

Article

Detecting redox potentials using porous boron nitride/ATP-DNA aptamer/methylene blue biosensor to monitor microbial activities

Kai Guo, Zirui Song , Gaoxing Wang and Chengchun Tang

	1	2	3	4	5	6	7	8	9	10	11	12
A	$100a$		$90a + 5b + 5c$	$90a + 5b + 5c$	$90a + 6b + 4c$	$90a + 6b + 4c$	$90a + 7b + 3c$	$90a + 7b + 3c$	$90a + 8b + 2c$	$90a + 8b + 2c$	$90a + 8b + 2c$	$90a + 9b + 1c$
B	$80a + 9b + 1c$	$80a + 19b + 1c$	$80a + 18b + 2c$	$80a + 18b + 2c$	$80a + 17b + 3c$	$80a + 17b + 3c$	$80a + 16b + 4c$	$80a + 16b + 4c$	$80a + 15b + 5c$	$80a + 15b + 5c$	$80a + 14b + 6c$	$80a + 14b + 6c$
C	$80a + 13b + 7c$	$80a + 13b + 7c$	$80a + 12b + 8c$	$80a + 12b + 8c$	$80a + 11b + 9c$	$80a + 11b + 9c$	$80a + 10b + 10c$	$80a + 10b + 10c$	$80a + 9b + 11c$	$80a + 9b + 11c$	$80a + 8b + 12c$	$80a + 8b + 12c$
D	$80a + 7b + 13c$	$80a + 7b + 13c$	$80a + 6b + 14c$	$80a + 6b + 14c$	$80a + 5b + 15c$	$80a + 5b + 15c$	$80a + 4b + 16c$	$80a + 4b + 16c$	$80a + 3b + 17c$	$80a + 3b + 17c$	$80a + 2b + 18c$	$80a + 2b + 18c$
E	$80a + 11b + 19c$	$80a + 11b + 19c$	$70a + 29b + 1c$	$70a + 29b + 1c$	$70a + 28b + 2c$	$70a + 28b + 2c$	$70a + 27b + 3c$	$70a + 27b + 3c$	$70a + 26b + 4c$	$70a + 26b + 4c$	$70a + 25b + 5c$	$70a + 25b + 5c$
F	$70a + 24b + 6c$	$70a + 24b + 6c$	$70a + 23b + 7c$	$70a + 23b + 7c$	$70a + 22b + 8c$	$70a + 22b + 8c$	$70a + 21b + 9c$	$70a + 21b + 9c$	$70a + 20b + 10c$	$70a + 20b + 10c$	$70a + 19b + 11c$	$70a + 19b + 11c$
G	$70a + 18b + 12c$	$70a + 18b + 12c$	$70a + 17b + 13c$	$70a + 17b + 13c$	$70a + 16b + 14c$	$70a + 16b + 14c$	$70a + 15b + 15c$	$70a + 15b + 15c$	$70a + 14b + 16c$	$70a + 14b + 16c$	$70a + 13b + 17c$	$70a + 13b + 17c$
H	$70a + 12b + 18c$	$70a + 12b + 18c$	$70a + 11b + 19c$	$70a + 11b + 19c$	$70a + 10b + 20c$	$70a + 10b + 20c$	$70a + 9b + 21c$	$70a + 9b + 21c$	$70a + 8b + 22c$	$70a + 8b + 22c$	$70a + 7b + 23c$	$70a + 7b + 23c$

