

Supplementary Information

Adaptive use of personal glucose meter (PGM) for acute biotoxicity assessment basing on the glucose consumption of microbes

Deyu Fang,^{a,b} Guanyue Gao,^{a,b} Yuan Yu,^a Jie Shen,^a Jinfang Zhi^{a, *}

*^a Key Laboratory of Photochemical Conversion and Optoelectronic Materials,
Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing
100190, PR China*

^b University of Chinese Academy of Sciences, Beijing 100049, PR China

*Corresponding authors: Jinfang Zhi, Dr. Prof.

Address: Technical Institute of Physics and Chemistry, Chinese Academy of Sciences,
Beijing 100190, PR China

Tel.: +86-010-82543538; Fax: +86-010-82543538

E-mail: zhi-mail@mail.ipc.ac.cn (Jinfang Zhi)

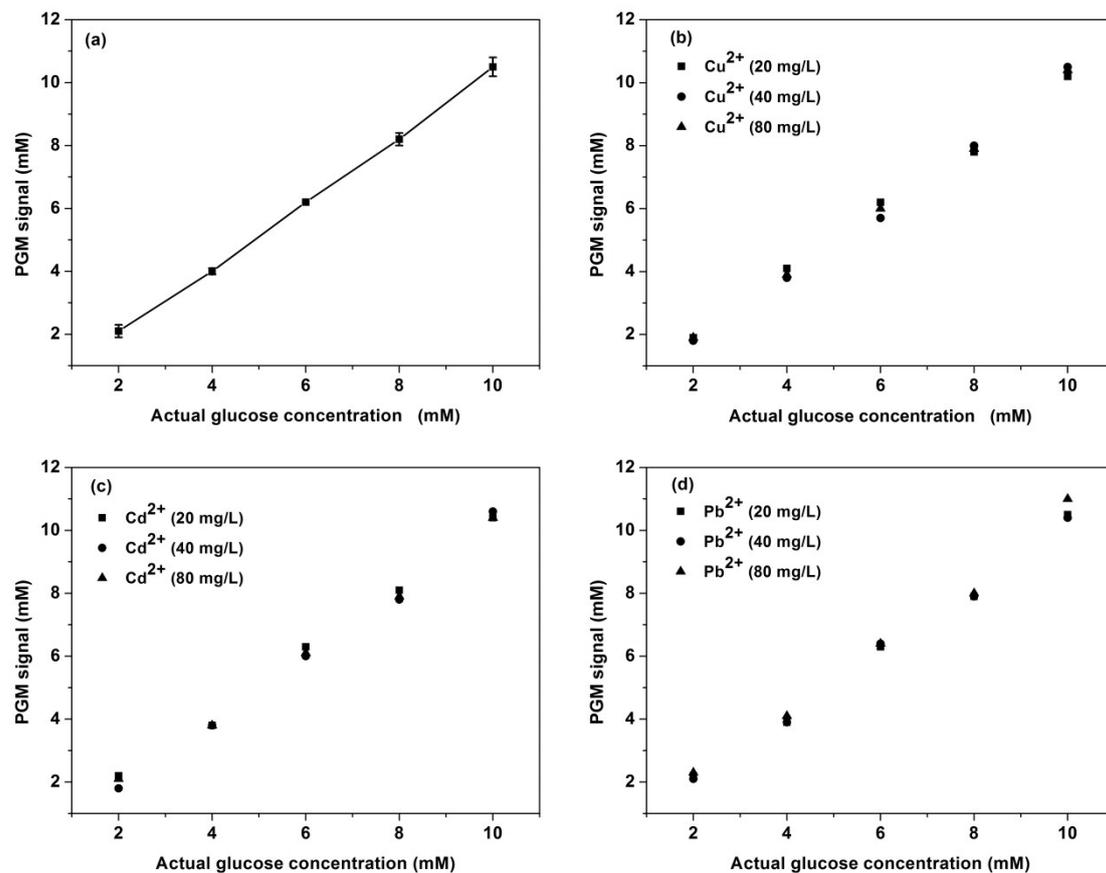


Fig. S1. (a) The relationship between the glucose concentrations detected by PGM and the actual glucose concentrations prepared in present experimental. Data points represent the average of three replicates. (b) (c) and (d) The relationship between the glucose concentrations detected by PGM and the actual glucose concentration when solution contained Cu^{2+} , Cd^{2+} and Pb^{2+} with different concentrations (20 mg/L, 40 mg/L, 80 mg/L). All the solutions were prepared with 0.85% (w/V) sodium chloride solution.

