

# Fast and Sensitive Swab-based Bioluminescent detection method for meat and chicken microbiological contamination using *Amydetes vivianii* firefly luciferase

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## SUPPLEMENTARY INFORMATION

**Table S1.** Luminescence intensity values (cps) for each ATP concentration tested over three days for *E. coli* X11-Blue diluted cultures.

| Luminescence Intensities (cps) |                          |                      |                      |                      |                      |
|--------------------------------|--------------------------|----------------------|----------------------|----------------------|----------------------|
| Day                            | Culture dilution (μL/mL) |                      |                      |                      |                      |
|                                | 1000                     | 100                  | 10                   | 1                    | 0.1                  |
| 1                              | 1.70×10 <sup>6</sup>     | 2.10×10 <sup>5</sup> | 3.89×10 <sup>4</sup> | 1.53×10 <sup>4</sup> | 9.22×10 <sup>3</sup> |
| 2                              | 1.95×10 <sup>6</sup>     | 1.79×10 <sup>5</sup> | 3.09×10 <sup>4</sup> | 1.34×10 <sup>4</sup> | 1.01×10 <sup>4</sup> |
| 3                              | 1.18×10 <sup>6</sup>     | 2.25×10 <sup>5</sup> | 2.98×10 <sup>4</sup> | 1.23×10 <sup>4</sup> | 1.07×10 <sup>4</sup> |
| Average (cps)                  | 1.61×10 <sup>6</sup>     | 2.05×10 <sup>5</sup> | 3.32×10 <sup>4</sup> | 1.36×10 <sup>4</sup> | 1.00×10 <sup>4</sup> |
| SD                             | 3.89×10 <sup>5</sup>     | 2.37×10 <sup>4</sup> | 4.97×10 <sup>3</sup> | 1.54×10 <sup>3</sup> | 7.60×10 <sup>2</sup> |
| Precision%                     | 24.2                     | 11.6                 | 15.0                 | 11.3                 | 7.6                  |

**Table S2.** Luminescence intensity values (cps) for each concentration tested over three days for *E. coli* X11-Blue diluted cultures using swabs.

| Luminescence Intensities (cps) |                                    |                      |                      |                      |                      |
|--------------------------------|------------------------------------|----------------------|----------------------|----------------------|----------------------|
| Day                            | Culture dilution with swab (μL/mL) |                      |                      |                      |                      |
|                                | 1000                               | 100                  | 10                   | 1                    | 0.1                  |
| 1                              | 4.90×10 <sup>5</sup>               | 1.01×10 <sup>5</sup> | 2.88×10 <sup>4</sup> | 1.47×10 <sup>4</sup> | 9.03×10 <sup>3</sup> |
| 2                              | 5.93×10 <sup>5</sup>               | 1.07×10 <sup>5</sup> | 1.92×10 <sup>4</sup> | 1.06×10 <sup>4</sup> | 7.75×10 <sup>3</sup> |
| 3                              | 5.97×10 <sup>5</sup>               | 7.17×10 <sup>4</sup> | 2.14×10 <sup>4</sup> | 8.76×10 <sup>3</sup> | 5.81×10 <sup>3</sup> |
| Average (cps)                  | 5.60×10 <sup>5</sup>               | 9.32×10 <sup>4</sup> | 2.32×10 <sup>4</sup> | 1.13×10 <sup>4</sup> | 7.53×10 <sup>3</sup> |
| SD                             | 6.05×10 <sup>4</sup>               | 1.89×10 <sup>4</sup> | 5.02×10 <sup>3</sup> | 3.04×10 <sup>3</sup> | 1.62×10 <sup>3</sup> |
| Precision%                     | 10.8                               | 20.2                 | 21.7                 | 26.8                 | 21.5                 |

