Supplementary Information (SI) for Sustainable Food Technology.
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Supporting Information of

Fabrication of blue emissive carbon dots using *Morinda citrifolia* fruit pulp for clodinafop and cypermethrin detection via fluorescence Turn-Off and enhancement Mechanisms

Juhi Bhadresh Raval[a], Vaibhavkumar N .Mehta[b], Sanjay Jha[b], Tae Jung Park[c] and Suresh Kumar Kailasa[a]*

[a]*Department of Chemistry, Sardar Vallabhbhai National Institute of Technology, Surat-395 007, Gujarat, India*

[b]ASPEE SHAKILAM Biotechnology Institute, Navsari Agricultural University, Surat, 395007, Gujarat, India

[c]*Department of Chemistry, Research Institute of Chem-Bio Diagnostic Technology, Chung-Ang University, 84 Heukseok-ro, Dongjak-gu, Seoul 06974, Republic of Korea*

**** Corresponding author***

E-mail: sureshkumarchem@gmail.com; skk@chem.svnit.ac.in (S.K. Kailasa)

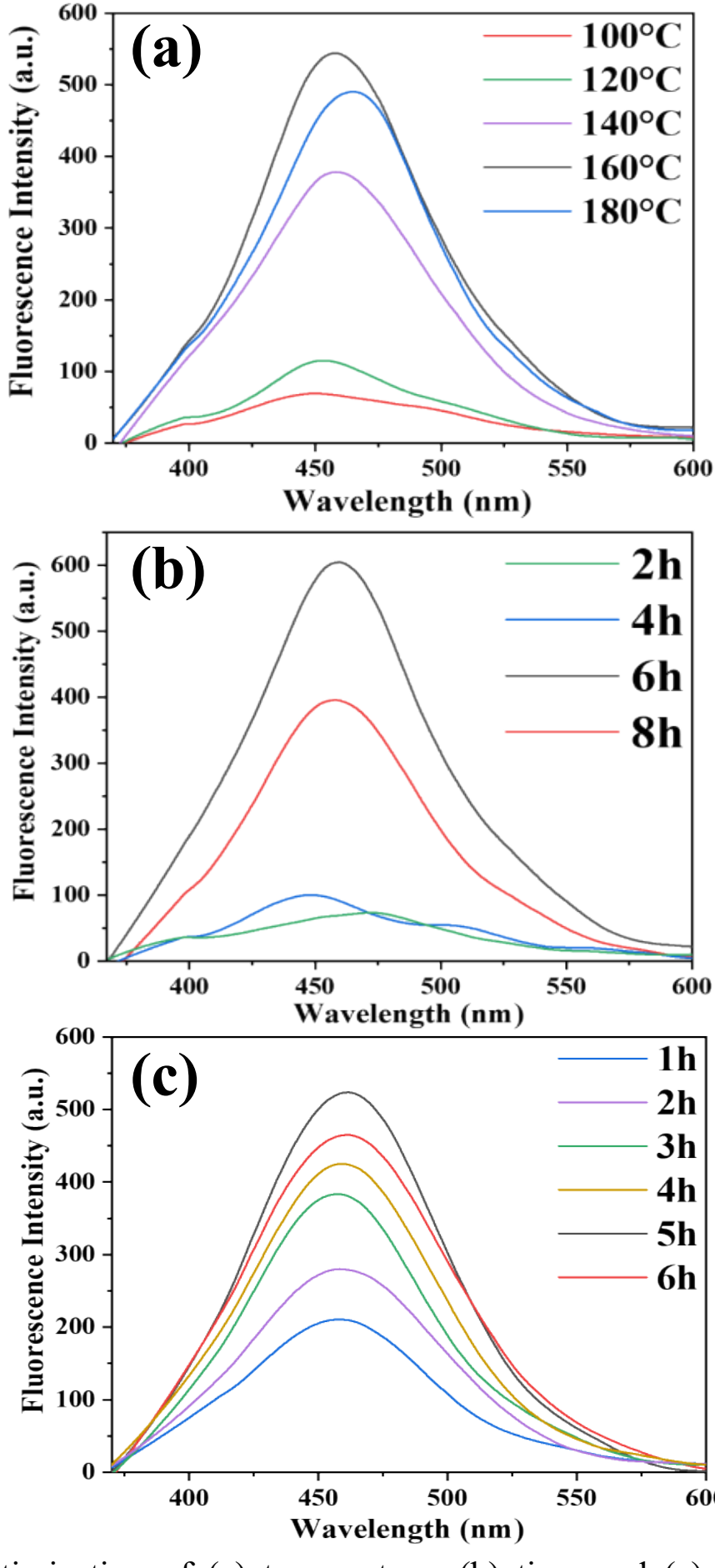

Figure S1. Optimization of (a) temperature, (b) time and (c) dialysis time for fabrication of *M. citrifolia*- CDs from *M. citrifolia* fruit pulp

