## Supplementary Materials

**Figure S1.** Pictorial diagram for thin-layer chromatography (TLC) plates of piperine (PPN) using sustainable reversed-phase HPTLC.

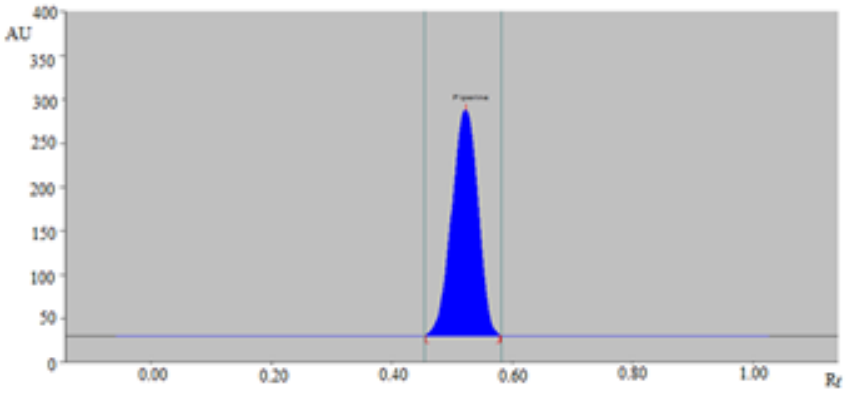


**Figure S2.** Densitometry chromatograms of standard PPN recorded using reversed-phase HPTLC.

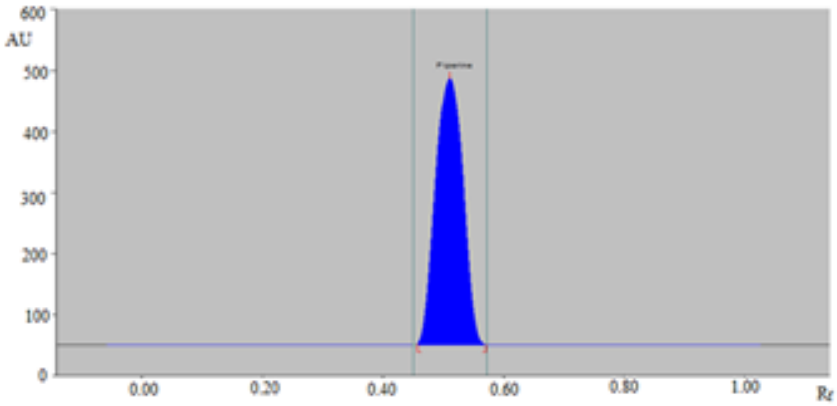


**Figure S3.** Densitometry chromatogram of PPN in methanolic extract of black pepper (BPMH) recorded using reversed-phase HPTLC technique.

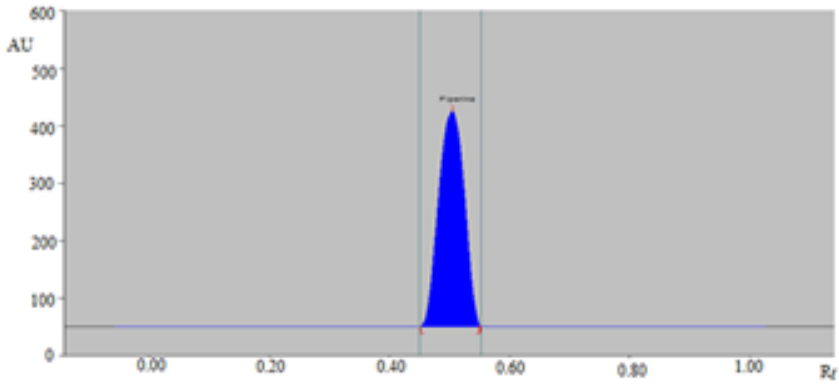


**Figure S4.** Densitometry chromatograms of PPN in methanolic extract of black pepper (BPPA) recorded using reversed-phase HPTLC technique.


**Figure S5.** Eco-scale value of sustainable reversed-phase HPTLC technique predicted using AGREE: The Analytical Greenness Calculator.

**Table S1.** Results of least square regression analysis for piperine (PPN) for a sustainable reversed-phase high-performance thin-layer chromatography (HPTLC) technique (mean ± SD; n = 6).

| Parameters | Reversed-phase HPTLC |
|---|---|
| Linearity range (ng band$^{-1}$) | 50-500 |
| Regression equation | y = 43.27x + 522.19 |
| $R^2$ | 0.9990 |
| Slope ± SD | 43.27 ± 1.11 |
| Intercept ± SD | 522.19 ± 4.28 |
| Standard error of slope | 0.45 |
| Standard error of intercept | 1.74 |
| 95% confidence interval of slope | 38.49-48.04 |
| 95% confidence interval of intercept | 503.77-540.60 |
| LOD ± SD (ng band$^{-1}$) | 17.10 ± 0.82 |
| LOQ ± SD (ng band$^{-1}$) | 51.30 ± 2.46 |

**Table S2.** Results of accuracy evaluation for reversed-phase HPTLC technique (mean ± SD; n = 6).

| Conc. (ng band$^{-1}$) | Conc. found (ng band$^{-1}$) ± SD | Recovery (%) | RSD (%) |
|---|---|---|---|
| 50 | 50.92 ± 0.76 | 101.84 | 1.49 |
| 300 | 302.84 ± 2.23 | 100.94 | 0.73 |
| 500 | 494.14 ± 2.95 | 98.82 | 0.59 |

**Table S3.** Results of precision evaluation for reversed-phase HPTLC technique (mean ± SD; n = 6).

| Conc. | Intraday precision | | | Interday precision | | |
|---|---|---|---|---|---|---|
| (ng band$^{-1}$) | Area ± SD | Standard error | RSD (%) | Area ± SD | Standard error | RSD (%) |
| 50 | 2668 ± 32 | 13.06 | 1.19 | 2578 ± 38 | 15.51 | 1.47 |
| 300 | 12284 ± 129 | 52.67 | 1.05 | 13156 ± 149 | 60.84 | 1.13 |
| 500 | 20824 ± 168 | 68.59 | 0.80 | 21322 ± 188 | 76.76 | 0.88 |

**Table S4.** Results of robustness evaluation for reversed-phase HPTLC technique (mean ± SD; n = 6).

| Conc. | Mobile phase composition (ethanol/water) | | | Results | | |
|---|---|---|---|---|---|---|
| (ng band$^{-1}$) | Original | Used | | Area ± SD | % RSD | $R_f$ |
| 300 | 80:20 | 82:18 | +0.2 | 14134 ± 162 | 1.14 | 0.51 |
| | | 80:20 | 0.0 | 13346 ± 154 | 1.15 | 0.52 |
| | | 78:22 | -0.2 | 12356 ± 143 | 1.15 | 0.53 |

**Table S5.** Application of sustainable reversed-phase HPTLC technique in determination of PPN in commercial food products in which PPN was extracted by traditional and ultrasound procedures (mean ± SD; n = 3).

| Samples | Traditional extraction | Ultrasound-based extraction |
|---|---|---|
| | Amount of PPN (mg $g^{-1}$) | |
| BPMH | 133.67 ± 3.02 | 143.84 ± 3.86 |
| BPLU | 128.35 ± 2.95 | 142.29 ± 2.98 |
| BPSH | 122.46 ± 2.64 | 128.39 ± 2.70 |
| BPPA | 119.72 ± 2.52 | 125.56 ± 2.57 |