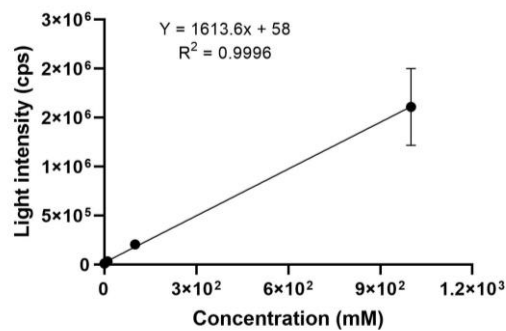
**Table S3.** Luminescence intensity values (cps) for each ATP concentration tested over three days.

| Luminescence Intensities (cps) |                           |                       |                       |                       |                       |
|--------------------------------|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Day                            | ATP concentration (μL/mL) |                       |                       |                       |                       |
|                                | 5.00×10 <sup>-3</sup>     | 5.00×10 <sup>-4</sup> | 5.00×10 <sup>-5</sup> | 5.00×10 <sup>-6</sup> | 5.00×10 <sup>-7</sup> |
| 1                              | 1.94 ×10 <sup>6</sup>     | 3.15 ×10 <sup>5</sup> | 3.53 ×10 <sup>4</sup> | 4.86 ×10 <sup>3</sup> | 1.68 ×10 <sup>3</sup> |
| 2                              | 2.48 ×10 <sup>6</sup>     | 2.35 ×10 <sup>5</sup> | 2.48 ×10 <sup>4</sup> | 4.16 ×10 <sup>3</sup> | 1.82 ×10 <sup>3</sup> |
| 3                              | 2.02 ×10 <sup>6</sup>     | 2.41 ×10 <sup>5</sup> | 3.21 ×10 <sup>4</sup> | 5.44 ×10 <sup>3</sup> | 2.27 ×10 <sup>3</sup> |
| Average (cps)                  | 2.02 ×10 <sup>6</sup>     | 2.41 ×10 <sup>5</sup> | 3.21 ×10 <sup>4</sup> | 4.86 ×10 <sup>3</sup> | 1.82 ×10 <sup>3</sup> |
| SD                             | 2.89 ×10 <sup>5</sup>     | 4.45 ×10 <sup>4</sup> | 5.39 ×10 <sup>3</sup> | 6.42 ×10 <sup>2</sup> | 3.08 ×10 <sup>2</sup> |
| Precision%                     | 14.3                      | 18.5                  | 16.8                  | 13.2                  | 16.9                  |

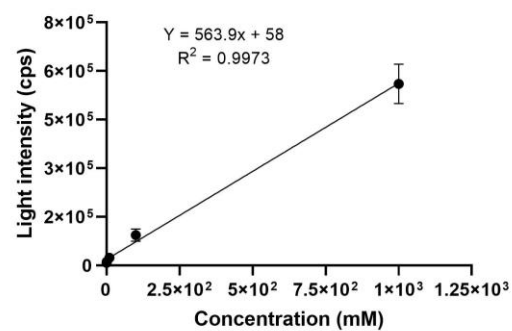
**Table S4.** Values from the equation of the lines over three days of linearity evaluation.

| Day        | Dilution         |              |                       | Swab             |              |                       |
|------------|------------------|--------------|-----------------------|------------------|--------------|-----------------------|
|            | <i>Intercept</i> | <i>Slope</i> | <i>R</i> <sup>2</sup> | <i>Intercept</i> | <i>Slope</i> | <i>R</i> <sup>2</sup> |
| 1          | 58.00            | 1701.10      | 0.9997                | 58.00            | 495.63       | 0.9926                |
| 2          | 58.00            | 1945.20      | 0.9998                | 58.00            | 598.02       | 0.9955                |
| 3          | 58.00            | 1194.50      | 0.9931                | 58.00            | 597.91       | 0.9998                |
| N          | 3                | 3            | 3                     | 3                | 3            | 3                     |
| Average    | 58.00            | 1613.60      | 0.9975                | 58.00            | 563.85       | 0.9960                |
| SD         | 0                | 382.92       | 0.00                  | 0                | 59.08        | 0.00                  |
| Precision% | 0                | 23.73        | 0.38                  | 0                | 10.48        | 0.36                  |

(A)



(B)