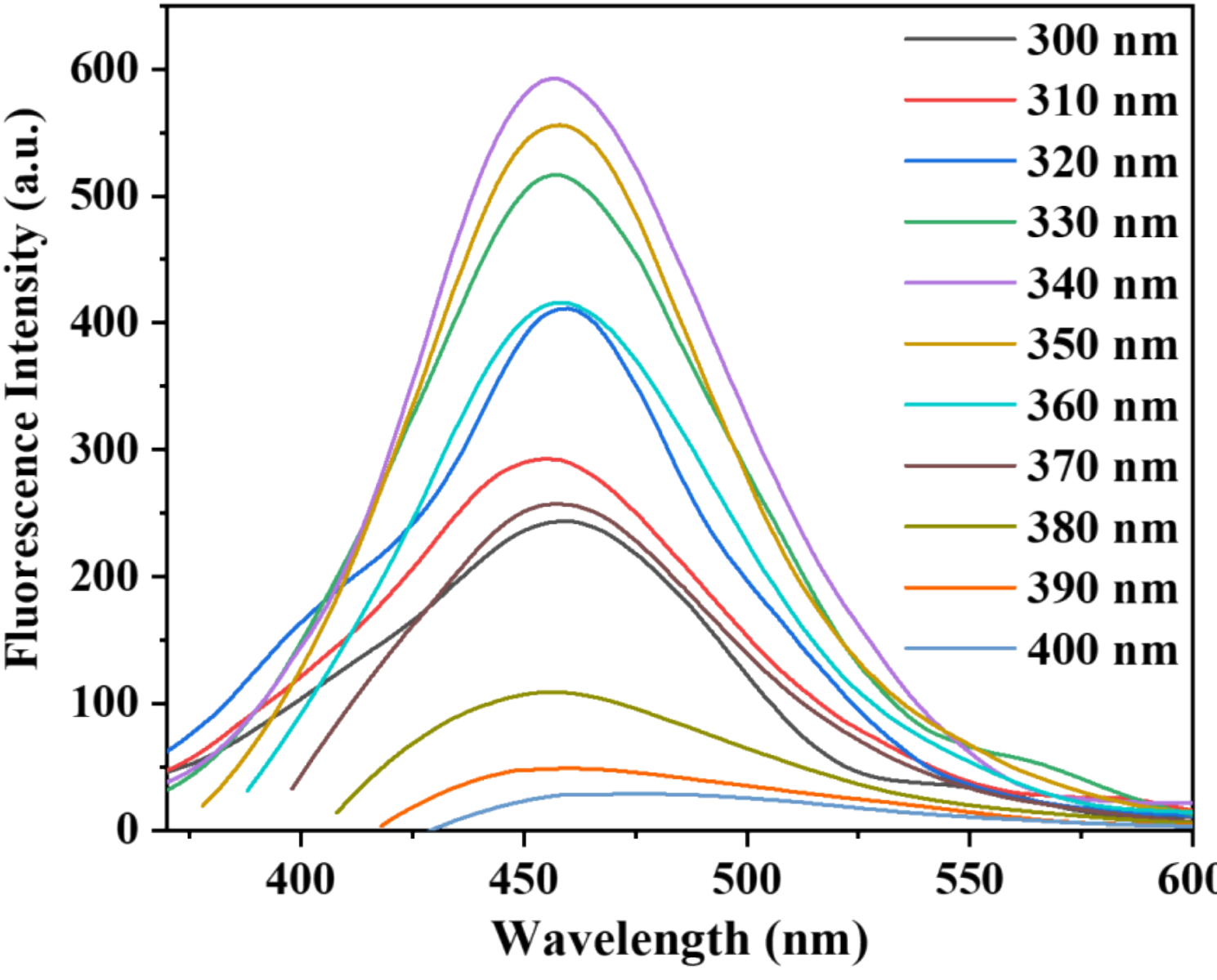

Figure S2. Excitation-independent emission spectra of *M.citrifolia*-CDs showing 340 nm as the maximum emission wavelength

