.5 eV)
2mg/ml	GOx/PEI/CNT	7.6	77.6
	GA/[GOx/PEI/CNT]	8.1	78.9
	TPA/[GOx/PEI/CNT]	**24.2**	**66.5**
4mg/ml	GOx/PEI/CNT	10.1	74.2
	GA/[GOx/PEI/CNT]	12.1	73.7
	TPA/[GOx/PEI/CNT]	**25.1**	**65.5**
6mg/ml	GOx/PEI/CNT	11.7	76.7
	GA/[GOx/PEI/CNT]	14.1	67.1
	TPA/[GOx/PEI/CNT]	**30.3**	**64.4**

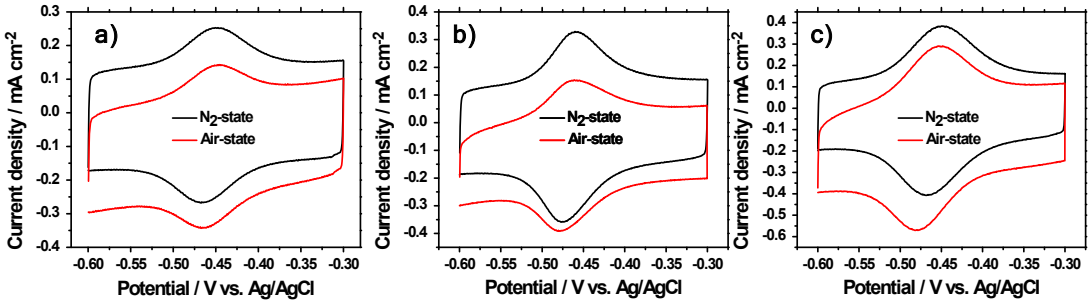

Fig. S1. Cyclic voltammograms of a) GOx/PEI/CNT, b) GA/[GOx/PEI/CNT] and c) TPA/[GOx/PEI/CNT] run at air-saturated state and N_2 state without provision of glucose.

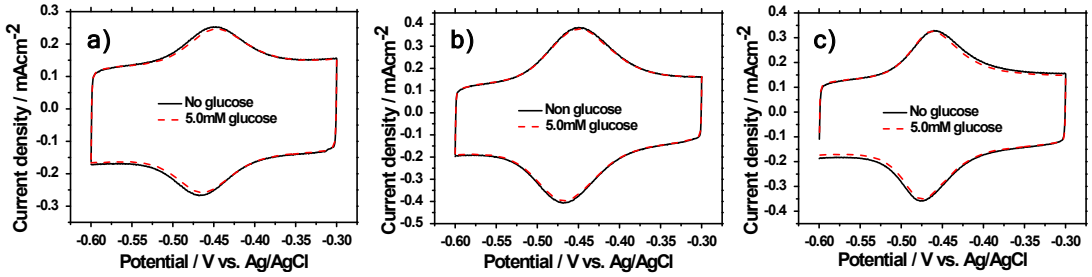

Fig. S2. Cyclic voltammograms of a) GOx/PEI/CNT, b) GA/[GOx/PEI/CNT] and c) TPA/[GOx/PEI/CNT] run at N_2 state with provision of 0 and 5 mM glucose.

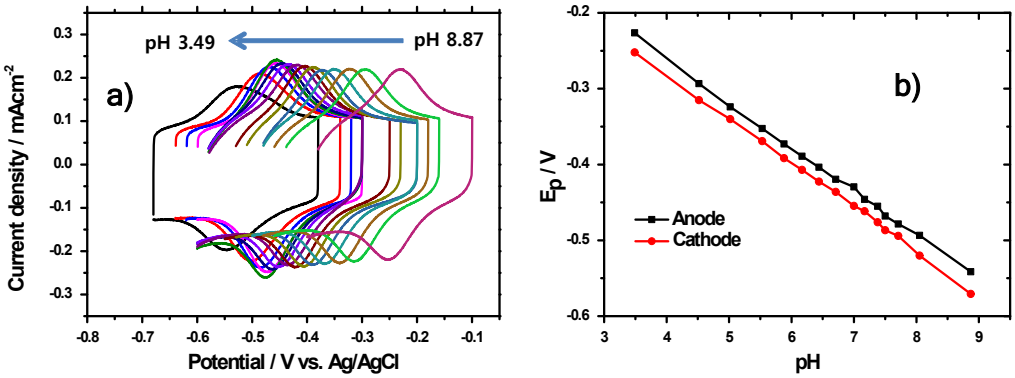

Fig. S3. a) Cyclicvoltammograms of TPA/[GOx/PEI/CNT] run under the condition of different pHs and b) a relationship between electrolyte pH and its peak potential. For the CV tests, 1.0 M PBS (pH 7.4) was used as electrolyte and potential scan rate was 50mV s^{-1}, while electrolyte pH was varied from 3.49 to 8.87.

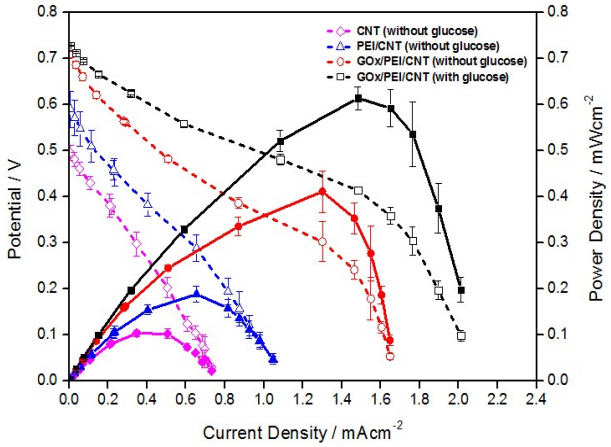

Fig. S4. MPDs of EBCs adopting CNT (Pink), PEI/CNT (Blue) and GOx/PEI/CNT (Red) catalysts including GOx concentrations of 4 mg·mL^{-1} without glucose. In the tests, 0.2 M glucose solution was fed and circulated as a fuel from an external bottle to the anode chamber of the EBC at a rate of 60 mL min^{-1}, while 50 cc min^{-1} of O_2 gas was fed to the cathode.