

Simple monitoring of pH and urea in whole blood using wearable smart woman pad

Bambang Kuswandi*, Nur Andriani, Ari S Nugraha

Chemo and Biosensors Group, Faculty of Pharmacy, University of Jember, Jl. Kalimantan 37, Jember, 68121, Indonesia

Supplemental file 1

Table S1. Results of pH detection in the pH range 4-7.5)

pH	μPAD			Sensing response (mean RGB)	Δ mean RGB value
Before reacted with pH				151.987±1.271	-
4.0				148.776± 1.582	3.211 ± 0.311
4.5				147.019 ± 1.873	4.968 ± 0.502
5.0				144.240 ±1.331	7.747 ± 0.060
5.5				140.019 ± 1.365	11.968 ± 0.094

6.0		137.801 ± 1.026	14.186 ± 0.155
6.5		135.303 ± 1.448	16.684 ± 0.177
7.0		131.497 ± 0.875	20.490 ± 0.406
7.5		128.073 ± 1.407	23.914 ± 0.236

Table S2. The results of urea sensing response toward the urea standard in the concentration range from 100 to 2000 $\mu\text{g/mL}$.

[Urea], $\mu\text{g/mL}$	μPAD	Sensing response (mean RGB)	Δ mean RGB value
Before reaction		-	-
Blank		165.910 ± 1.271	-
100		163.752 ± 1.753	2.158 ± 0.482
200		161.142 ± 1.318	4.768 ± 0.470
300		158.639 ± 1.032	7.271 ± 0.239

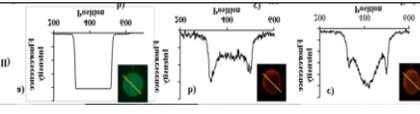
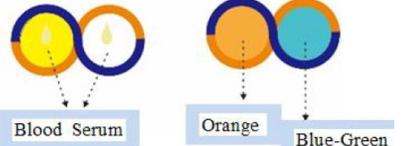
400		156.855 ± 1.343	9.055 ± 0.720
500		$155,492 \pm 1,584$	10.418 ± 0.313
600		152.658 ± 1.463	13.252 ± 0.192
700		151.834 ± 1.677	14.076 ± 0.406

Table S2. Continue...

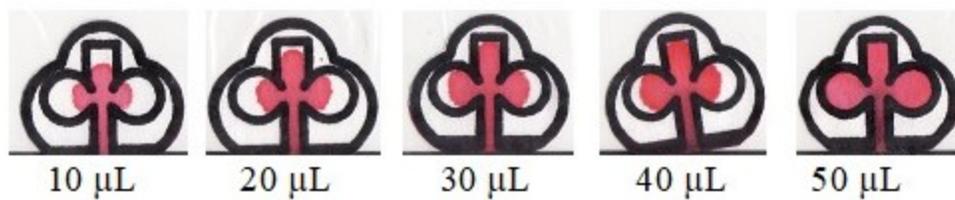
[Urea], $\mu\text{g/mL}$	μPAD	Sensing response (mean RGB)	Δ mean RGB value
800		149.071 ± 1.3742	16.839 ± 0.471
900		148.155 ± 0.568	17.755 ± 0.720
1000		146.442 ± 0.966	19.468 ± 0.235
1200		145.130 ± 0.977	20.780 ± 0.464
1400		143.861 ± 1.004	22.049 ± 0.703

1600		141.043 ± 1.317	24.867 ± 0.460
1800		137.422 ± 1.973	28.468 ± 0.702
2000		134.488 ± 1.715	31.422 ± 0.444

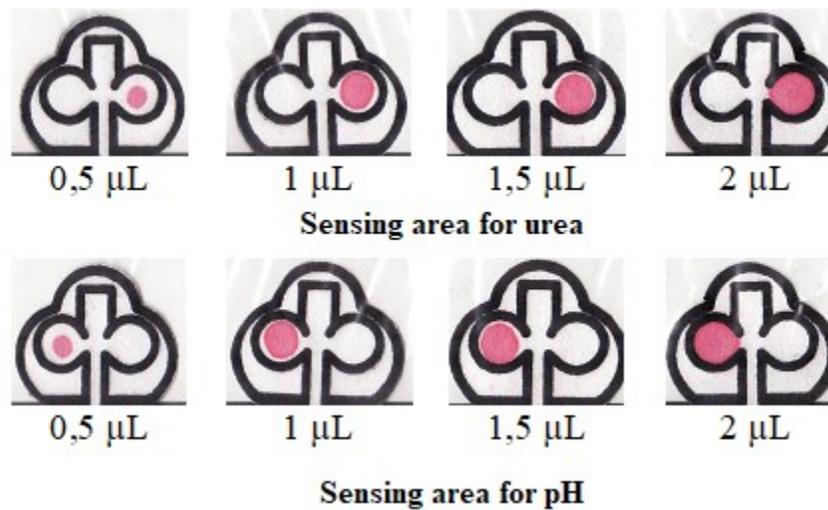
Table S3. The comparison results between μ PAD for the detection of urea in clinical samples

