***Supplementary Information***

# A Sustainable One-Pot Synthesis of Chiral Carbon Dots Using Response Surface Methodology: Elucidating the Mechanistic Pathways through Biological Responses

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**Table S1.** Experimental matrix for the synthesis of L-pro.CA CDots using BBD. Independent variables are $X_1$= time, $X_2$= temperature and $X_3$= molar ratio of proline to CA and their dependent response is Y= Chiral integration.

| Run | Factors | | | Response |
|---|---|---|---|---|
| | $X_1$ | $X_2$ | $X_3$ | Y |
| 1 | 17.5 | 160.0 | 3.0 | 547.6 |
| 2 | 10.0 | 175.0 | 3.0 | 528.6 |
| 3 | 17.5 | 175.0 | 5.0 | 411.8 |
| 4 | 17.5 | 160.0 | 7.0 | 410.5 |
| 5 | 10.0 | 175.0 | 7.0 | 305.2 |
| 6 | 17.5 | 175.0 | 5.0 | 360.9 |
| 7 | 25.0 | 175.0 | 7.0 | 310.0 |
| 8 | 17.5 | 190.0 | 3.0 | 307.6 |
| 9 | 17.5 | 175.0 | 5.0 | 423.7 |
| 10 | 17.5 | 175.0 | 5.0 | 393.7 |
| 11 | 25.0 | 160.0 | 5.0 | 444.5 |
| 12 | 10.0 | 160.0 | 5.0 | 420.7 |
| 13 | 10.0 | 190.0 | 5.0 | 349.5 |
| 14 | 17.5 | 190.0 | 7.0 | 243.3 |
| 15 | 25.0 | 190.0 | 5.0 | 159.9 |
| 16 | 17.5 | 175.0 | 5.0 | 400.4 |
| 17 | 25.0 | 175.0 | 3.0 | 321.0 |

**Table S2.** The result for sequential model sum of squares. The quadratic model, which offers a polynomial of higher order than a linear model, is employed. In addition, the quadratic model avoids aliasing, distinguishing it from the cubic model.

| Source | Sum of Squares | df | Mean Squares | *F*-Value | *P*-Value | |
|---|---|---|---|---|---|---|
| Linear | 1 | 3 | 0.33 | 11.67 | 0.0005 | |
| 2FI | 0.24 | 3 | 0.08 | 6.20 | 0.01 | |
| Quadratic | 0.11 | 3 | 0.03 | 10.23 | 0.0059 | Suggested |
| Cubic | $9.370E-003$ | 3 | $3.123E-003$ | 0.84 | 0.5367 | Aliased |

**Table S3.** ANOVA results for the modified quadratic model.

($X_1$= time, $X_2$= temperature and $X_3$= molar ratio of proline to CA)

| Source | Sum of Squares | df | Mean Squares | *F*-Value | *P*-Value Prob >F |
|---|---|---|---|---|---|
| Model | 1.35 | 7 | 0.19 | 69.52 | $< 0.0001$ |
| $X_1$ | 0.18 | 1 | 0.18 | 66.03 | $< 0.0001$ |
| $X_2$ | 0.67 | 1 | 0.67 | 240.12 | $< 0.0001$ |
| $X_3$ | 0.15 | 1 | 0.15 | 55.26 | |
| $X_1X_2$ | 0.18 | 1 | 0.18 | 63.19 | 0.0001 |
| $X_1X_3$ | 0.06 | 1 | 0.06 | 19.97 | .0016 |
| $X_1^2$ | 0.05 | 1 | 0.05 | 16.10 | .0031 |
| $X_2^2$ | 0.04 | 1 | 0.04 | 5.48 | .0473 |
| Residual | 0.02 | 9 | $2.77E-003$ | | |
| Lack of fit | 0.01 | 5 | $2.03E-003$ | 0.55 | 0.7373 |
| Mean | 5.88 | | R-Squared | 0.98 | |
| C.V% | 0.89 | | Adj. R-Squared | 0.96 | |
| Adeq. precision | 32.95 | | Pred. R-Squared | 0.91 | |