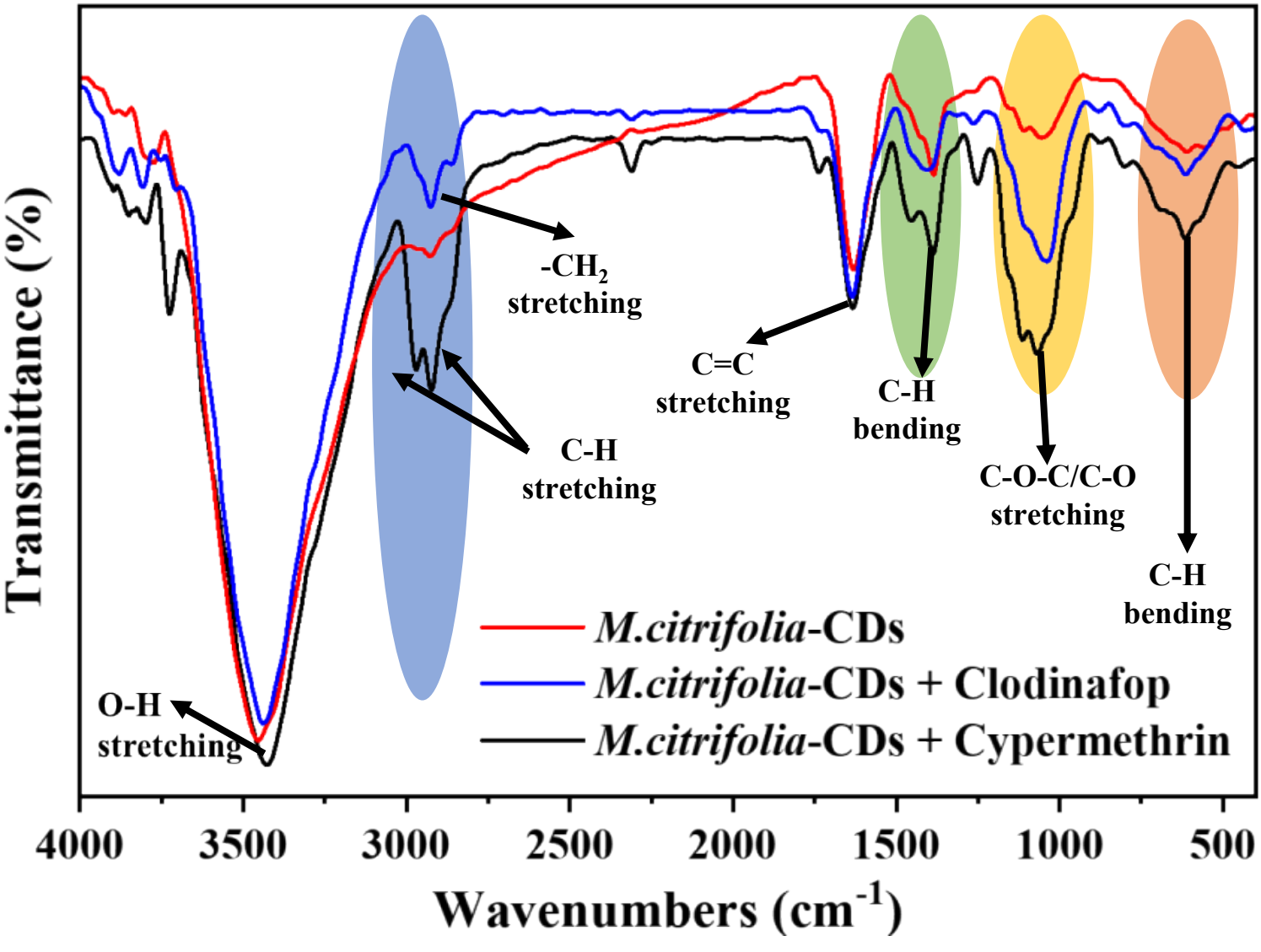

Figure S3. FT-IR spectra of *M.citrifolia*-CDs, *M.citrifolia*-CDs + clodinafop and *M.citrifolia*-CDs + cypermethrin

