Supplementary Material

Sodium alginate hydrogelation mediated paper-based POCT sensor for visual distance reading and smartphone-assisted colorimetric dual-signal determination of *L*-lactate Wenjuan Wang,^{ab} Danrong Chen,^{ab} Yujiao Cai,^{ab} Zijing Liu,^{ab} Hongfen Yang,^{ab} Hongbin Xie,^c Jinquan Liu^{ab} and Shengyuan Yang^{*ab}

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S1 Apparatus

The CNC ultrasonic cleaner was purchased from Kunshan Ultrasonic Instrument Co., Ltd. (Jiangsu, China). Super ultrapure water device was purchased from Hunan Zhongwo Water Environmental Technology Co., Ltd. (Hunan, China), MS-100 constant temperature mixer was purchased from Hangzhou Aosheng Instrument Co., Ltd. (Hangzhou, China). 78-1 magnetic heating stirrer was purchased from Shanghai Pudong Physical Optical Instrument Factory (Shanghai, China). Vernier caliper was purchased from Shanghai Minate Industrial Co., Ltd. (Shanghai, China). The desktop high-speed refrigerated centrifuge was purchased from Thermo Fisher Scientific Co., Ltd. (Shanghai, China). Other devices used include carton (self-made in the laboratory), iPhone 13 (Apple, USA), and rheometer (HAAKE MARS60, Germany).



Fig. S1 Diffusion diameters of different sol mixtures on MCE. A: Sodium alginate + RB; B: Sodium alginate + RB + CaCO₃; C: Sodium alginate + RB + CaCO₃ + LDH; D: Sodium alginate + RB + CaCO₃ + LDH + *L*-lactate.



Fig. S2 Diffusion shapes of 50 µL sol mixtures on six different commercially available





Fig. S3 Optimization of the experimental conditions: Relationship between ΔD and diffusion time (A). Effect of sodium alginate concentration on ΔD (B). The effect of the sol mixture volume (C) and lactate dehydrogenase concentration (D) on the growth of ΔD (without *L*-lactate solution as the control group). Effect of incubation time on ΔD growth (E).



Fig. S4 The Fig. S4 is the standard curve of RGB detection of *L*-lactate. The vertical axis is the increase in B value (Δ Blue) before and after adding *L*-lactate, and the horizontal axis is the concentration C (μ M). It can be seen that Δ Blue is not linearly proportional to the concentration of *L*-lactate. The G value is almost 0, which can be ignored.



Fig. S5 As showing in Fig. S5A-B, in the presence of with 1 μ M, for samples, *L*-lactate, pyruvate, citric acid or acetic acid, Δ D and Δ R were obviously bigger for samples with LDH than that without. (note: concentrations of pyruvate, citric acid, and acetic acid are 1 μ M.)

Table S1Comparison of this method with previously reported methods for the

Sensor	Linear range	Detection	Reference
		limit	
Electrochemical	$0.2 \text{ mM} \sim 3 \text{mM}$	0.11 mM	[1]
TPE-HPro	0 μM~200 μM	5.5 µM	[2]
Electrochemical	0.05–10 mM	9.1 μM	[3]
3-APBA@ZnO NPs	2.5-302.5-30mM	3.98mM	[4]
closed bipolar electrode	-	86 µM	[5]
enzymatic	0.6–10 mM	0.1mM	[6]
Co@BQDs	0.01–10 mM	3.1 µM	[7]
visual distance reading	0 .1 μM ~15 μM	0.03 μM	This Work
smartphone-assisted	0.3 μM ~15 μM	0.07µM	
colorimetric analysis	· ·	·	

detection of *L*-lactate.

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