**Figure S1.** Linearity graphs of the ATP extracted (A) from the diluted culture, and (B) from the culture in swab of five concentrations and their respective results in cps.**Table S5.** Luminescence intensity values (cps) for solutions without ATP.

| Luminescence intensity (cps) |          |       |
|------------------------------|----------|-------|
| Measurement                  | Dilution | Swab  |
| Average (cps)                | 58.20    | 45.20 |
| SD                           | 5.54     | 9.93  |
| Precision%                   | 10%      | 22%   |

**Table S6.** Luminescence intensity results (cps) in the interday evaluation of the *E. coli* X11-Blue diluted culture.

| Luminescence intensity (cps) of dilutions |                      |                        |                      |                               |                      |                       |
|---|----------------------|------------------------|----------------------|-------------------------------|----------------------|-----------------------|
| Day                                       | Standard value*      | Average of high value* | Standard value*      | Average of the average value* | Standard value*      | Average of low value* |
| 1   | 2.02×10 <sup>6</sup> | 1.43×10 <sup>6</sup>   | 3.21×10 <sup>4</sup> | 2.54×10 <sup>4</sup>          | 3.87×10 <sup>3</sup> | 1.89×10 <sup>4</sup>  |
| 2   |                      | 1.56×10 <sup>6</sup>   |                      | 2.69×10 <sup>4</sup>          |                      | 1.24×10 <sup>4</sup>  |
| 3   |                      | 2.18×10 <sup>6</sup>   |                      | 3.27×10 <sup>4</sup>          |                      | 1.10×10 <sup>4</sup>  |
| N   |                      | 15                     |                      | 15                            |                      | 15                    |
| Average (cps)                             |                      | 1.72×10 <sup>6</sup>   |                      | 2.83×10 <sup>4</sup>          |                      | 1.41×10 <sup>4</sup>  |
| SD  |                      | 3.86×10 <sup>3</sup>   |                      | 4.37×10 <sup>3</sup>          |                      | 3.88×10 <sup>5</sup>  |
| Precision%                                |                      | 27.4                   |                      | 15.4                          |                      | 22.5                  |

**Table S7.** Luminescence intensity results (cps) in the interday evaluation of the *E. coli* X11-Blue diluted culture in swab.

| Luminescence intensity (cps) using swab |                      |                        |                      |                          |                      |                       |
|---|----------------------|------------------------|----------------------|--------------------------|----------------------|-----------------------|
| Day                                     | Standard value*      | Average of high value* | Standard value*      | Average of median value* | Standard value*      | Average of low value* |
| 1                                       | 2.02×10 <sup>6</sup> | 3.86×10 <sup>5</sup>   | 3.21×10 <sup>4</sup> | 1.60×10 <sup>4</sup>     | 3.87×10 <sup>3</sup> | 6.48×10 <sup>3</sup>  |
| 2                                       |                      | 4.29×10 <sup>5</sup>   |                      | 2.00×10 <sup>4</sup>     |                      | 7.77×10 <sup>3</sup>  |
| 3                                       |                      | 4.51×10 <sup>5</sup>   |                      | 1.88×10 <sup>4</sup>     |                      | 6.27×10 <sup>3</sup>  |
| N                                       |                      | 15                     |                      | 15                       |                      | 15                    |
| Average (cps)                           |                      | 4.22×10 <sup>5</sup>   |                      | 1.83×10 <sup>4</sup>     |                      | 6.84×10 <sup>3</sup>  |
| SD                                      |                      | 9.56×10 <sup>4</sup>   |                      | 3.21×10 <sup>3</sup>     |                      | 1.57×10 <sup>3</sup>  |
| Precision%                              |                      | 22.6                   |                      | 17.6                     |                      | 22.9                  |