Sample	Biosensing Principle	Biosensor design	Figures of merit	Method	Ref.
Urine	$\text{CO}(\text{NH}_2)_2 + 3\text{H}_2\text{O} \xrightarrow{\text{Urease}} 2\text{NH}_4^+ + \text{HCO}_3^- + \text{OH}^-$		LOD: 1.02 mM (6.12 mg/dL) LR: 0–50 mM (0-300 mg/dL) r: 0.988	Fluorimetric	25
Saliva	$\text{CO}(\text{NH}_2)_2 + \text{H}_2\text{O} \xrightarrow{\text{Urease}} 2\text{NH}_3 + \text{CO}_2$		LOD: 10.4 mg/dL LR: 10–260 mg/dL r: 0.960	Colorimetric	29
Blood Serum	$\text{CO}(\text{NH}_2)_2 + \text{H}_2\text{O} \xrightarrow{\text{Urease}} 2\text{NH}_3 + \text{CO}_2$		LOD: n.d. LR: 10-100 mg/dL r: 0.995	Colorimetric	30
Blood mensuration	$\text{CO}(\text{NH}_2)_2 + \text{H}_2\text{O} \xrightarrow{\text{Urease}} 2\text{NH}_3 + \text{CO}_2$		LOD: 72.552 $\mu\text{g}/\text{mL}$ (7.26 mg/dL) LR: 100-2000 $\mu\text{g}/\text{mL}$ (10-200 mg/dL) r: 0.988	Colorimetric	This work

Note: LOD = limit of detection; LR = Linear range; n.d = not determined



(a)

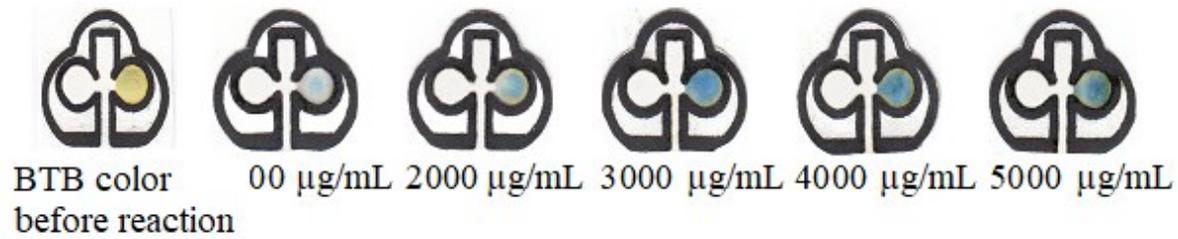


(b)

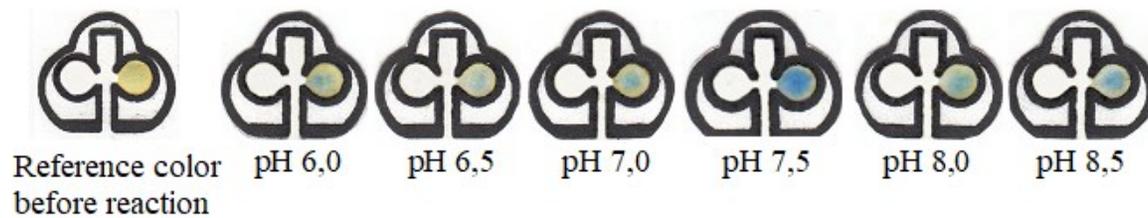
Figure S1. Determination of sample volume for μPAD (a) and both sensing areas (b).



(a)



(b)



(c)

Figure S2. Optimization of reagent concentration used in μPAD (a) CRP for pH detection, (b) BTB for urea detection, and (c) effect of of pH used in urea detection.