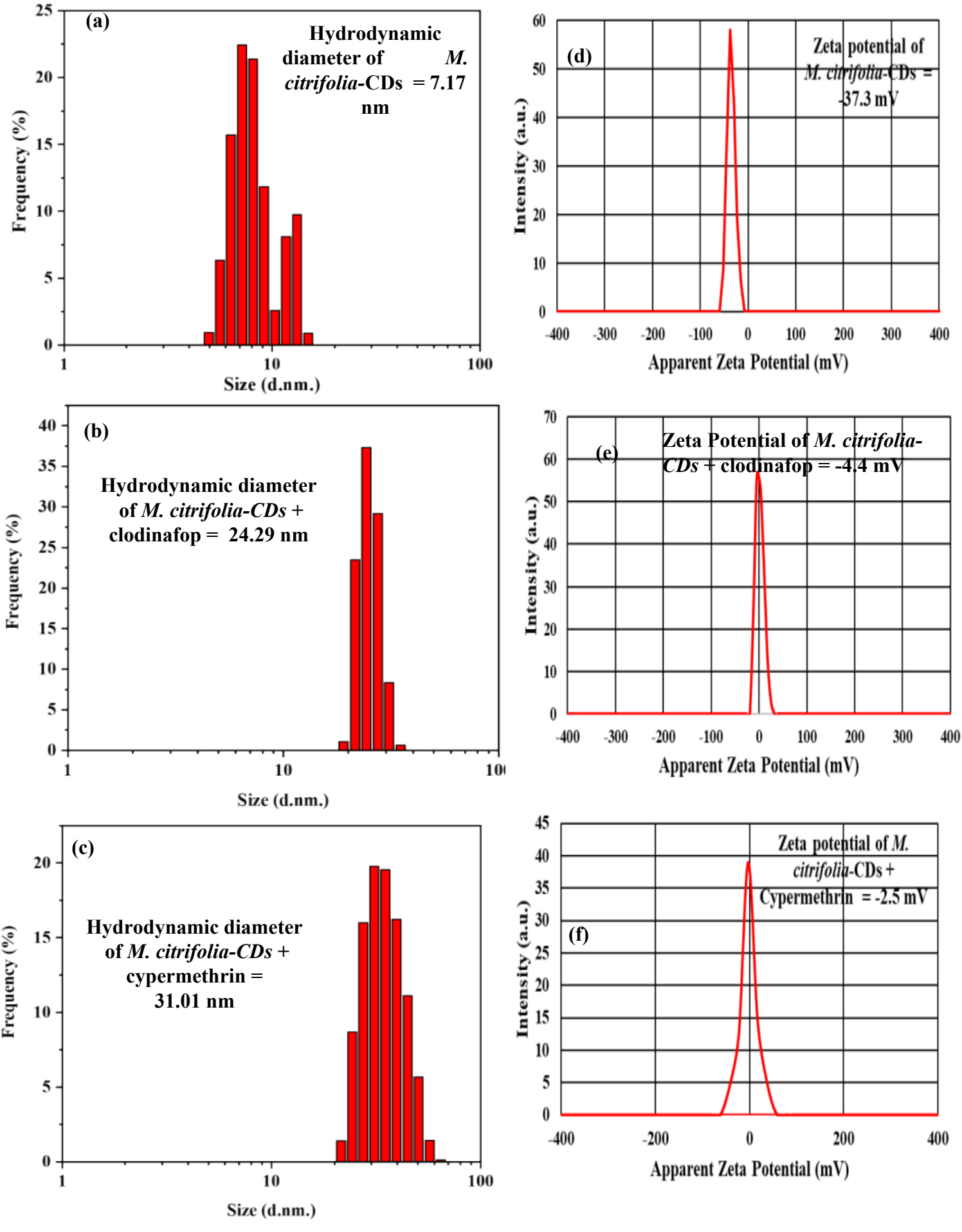

Figure S4. Hydrodynamic diameter of (a) *M. citrifolia* – CDs (b) *M. citrifolia* – CDs + clodinafop (c) *M. citrifolia* – CDs + cypermethrin and, Zeta Potential of (d) *M. citrifolia* – CDs (e) *M. citrifolia* – CDs + clodinafop (f) *M. citrifolia* – CDs + cypermethrin