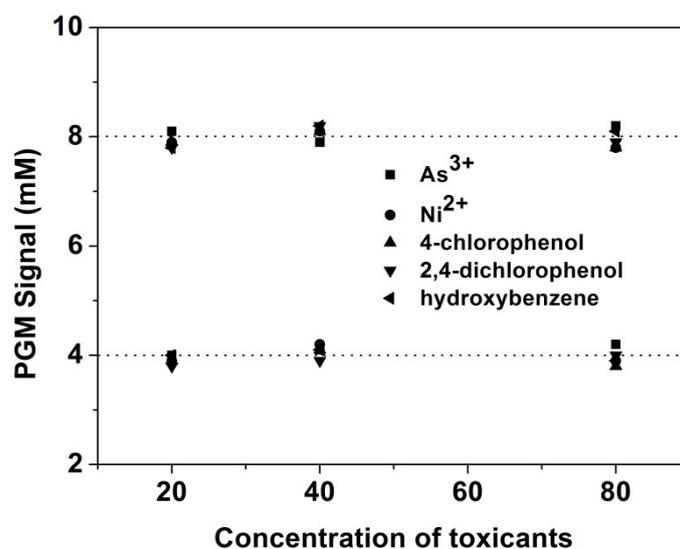


Fig. S2. The relationship between the glucose concentrations detected by PGM readout and the actual glucose concentration (4 mM, 8 mM) when solutions contained As³⁺, Ni²⁺, 4-chlorophenol, 2,4-dichlorophenol, hydroxybenzene with different concentrations (20 mg/L, 40 mg/L, 80 mg/L), respectively. All the solutions were prepared with 0.85% (w/V) sodium chloride solution.

We also investigated the interference effects of As³⁺, Ni²⁺, 4-chlorophenol, 2,4-dichlorophenol and hydroxybenzene, and the results are shown in Fig. S2. As can be seen in Fig. S2, the glucose concentrations detected by the PGM agree well with the actual glucose concentrations even though As³⁺, Ni²⁺, 4-chlorophenol, 2,4-dichlorophenol and hydroxybenzene existed. Hence, the interference effects of As³⁺, Ni²⁺, 4-chlorophenol, 2,4-dichlorophenol and hydroxybenzene on PGM are negligible.

Table S1 The pH of all samples before and after incubation at 37°C for 1 h.

| Samples | Control group (without any toxicants) | Experimental group A (heavy metal ions contained) | Experimental group B (phenolic compounds contained) |
|----------------------|--|--|--|
| pH before incubation | 7.5-7.4 | 7.2-7.0 | 7.4-7.2 |
| pH after incubation | 6.9-6.8 | 7.1-6.8 | 7.2-6.9 |

Table S2 The influence of pH on glucose detection by ACCU-CHEK[®] Performa PGM. Glucose solutions (4 mM, 8 mM and 16 mM) were prepared by 50 mM phosphate buffered saline solution with different pH values.

| Actual glucose concentration (mM) | 4 | 8 | 16 |
|-----------------------------------|-------------------|-------------------|--------------------|
| PGM signal (mM) (pH=7.5) | 3.8 (± 0.1) | 7.9 (± 0.2) | 15.8 (± 0.1) |
| PGM signal (mM) (pH=7.3) | 4.0 (± 0.1) | 7.8 (± 0.1) | 15.9 (± 0.2) |
| PGM signal (mM) (pH=7.0) | 3.9 (± 0.1) | 8.1 (± 0.1) | 16.0 (± 0.1) |

We tested the pH values of all samples before and after incubation at 37°C for 1 h and the results are shown in Table S1. Although a drop of pH could be observed for all samples after incubation, the pH of all samples were almost neutral. To clarify the effect of pH on the glucose detection accuracy by PGM, we prepared various glucose solutions with different glucose concentrations and pH values first, and then detected their glucose concentrations by PGM (ACCU-CHEK[®] Performa), and the results are shown in Table S2. As shown in Table S2, the glucose concentrations detected by the PGM were quite stable and meet well with the actual glucose concentrations if the solutions are at neutral pH range. Given the fact that all samples in our experiment were at neutral pH and the ACCU-CHEK[®] Performa PGM was quite precise at near neutral pH, it can be concluded that the influence of pH change on the changes in glucose readout is negligible.