**Table S8.** Luminescence intensity results (cps) in the intraday evaluation of the *E. coli* Xl1-Blue diluted culture.

| Luminescence intensity (cps) of dilutions |                    |                        |                    |                          |                    |                       |
|---|--------------------|------------------------|--------------------|--------------------------|--------------------|-----------------------|
| Measurements                              | Standard value*    | Average of high value* | Standard value*    | Average of median value* | Standard value*    | Average of low value* |
| Average (cps)                             | $2.02 \times 10^6$ | $1.43 \times 10^6$     | $3.21 \times 10^4$ | $2.54 \times 10^4$       | $3.87 \times 10^3$ | $1.89 \times 10^4$    |
| N   |                    | 5                      |                    | 5                        |                    | 5                     |
| SD  |                    | $2.13 \times 10^5$     |                    | $1.24 \times 10^3$       |                    | $1.32 \times 10^3$    |
| Precision%                                |                    | 14.9                   |                    | 4.9                      |                    | 7.0                   |

**Table S9.** Luminescence intensity results (cps) in the intraday evaluation of the *E. coli* Xl1-Blue diluted culture in swab.

| Luminescence intensity (cps) using swab |                    |                        |                    |                          |                    |                       |
|---|--------------------|------------------------|--------------------|--------------------------|--------------------|-----------------------|
| Measurements                            | Standard value*    | Average of high value* | Standard value*    | Average of median value* | Standard value*    | Average of low value* |
| Average (cps)                           | $1.92 \times 10^6$ | $3.86 \times 10^5$     | $3.21 \times 10^4$ | $1.60 \times 10^4$       | $3.87 \times 10^3$ | $7.25 \times 10^3$    |
| N                                       |                    | 5                      |                    | 5                        |                    | 5                     |
| SD                                      |                    | $6.38 \times 10^4$     |                    | $9.87 \times 10^2$       |                    | $4.77 \times 10^2$    |
| Precision%                              |                    | 16.5                   |                    | 6.2                      |                    | 6.6                   |

**Table S10.** Luminescence intensity results (cps) of the matrix effect evaluation in two standard ATP concentrations ( $5.00 \times 10^{-3}$  and  $5.00 \times 10^{-7}$  mM).

| Measurements           | Culture with standard ATP without extraction buffer |                       | Swab with water and standard ATP without extraction buffer |                       |
|------------------------|---|-----------------------|--|-----------------------|
| ATP concentration (mM) | $5.00 \times 10^{-3}$                               | $5.00 \times 10^{-7}$ | $5.00 \times 10^{-3}$                                      | $5.00 \times 10^{-7}$ |
| Average                | $3.76 \times 10^6$                                  | $4.55 \times 10^4$    | $3.95 \times 10^6$   | $5.57 \times 10^4$    |
| SD                     | $3.64 \times 10^5$                                  | $8.11 \times 10^3$    | $3.87 \times 10^5$   | $1.05 \times 10^4$    |
| Precision%             | 10%   | 18%                   | 10%  | 19%                   |
| Accuracy%              | 71%   |                       | 70%  |                       |

**Table S11.** Luminescence intensity of four conditions under which the solution was evaluated in for stability over four different time periods.