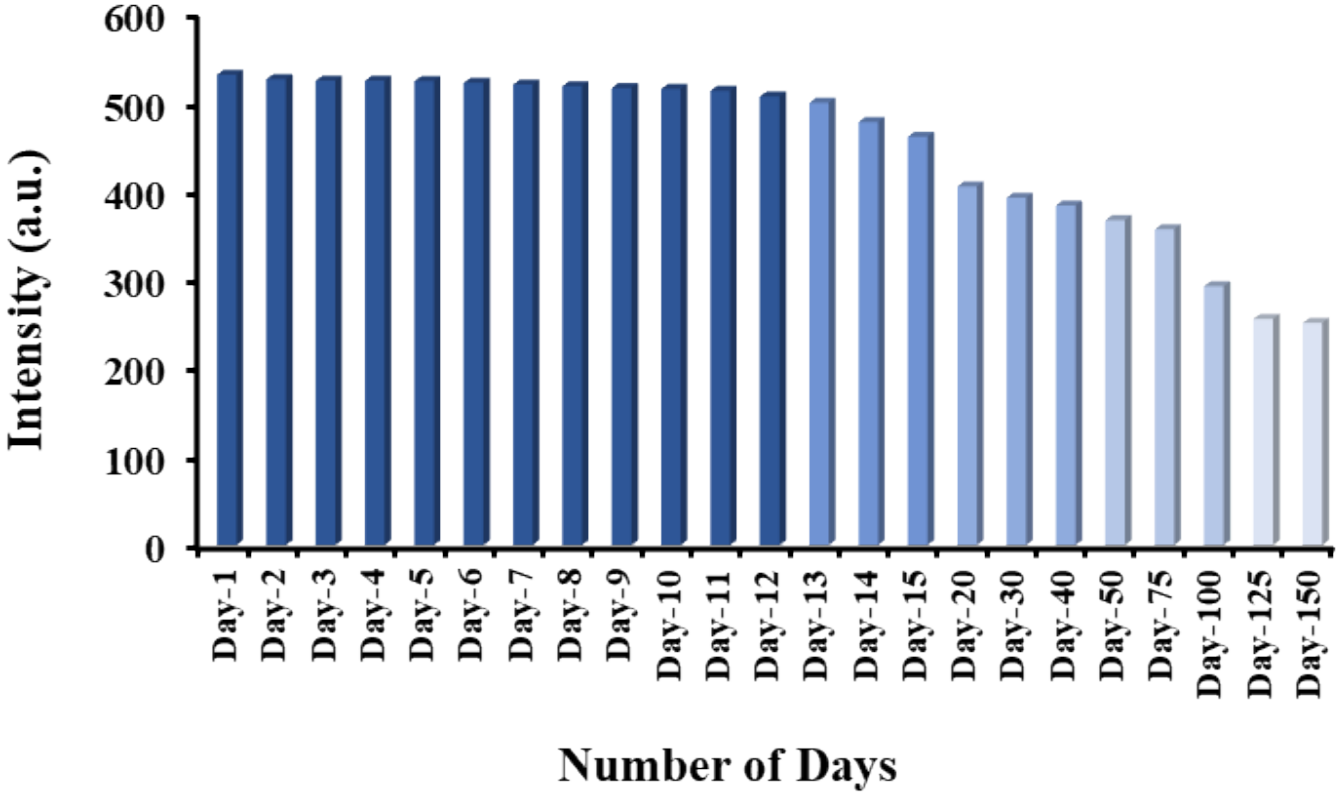

Figure S5. Emission spectra of *M.citrifolia*-CDs stability from day-1 to day-150