	1	2	3	4	5	6	7	8	9	10	11	12
A	70 a + 6b + 24c	70 a + 6b + 24c	70 a + 5b + 25c	70 a + 5b + 25c	70 a + 4b + 26c	70 a + 4b + 26c	70 a + 3b + 27c	70 a + 3b + 27c	70 a + 2b + 28c	70 a + 2b + 28c	70 a + 1b + 29c	70 a + 1b + 29c
B	60 a + 29b + 11c	60 a + 29b + 11c	60 a + 28b + 12c	60 a + 28b + 12c	60 a + 27b + 13c	60 a + 27b + 13c	60 a + 26b + 14c	60 a + 26b + 14c	60 a + 25b + 15c	60 a + 25b + 15c	60 a + 24b + 16c	60 a + 24b + 16c
C	60 a + 23b + 17c	60 a + 23b + 17c	60 a + 22b + 18c	60 a + 22b + 18c	60 a + 21b + 19c	60 a + 21b + 19c	60 a + 20b + 20c	60 a + 20b + 20c	60 a + 19b + 21c	60 a + 19b + 21c	60 a + 18b + 22c	60 a + 18b + 22c
D	60 a + 17b + 23c	60 a + 17b + 23c	60 a + 16b + 24c	60 a + 16b + 24c	60 a + 15b + 25c	60 a + 15b + 25c	60 a + 14b + 26c	60 a + 14b + 26c	60 a + 13b + 27c	60 a + 13b + 27c	60 a + 12b + 28c	60 a + 12b + 28c
E	60 a + 11b + 29c	60 a + 11b + 29c	60 a + 10b + 30c	60 a + 10b + 30c	60 a + 9b + 31c	60 a + 9b + 31c	60 a + 8b + 32c	60 a + 8b + 32c	60 a + 7b + 33c	60 a + 7b + 33c	60 a + 6b + 34c	60 a + 6b + 34c
F	60 a + 5b + 35c	60 a + 5b + 35c	60 a + 4b + 36c	60 a + 4b + 36c	60 a + 3b + 37c	60 a + 3b + 37c	60 a + 2b + 38c	60 a + 2b + 38c	60 a + 1b + 39c	60 a + 1b + 39c		
G												
H												

Figure S1. Fluorescence testing when changing the composition of microbial community (a: *Flavobacteria* sp.; b: *E. coli*.; c: *Bacillus subtilis*).

	1	2	3	4	5	6	7	8	9	10	11	12
A			1i	1i	2i	2i	3i	3i	4i	4i	5i	5i
B	6i	6i	7i	7i	8i	8i	9i	9i	10i	10i	11i	11i
C	12i	12i	13i	13i	14i	14i	15i	15i	16i	16i	17i	17i
D	18i	18i	19i	19i	20i	20i	21i	21i	22i	22i	23i	23i
E	24i	24i	25i	25i	26i	26i	27i	27i	28i	28i	29i	29i
F	30i	30i	31i	31i	32i	32i						
G												
H												

Figure S2. Added heavy metals to each well (Control A1 & A2). $\text{Zn}(\text{CH}_3\text{COO})_2$ (i) is shown as an example here, according to which the other three metals are added as well.

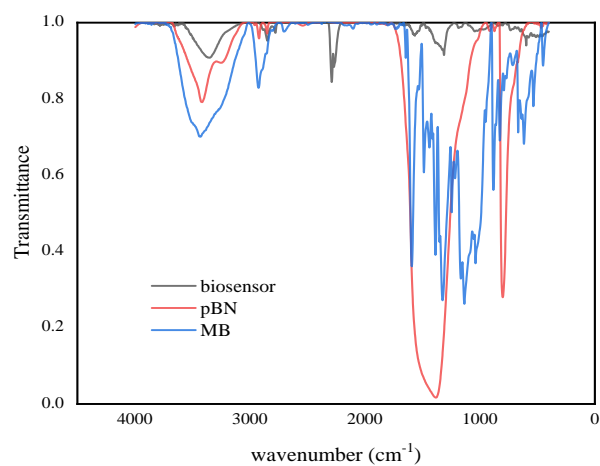


Figure S3. FTIR spectra of the biosensor, pBN and MB.

