**Supplementary Materials**

**Optimizing Ciprofloxacin Detection: Spectrophotometric Method Validation Across Chemical and Thermal Parameters**

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 Fig. S1. CIP cationic, neutral, and anionic forms.

**Table S1.** Features of the calibration curve for CIP determined by spectrophotometric method:

|  |  |
| --- | --- |
| **Parameters of regression lines** | **values** |
| Beer's law limit (µg/ml) | 5-30 |
| Regression coefficient (r2) | 0.99 |
| Molar absorptivity (104 L mol-1 cm-1) | 2.26 |
| Linearity equationa | y = 0.0588x+0.1185 |
| LODb (µg/ml) | 5.73 |
| LOQc (µg/ml) | 17.38 |
| Mean recovery (%) | 99.2 |

a y refers to absorbance; x refers to concentration in µg/ml

b Limit of detection

C Limit of quantification

**Table S2.** Assay data of ciprofloxacin at different pH.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable Parameter** | **concentration range****(µgml-1)** | **Found concentration (µg ml-1)** | **Linearity eq.** | **Molar absorptivity (104 L.mol-1.cm-1 )** |
| pH = 2 | 3-15 | 2.9-15.6 | Y = 0.0694 X + 0.0826 | 2.68 |
| pH = 3 | 3-15 | 2.6-15.1 | Y = 0.0599 X + 0.1533 | 2.31 |
| pH = 4 | 3-15 | 2.7-15.3 | Y = 0.0633 X + 0.1378 | 2.44 |
| pH = 5 | 3-15 | 2.9-16.2 | Y = 0.058 X + 0.1383 | 2.24 |
| pH = 6 | 3-15 | 3.2-15.6 | Y = 0.0569 X + 0.1157 | 2.2 |
| pH = 8 | 3-15 | 3.2-14.9 | Y = 0.0501 X + 0.2185 | 1.93 |
| pH = 10 | 3-15 | 3.5-15.7 | Y = 0.0542 X + 0.1806 | 2.09 |
| pH = 11 | 3-15 | 2.7-15 | Y = 0.0533 X + 0.1738 | 2.06 |
| pH = 12 | 3-15 | 2.4-15.3 | Y = 0.0518 X + 0.1737 | 1.99 |

**Table S3.** LOD, LOQ, recovery (%), and mean recovery data of ciprofloxacin at different pH values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable Parameter** | **LOD** | **LOQ** | **Recovery (%)** | **Mean recovery** |
| pH = 2 | 5.00 | 15.2 | 96.9-104.4 | 100.30 |
| pH = 3 | 6.10 | 18.6 | 87.6-100.7 | 99.80 |
| pH = 4 | 4.50 | 13.5 | 90.23-102.3 | 99.90 |
| pH = 5 | 9.30 | 28.2 | 98.1-107.9 | 100.60 |
| pH = 6 | 3.40 | 10.3 | 107.9-103.7 | 100.00 |
| pH = 8 | 3.80 | 11.5 | 106.8-99.6 | 100.20 |
| pH = 10 | 5.40 | 16.4 | 117.2-101.2 | 101.20 |
| pH = 11 | 3.20 | 9.7 | 89.2-100.1 | 99.70 |
| pH = 12 | 5.02 | 15.2 | 81.1-102.1 | 98.90 |

**Table S4.** Assay data of ciprofloxacin at different ionic strength values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable Parameter** | **concentration range (µg ml-1)** | **Found concentration** | **Linearity eq.** | **Molar absorptivity (104 L.mol-1.cm-1 )** |
| I = 0.05 | (3-15 µg/ml ) | 2.7-15 | y = 0.0622x + 0.154 | 2.4 |
| I = 0.1 | (3-15 µg/ml ) | 2.7-14.9 | y = 0.0599x + 0.146 | 2.31 |
| I = 0.2 | (3-15 µg/ml ) | 3.3-14.9 | y = 0.0589x + 0.1713 | 2.27 |
| I = 0.3 | (3-15 µg/ml ) | 2.8-15.1 | y = 0.0627x + 0.1543 | 2.42 |
| I = 0.5 | (3-15 µg/ml ) | 3.3-15.02 | y = 0.0631x + 0.1435 | 2.43 |

**Table S5.** LOD, LOQ, recovery (%), and mean recovery data of ciprofloxacin at different ionic strength values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable Parameter** | **LOD** | **LOQ** | **Recovery(%)** | **Mean recovery** |
| I = 0.05 M | 5.2 | 15.7 | 89.01-99.9 | 99.7 |
| I = 0.1 M | 1.7 | 5.2 | 91.3-99.4 | 99.6 |
| I = 0.2 M | 3.9 | 11.8 | 111.3-99.5 | 100.9 |
| I = 0.3 M | 4.3 | 13.2 | 93.8-100.9 | 100.03 |
| I = 0.5 M | 4.3 | 13 | 109.2-100.1 | 100.5 |

**Table S6.** Assay data of ciprofloxacin at different temperature values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable Parameter** | **concentration range (µg ml-1)** | **Found concentration** | **Linearity eq.** | **Molar absorptivity (104 L mol-1 cm-1)** |
| T = 283 K | 3-15 | 2.6-16.3 | y = 0.0562x + 0.1275 | 2.17 |
| T = 293 K | 3-15 | 2.9-14.6 | y = 0.0494x + 0.2425 | 1.91 |
| T = 303 K | 3-15 | 3.1-15.9 | y = 0.0565x + 0.1799 | 2.18 |
| T = 403 K | 3-15 | 3.8-16.3 | y = 0.0579x + 0.1868 | 2.23 |

**Table S7.** LOD, LOQ, recovery (%), and mean recovery data of ciprofloxacin at different temperature values

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable Parameter** | **LOD** | **LOQ** | **Recovery(%)** | **Mean recovery** |
| T = 283 K | 9.4 | 28.4 | 87.01-108.5 | 99.4 |
| T = 293 K | 9.3 | 28.2 | 95.9-97.6 | 100.05 |
| T = 303 K | 8.2 | 24.7 | 103.3-106.2 | 101.2 |
| T = 403 K | 7.9 | 23.8 | 126.8-108.5 | 101.9 |