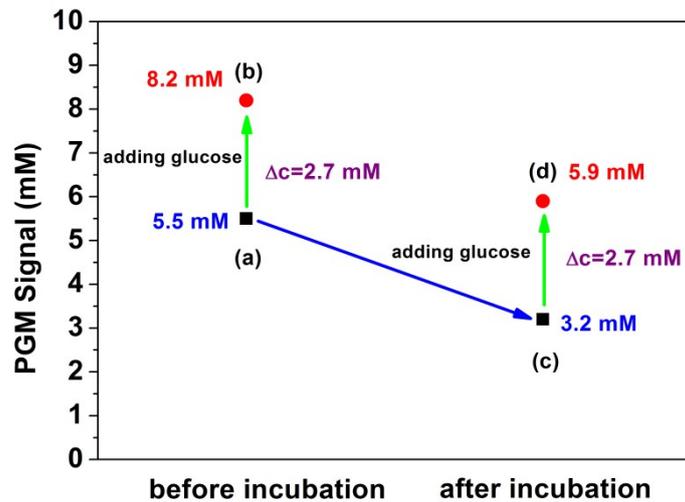


Fig. S3 The glucose concentration of sample: (a) before incubation; (b) after the adding of glucose in (a); (c) after incubation for 1 h; (d) after the adding of glucose in (c). The amounts of added glucose were the same in (b) and (d).

In our experiment, the solutions for acute biotoxicity assessment contain broth, *E. coli* cells, NaCl and toxicants. Due to the complex composition of these solutions, it is really difficult to calculate their ionic strengths. Hence, it is impossible to determine the effect of ionic strength on PGM readout directly just by calculating the ionic strengths of these solutions before and after incubation. But we have tried to clear out the influence of ionic strength by an indirect way, and the results are shown in Fig. S3. As can be seen in Fig. S3, the glucose concentration detected by PGM was 5.5 mM before incubation. With the adding of some glucose in this solution, the glucose concentration detected by PGM was 8.2 mM, i. e., the increment of glucose concentration was 2.7 mM. After the incubation for 1 h, the glucose concentration decreased from 5.5 mM to 3.2 mM due to the consumption by *E. coli*. With the adding of the same amount of glucose into the solution that has been incubated for 1 h, the glucose concentration detected by PGM was 5.9 mM, i. e., the increment of glucose concentration was also 2.7 mM. Given that the increments of glucose concentration after the extra adding of glucose were the same for the solution regardless of the incubation, we can conclude that there was no obvious change of ionic strength during the incubation, i. e., ionic strength has negligible effect on the changes in glucose readout in our experiment.