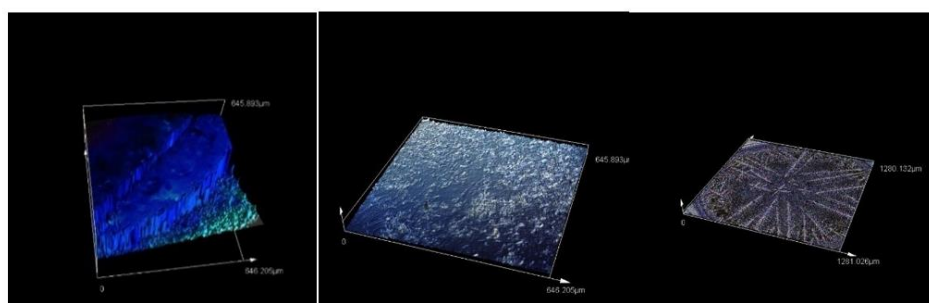


Figure S4. Images for biosensor (a), Flavobacterium sp. & biosensor (b), and Flavobacterium sp. & E coli. & Bacillus subtilis (c) using laser bifocal microscope.



Figure S5. Colorimetric differences (a)MB; (b) MB-aptamer; (c) MB-aptamer-Fe (III); (d) MB-aptamer-ascorbic acid.

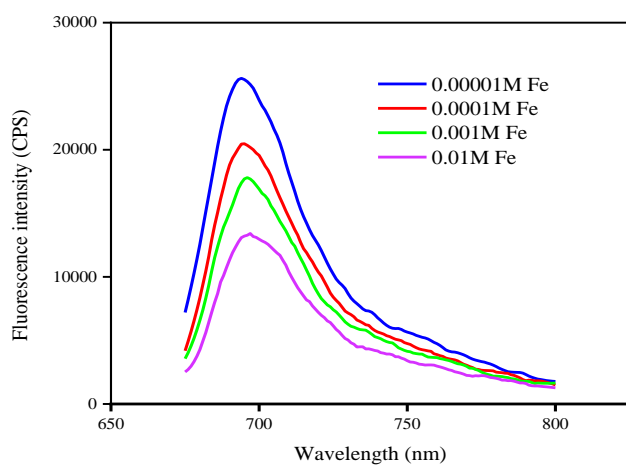


Figure S6. Fluorescence change when MB/biosensor was added to Fe (III) solution with different concentrations.

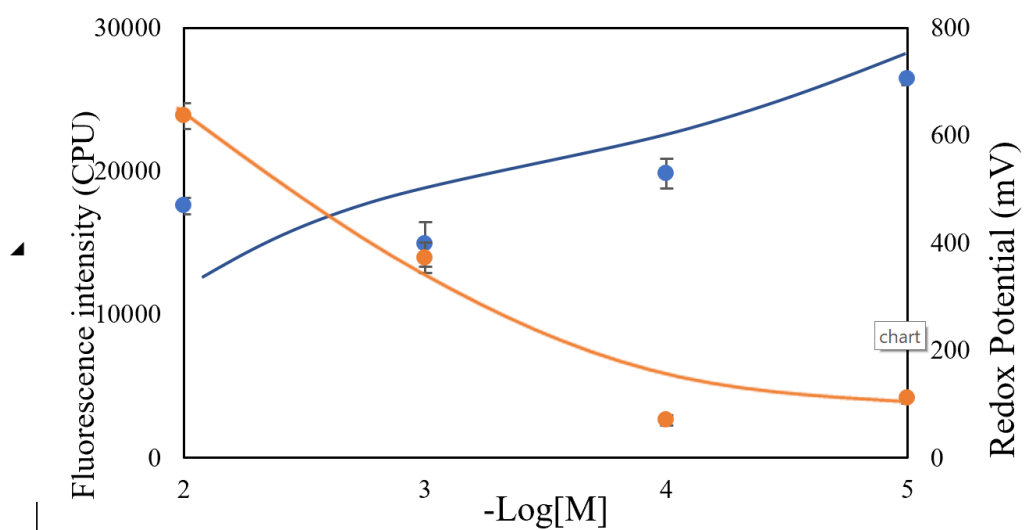


Figure S7. "Mirror" relationship between fluorescence intensity and redox potential as the concentration of Fe (III) inclined. .