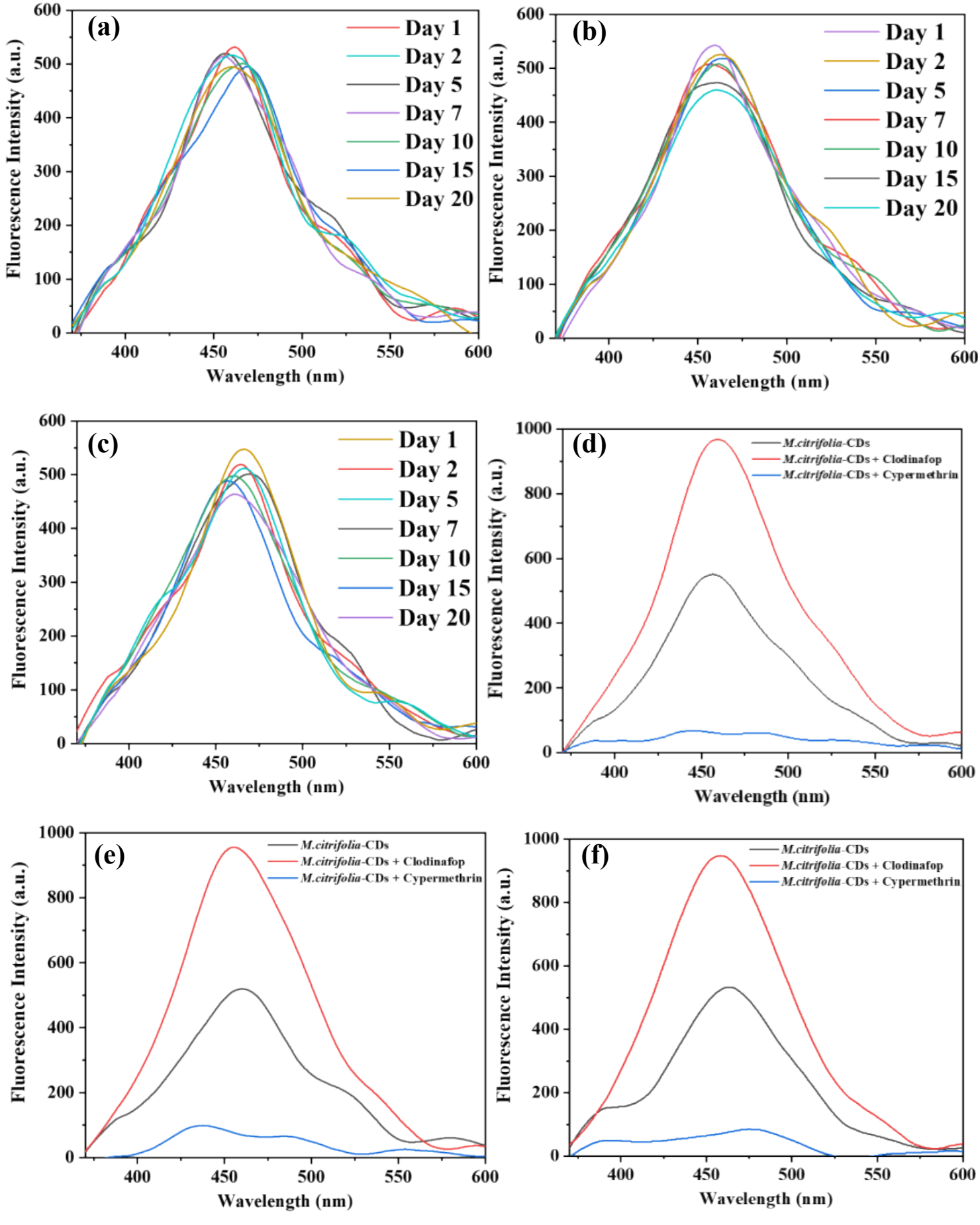

Figure S6. Investigation of the reproducibility and repeatability of the fabrication of *M.citrifolia*-CDs at (a-c) three different batches up to 20 days and (d-f) detection of clodinafop and cypermethrin using three different batches of *M.citrifolia*-CDs as a probe