| Measurements    | With Luciferin -20°C              |                                   |                                   | Without Luciferin -20°C           |                                   |                                   | With Luciferin 5°C                |                                   |                                   | Without Luciferin 5°C             |                                   |                                   |
|-----------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Concentration   | 5.00 <sup>x10</sup> <sup>-3</sup> | 5.00 <sup>x10</sup> <sup>-5</sup> | 5.00 <sup>x10</sup> <sup>-7</sup> | 5.00 <sup>x10</sup> <sup>-3</sup> | 5.00 <sup>x10</sup> <sup>-5</sup> | 5.00 <sup>x10</sup> <sup>-7</sup> | 5.00 <sup>x10</sup> <sup>-3</sup> | 5.00 <sup>x10</sup> <sup>-5</sup> | 5.00 <sup>x10</sup> <sup>-7</sup> | 5.00 <sup>x10</sup> <sup>-3</sup> | 5.00 <sup>x10</sup> <sup>-5</sup> | 5.00 <sup>x10</sup> <sup>-7</sup> |
| Average 15 days | 1.46 <sup>x10</sup> <sup>7</sup>  | 1.52 <sup>x10</sup> <sup>5</sup>  | 6.01 <sup>x10</sup> <sup>3</sup>  | 1.15 <sup>x10</sup> <sup>7</sup>  | 1.39 <sup>x10</sup> <sup>5</sup>  | 6.65 <sup>x10</sup> <sup>3</sup>  | 1.01 <sup>x10</sup> <sup>7</sup>  | 1.29 <sup>x10</sup> <sup>5</sup>  | 7.22 <sup>x10</sup> <sup>3</sup>  | 1.32 <sup>x10</sup> <sup>7</sup>  | 1.44 <sup>x10</sup> <sup>5</sup>  | 1.60 <sup>x10</sup> <sup>5</sup>  |
| SD              | 1.83 <sup>x10</sup> <sup>6</sup>  | 1.49 <sup>x10</sup> <sup>4</sup>  | 2.55 <sup>x10</sup> <sup>2</sup>  | 1.27 <sup>x10</sup> <sup>6</sup>  | 1.14 <sup>x10</sup> <sup>4</sup>  | 7.01 <sup>x10</sup> <sup>2</sup>  | 3.62 <sup>x10</sup> <sup>5</sup>  | 6.85 <sup>x10</sup> <sup>3</sup>  | 7.29 <sup>x10</sup> <sup>2</sup>  | 5.40 <sup>x10</sup> <sup>5</sup>  | 3.80 <sup>x10</sup> <sup>4</sup>  | 4.88 <sup>x10</sup> <sup>5</sup>  |
| Precision%      | 12%                               | 10%                               | 4%                                | 11%                               | 8%                                | 11%                               | 4%                                | 5%                                | 10%                               | 4%                                | 26%                               | 30%                               |
| Average 1 month | 1.89 <sup>x10</sup> <sup>7</sup>  | 1.92 <sup>x10</sup> <sup>5</sup>  | 2.04 <sup>x10</sup> <sup>4</sup>  | 2.04 <sup>x10</sup> <sup>7</sup>  | 2.14 <sup>x10</sup> <sup>5</sup>  | 2.68 <sup>x10</sup> <sup>4</sup>  | 3.33 <sup>x10</sup> <sup>6</sup>  | 4.77 <sup>x10</sup> <sup>4</sup>  | 4.89 <sup>x10</sup> <sup>3</sup>  | 1.89 <sup>x10</sup> <sup>7</sup>  | 2.66 <sup>x10</sup> <sup>5</sup>  | 2.82 <sup>x10</sup> <sup>4</sup>  |
| SD              | 1.88 <sup>x10</sup> <sup>6</sup>  | 1.52 <sup>x10</sup> <sup>4</sup>  | 1.47 <sup>x10</sup> <sup>3</sup>  | 1.35 <sup>x10</sup> <sup>6</sup>  | 3.19 <sup>x10</sup> <sup>4</sup>  | 2.22 <sup>x10</sup> <sup>3</sup>  | 2.86 <sup>x10</sup> <sup>5</sup>  | 4.47 <sup>x10</sup> <sup>3</sup>  | 7.28 <sup>x10</sup> <sup>2</sup>  | 1.38 <sup>x10</sup> <sup>6</sup>  | 5.76 <sup>x10</sup> <sup>4</sup>  | 4.07 <sup>x10</sup> <sup>3</sup>  |