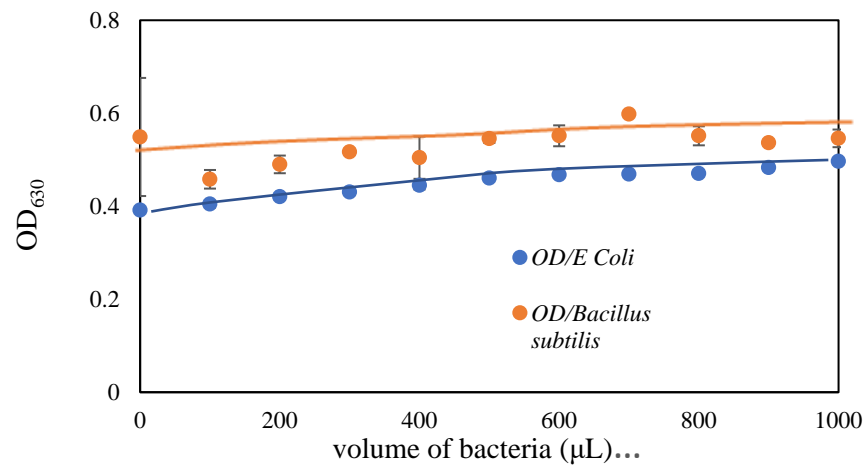


Figure S8. OD₆₃₀ values after Flavobacteria sp. were grown with E coli. or Bacillus subtilis.

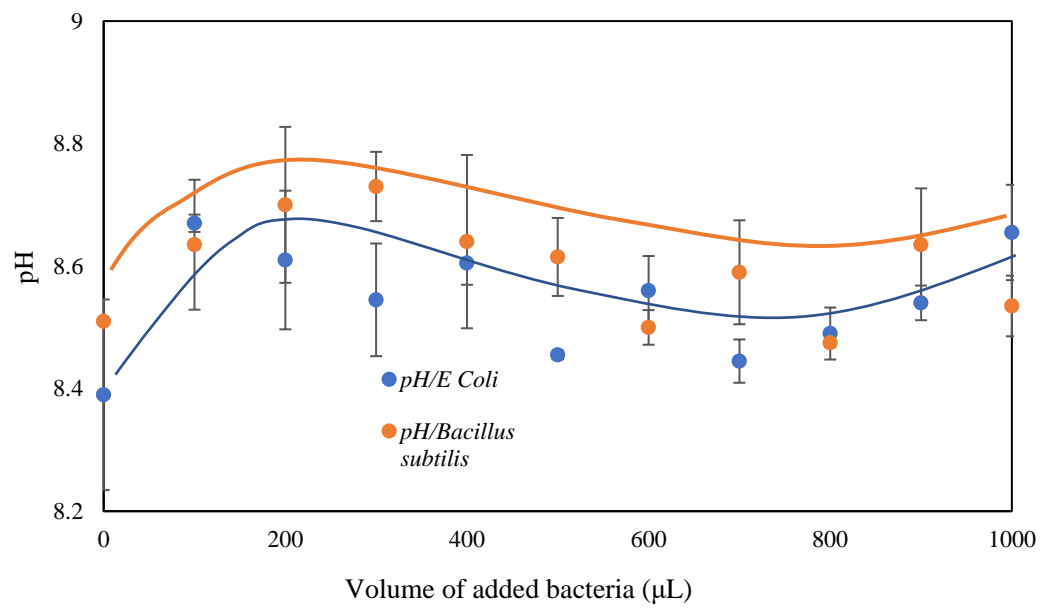


Figure S9. pH change after Flavobacteria sp. were grown with E coli. and Bacillus subtilis.