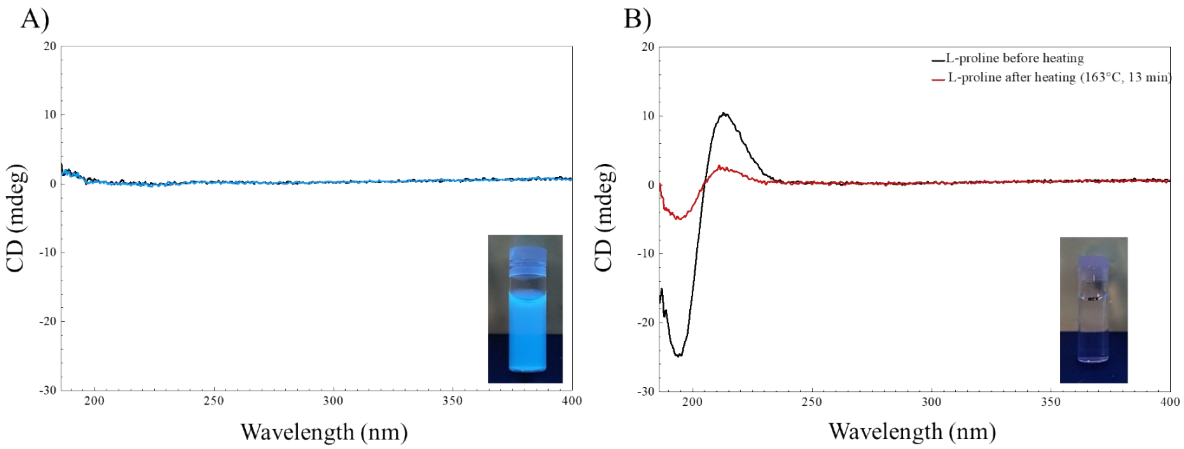


**Figure S1.** Absence of chiral signal in citric acid precursor before and after microwave in CD spectra; Inset: fluorescence of citric acid sample dissolved in water, indicating the formation of CDots (A). Heat treatment does not affect exciton couplet in L-proline, as demonstrated by CD spectra analysis; Inset: Fluorescence emission of L-proline after heating and dissolution in water demonstrating no sign of photoluminescence properties (B).

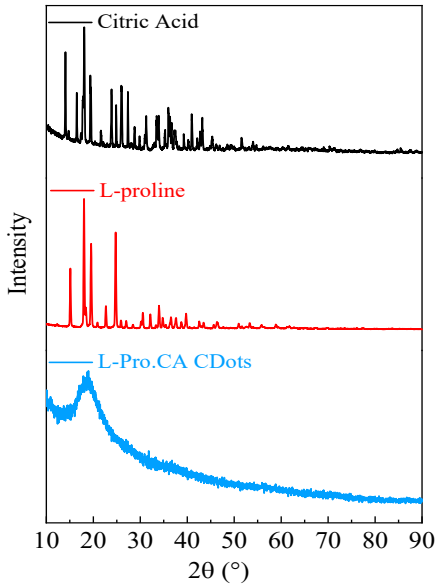


**Figure S2.** XRD pattern of L-Pro.CA CDots. Upon formation, the L-Pro.CA CDots evidence an amorphous halo centered at 17º 2θ along with the absence of all crystalline reflections from the precursors.

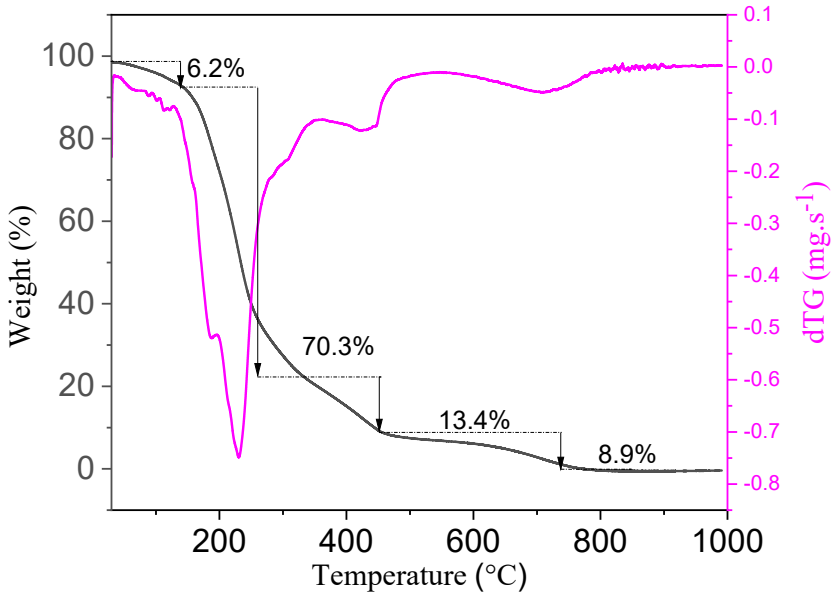


**Figure S3.** TGA profile of L-Pro.CA CDots reveals multiple weight losses with increasing temperature. The predominant weight loss of 70.3% occurs at 260°C, indicating the thermal stability of L-Pro.CA CDots up to this temperature.