| Precision%      | 10%                               | 8%                                | 7%                                | 7%                                | 15%                               | 8%                                | 9%                                | 9%                                | 15%                               | 7%                                | 22%                               | 14%                               |
| Average 3 month | 1.58 <sup>x10</sup> <sup>7</sup>  | 1.98 <sup>x10</sup> <sup>5</sup>  | 1.13 <sup>x10</sup> <sup>4</sup>  | 2.98 <sup>x10</sup> <sup>7</sup>  | 2.58 <sup>x10</sup> <sup>5</sup>  | 1.68 <sup>x10</sup> <sup>4</sup>  | 4.54 <sup>x10</sup> <sup>3</sup>  | 1.58 <sup>x10</sup> <sup>2</sup>  | 2.74 <sup>x10</sup>               | 2.37 <sup>x10</sup> <sup>6</sup>  | 2.74 <sup>x10</sup> <sup>4</sup>  | 2.81 <sup>x10</sup> <sup>3</sup>  |
| SD              | 1.79 <sup>x10</sup> <sup>6</sup>  | 1.92 <sup>x10</sup> <sup>4</sup>  | 2.20 <sup>x10</sup> <sup>3</sup>  | 3.87 <sup>x10</sup> <sup>6</sup>  | 2.47 <sup>x10</sup> <sup>4</sup>  | 1.68 <sup>x10</sup> <sup>3</sup>  | 4.91 <sup>x10</sup> <sup>2</sup>  | 3.08 <sup>x10</sup>               | 5.37                              | 7.02 <sup>x10</sup> <sup>5</sup>  | 8.29 <sup>x10</sup> <sup>3</sup>  | 7.81 <sup>x10</sup> <sup>2</sup>  |
| Precision%      | 11%                               | 10%                               | 19%                               | 13%                               | 10%                               | 10%                               | 11%                               | 19%                               | 20%                               | 30%                               | 36%                               | 28%                               |
| Average 6 month | 9.38 <sup>x10</sup> <sup>6</sup>  | 2.59 <sup>x10</sup> <sup>5</sup>  | 1.01 <sup>x10</sup> <sup>4</sup>  | 1.91 <sup>x10</sup> <sup>7</sup>  | 2.69 <sup>x10</sup> <sup>5</sup>  | 1.17 <sup>x10</sup> <sup>4</sup>  | 3.01 <sup>x10</sup> <sup>3</sup>  | 2.43 <sup>x10</sup> <sup>3</sup>  | 2.46 <sup>x10</sup> <sup>3</sup>  | 6.76 <sup>x10</sup> <sup>4</sup>  | 1.62 <sup>x10</sup> <sup>3</sup>  | 2.51 <sup>x10</sup> <sup>2</sup>  |
| SD              | 6.69 <sup>x10</sup> <sup>5</sup>  | 6.77 <sup>x10</sup> <sup>3</sup>  | 1.26 <sup>x10</sup> <sup>3</sup>  | 9.57 <sup>x10</sup> <sup>5</sup>  | 1.36 <sup>x10</sup> <sup>4</sup>  | 2.14 <sup>x10</sup> <sup>3</sup>  | 9.46 <sup>x10</sup> <sup>2</sup>  | 1.05 <sup>x10</sup> <sup>3</sup>  | 1.46 <sup>x10</sup> <sup>3</sup>  | 1.19 <sup>x10</sup> <sup>4</sup>  | 3.42 <sup>x10</sup> <sup>2</sup>  | 4.50 <sup>x10</sup>               |
| Precision%      | 7%                                | 3%                                | 12%                               | 5%                                | 5%                                | 18%                               | 31%                               | 43%                               | 59%                               | 18%                               | 21%                               | 18%                               |