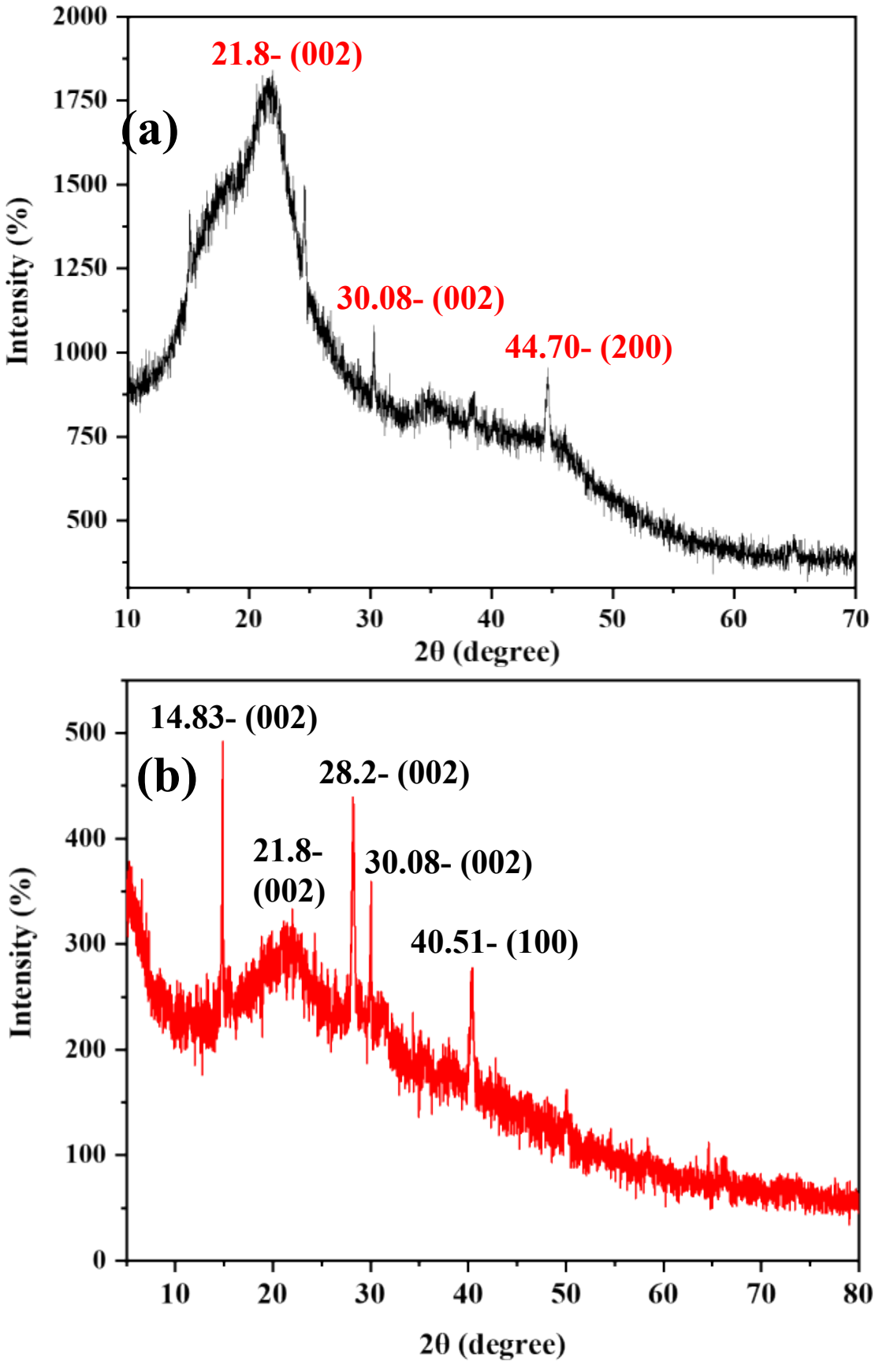

Figure S7. XRD analysis of (a) *M. citrifolia* fruit pulp shows amorphous nature with lower graphitic structure and (b) *M. citrifolia* – CDs confirms its amorphous nature with high disordered carbon atoms.

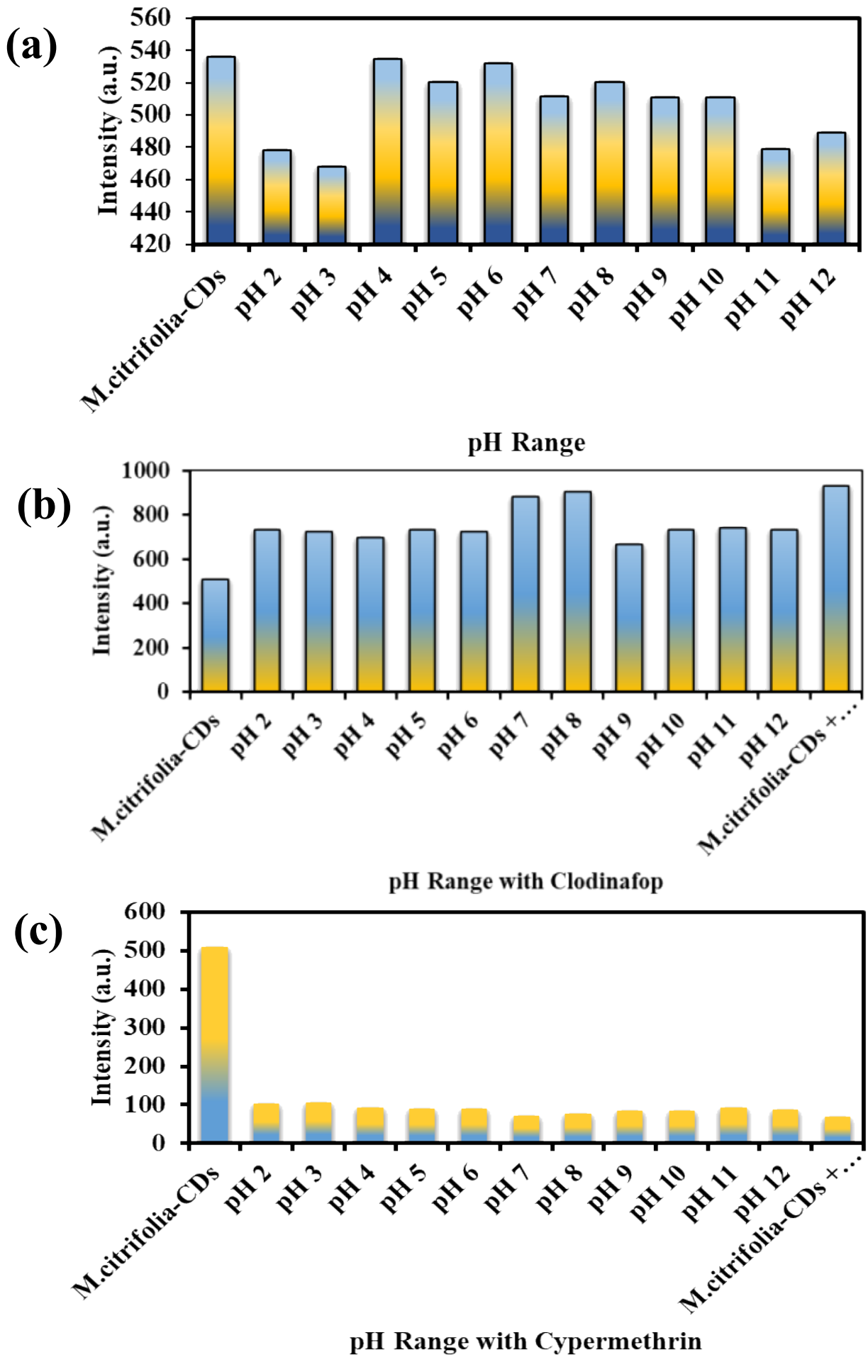

Figure S8. pH study (a) *M. citrifolia*-CDs (b) *M. citrifolia*-CDs + clodinafop (a) *M. citrifolia*-CDs + cypermethrin