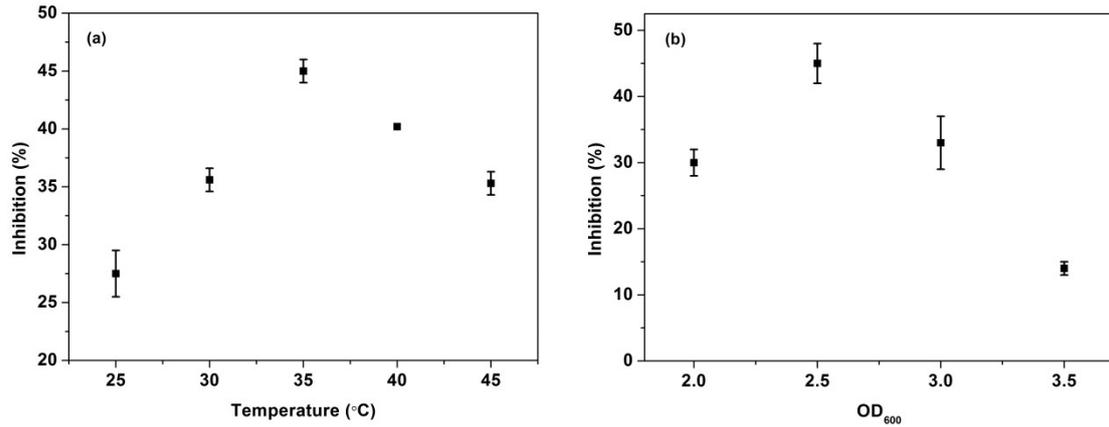


Fig. S4. (a) The inhibitions caused by Cu^{2+} (6 mg/L) to *E. coli* at different temperatures. The bacterial concentration was $\text{OD}_{600}=2.5$ and incubation time was 60 min. (b) Influence of microbial concentrations to inhibition caused by Cu^{2+} (6 mg/L) to *E. coli*. The incubation time was 60 min and temperature was 35 °C. Data points represent the average of three replicates.

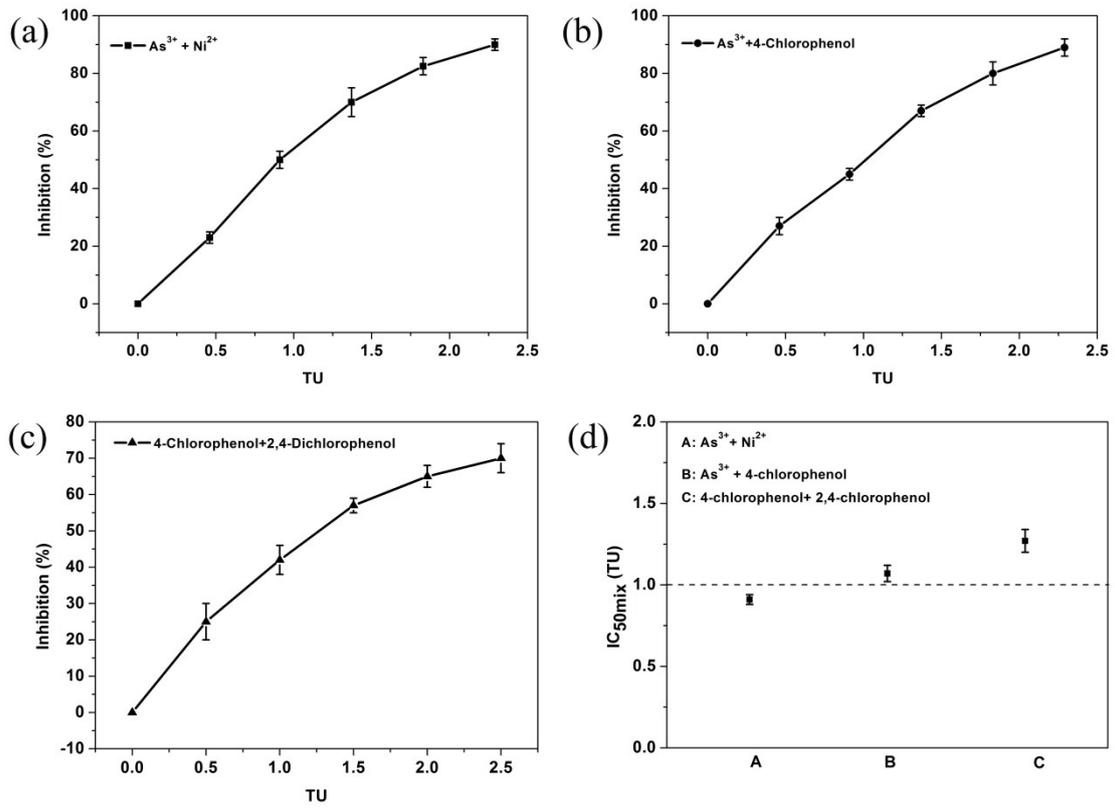


Fig. S5. The Inhibition–TU curves of the binary toxicants at different concentrations: (a) $As^{3+} + Ni^{2+}$; (b) $As^{3+} + 4\text{-chlorophenol}$; (c) $4\text{-chlorophenol} + 4\text{-chlorophenol}$. (d) The comparison of the IC_{50mix} of the three binary toxicants. Data points represent the average of three replicates.