**Table S12.** Analysis of the assay solution stability at different storage conditions and time periods by comparison using test-t of Student's with time zero.

| <b>Luminescent activity comparison (%)</b> |                             |                                |                           |                              |
|--|-----------------------------|--------------------------------|---------------------------|------------------------------|
| <b>Incubation period</b>                   | <b>With Luciferin -20°C</b> | <b>Without Luciferin -20°C</b> | <b>With Luciferin 5°C</b> | <b>Without Luciferin 5°C</b> |
| <b>15 days</b>                             | 84%                         | 96%                            | 97%                       | 88%                          |
| <b>1 month</b>                             | 72%                         | 69%                            | 56%                       | 72%                          |
| <b>3 month</b>                             | 80%                         | 70%                            | 41%                       | 51%                          |
| <b>6 month</b>                             | 94%                         | 72%                            | 41%                       | 41%                          |

**Table S13.** Average results of triplicate analysis in CFU/mL at three different optical densities of five different dilutions.

| <b>CFU/mL</b>        |                                      |                                      |                                      |                       |                      |
|----------------------|--------------------------------------|--------------------------------------|--------------------------------------|-----------------------|----------------------|
| <b>Dilution (μL)</b> | <b>Average OD<sub>600</sub>=1.08</b> | <b>Average OD<sub>600</sub>=1.25</b> | <b>Average OD<sub>600</sub>=1.17</b> | <b>Total Average</b>  | <b>SD</b>            |
| 1000                 | 3.10×10 <sup>8</sup>                 | 1.49 ×10 <sup>8</sup>                | 4.10 ×10 <sup>8</sup>                | 2.90 ×10 <sup>8</sup> | 1.32×10 <sup>8</sup> |
| 100                  | 5.30×10 <sup>7</sup>                 | 2.34 ×10 <sup>7</sup>                | 6.30 ×10 <sup>7</sup>                | 4.65 ×10 <sup>7</sup> | 2.06×10 <sup>7</sup> |
| 10                   | 3.70×10 <sup>6</sup>                 | 1.42 ×10 <sup>6</sup>                | 2.60 ×10 <sup>6</sup>                | 2.57 ×10 <sup>6</sup> | 1.14×10 <sup>6</sup> |
| 1                    | 6.80×10 <sup>5</sup>                 | 1.76×10 <sup>4</sup>                 | 5.30×10 <sup>5</sup>                 | 4.09×10 <sup>5</sup>  | 3.47×10 <sup>5</sup> |
| 0.1                  | 5.30×10 <sup>4</sup>                 | 1.21×10 <sup>3</sup>                 | 2.50×10 <sup>4</sup>                 | 2.64×10 <sup>4</sup>  | 2.59×10 <sup>4</sup> |

**Table S14.** Average results of triplicate analysis in luminescence intensity (cps) using *A. vivianii* assay at three different optical densities of five different dilutions.

| <b>Luminescence intensity (cps) using <i>A. vivianii</i> luciferase</b> |                                      |                                      |                                      |                      |                      |
|---|--------------------------------------|--------------------------------------|--------------------------------------|----------------------|----------------------|
| <b>Dilution (μL)</b>  | <b>Average OD<sub>600</sub>=1.08</b> | <b>Average OD<sub>600</sub>=1.25</b> | <b>Average OD<sub>600</sub>=1.17</b> | <b>Total Average</b> | <b>SD</b>            |
| 1000  | 1.23×10 <sup>9</sup>                 | 1.46×10 <sup>9</sup>                 | 1.87×10 <sup>9</sup>                 | 1.52×10 <sup>9</sup> | 3.24×10 <sup>8</sup> |
| 100   | 1.47×10 <sup>8</sup>                 | 1.24×10 <sup>8</sup>                 | 1.42×10 <sup>8</sup>                 | 1.37×10 <sup>8</sup> | 1.21×10 <sup>7</sup> |
| 10  | 2.02×10 <sup>7</sup>                 | 1.86×10 <sup>7</sup>                 | 1.40×10 <sup>7</sup>                 | 1.76×10 <sup>7</sup> | 3.22×10 <sup>6</sup> |
| 1   | 3.04×10 <sup>6</sup>                 | 5.50×10 <sup>6</sup>                 | 3.85×10 <sup>6</sup>                 | 4.13×10 <sup>6</sup> | 1.25×10 <sup>6</sup> |
| 0.1   | 3.71×10 <sup>6</sup>                 | 3.66×10 <sup>6</sup>                 | 3.89×10 <sup>6</sup>                 | 3.75×10 <sup>6</sup> | 1.21×10 <sup>5</sup> |

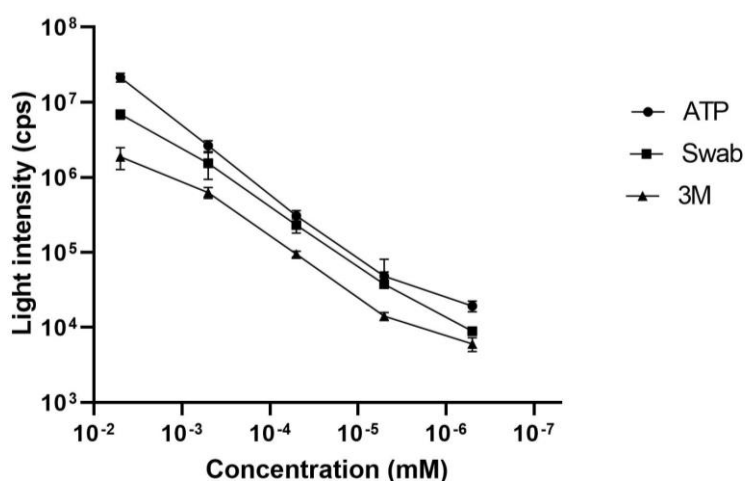
**Table S15.** Average results in luminescence intensity (cps) using a commercially available swab (3M) at three different optical densities of five different dilutions.

| <b>Luminescence intensity (cps) using 3M commercial swab</b> |                |                |                |              |           |
|--|----------------|----------------|----------------|--------------|-----------|
| <b>Dilution</b>  | <b>Average</b> | <b>Average</b> | <b>Average</b> | <b>Total</b> | <b>SD</b> |

| ( $\mu\text{L}$ ) | $\text{OD}_{600}=1.08$ | $\text{OD}_{600}=1.25$ | $\text{OD}_{600}=1.17$ | Average            |                    |
|-------------------|------------------------|------------------------|------------------------|--------------------|--------------------|
| 1000              | $1.25 \times 10^8$     | $9.53 \times 10^7$     | $1.43 \times 10^8$     | $1.21 \times 10^8$ | $2.41 \times 10^7$ |
| 100               | $2.83 \times 10^7$     | $2.47 \times 10^7$     | $3.55 \times 10^7$     | $2.95 \times 10^7$ | $5.50 \times 10^6$ |
| 10                | $2.71 \times 10^6$     | $2.07 \times 10^6$     | $5.62 \times 10^6$     | $2.47 \times 10^6$ | $1.89 \times 10^6$ |
| 1                 | $5.07 \times 10^5$     | $4.10 \times 10^5$     | $1.00 \times 10^6$     | $5.07 \times 10^5$ | $3.16 \times 10^5$ |
| 0.1               | $2.71 \times 10^5$     | $2.56 \times 10^5$     | $6.51 \times 10^5$     | $2.93 \times 10^5$ | $2.24 \times 10^5$ |

**Table S16.** Luminescence intensities (cps) of food matrix effect evaluation at two standard ATP concentrations ( $5.00 \times 10^{-3}$  and  $5.00 \times 10^{-7}$  mM).

| Luminescence intensity (cps) |                       |                       |                       |                       |                       |                       |
|------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Sample                       | Meat                  |                       | Chicken               |                       | Milk                  |                       |
| [ATP] (mM)                   | $5.00 \times 10^{-3}$ | $5.00 \times 10^{-7}$ | $5.00 \times 10^{-3}$ | $5.00 \times 10^{-7}$ | $5.00 \times 10^{-3}$ | $5.00 \times 10^{-7}$ |
| Average                      | $1.07 \times 10^6$    | $4.80 \times 10^4$    | $1.21 \times 10^6$    | $1.58 \times 10^5$    | $3.64 \times 10^6$    | $1.83 \times 10^5$    |
| SD                           | $6.12 \times 10^4$    | $9.00 \times 10^3$    | $3.68 \times 10^5$    | $3.78 \times 10^4$    | $3.00 \times 10^5$    | $3.47 \times 10^4$    |
| Precision%                   | 6%                    | 19%                   | 30%                   | 24%                   | 8%                    | 19%                   |
| Accuracy%                    | 73%                   |                       | 80%                   |                       | 70%                   |                       |



**Figure S2.** Linearity curves constructed for standard ATP (ATP), ATP extracted from the cultures in the swab (Swab) and the commercial swab (3M) at five different concentrations along with their respective luminescence intensities.