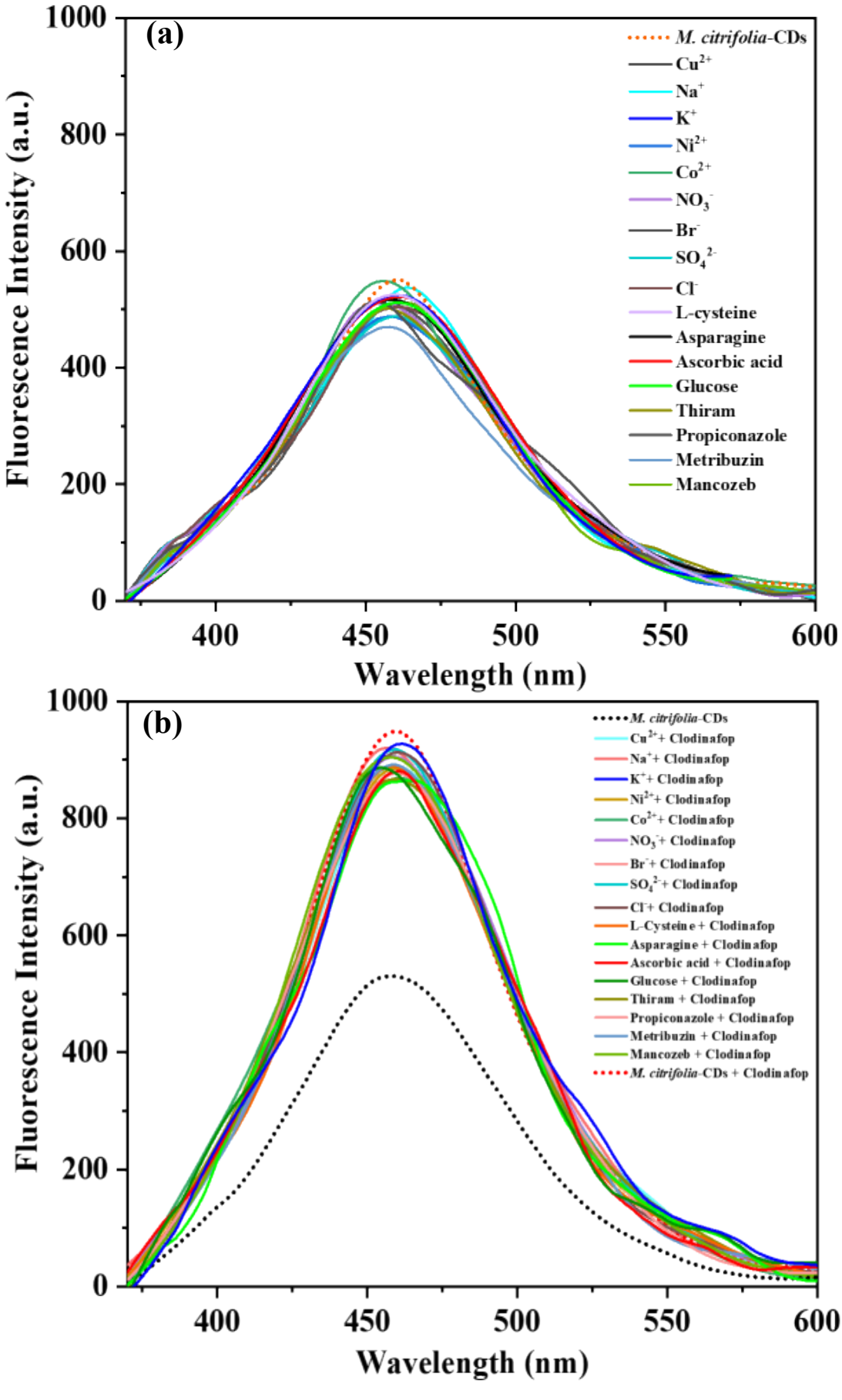

Figure S9. Selectivity study of *M. citrifolia*-CDs in the presence of various interferring chemical species such as Cations (Cu^{2+}, Na^{+}, K^{+}, Ni^{2+}, and Co^{2+}; 1000 µM), anions (NO_3^{-}, Br^{-}, SO_4^{2-}, and Cl^{-}; 1000 µM), biomolecules (L-cysteine, asparagine, ascorbic acid, glucose, 1000 µM), and pesticides (thiram, propiconazole, metribuzin, mancozeb; 1000 µM) (a) Absence of clodinafop (b) Presence of clodinafop

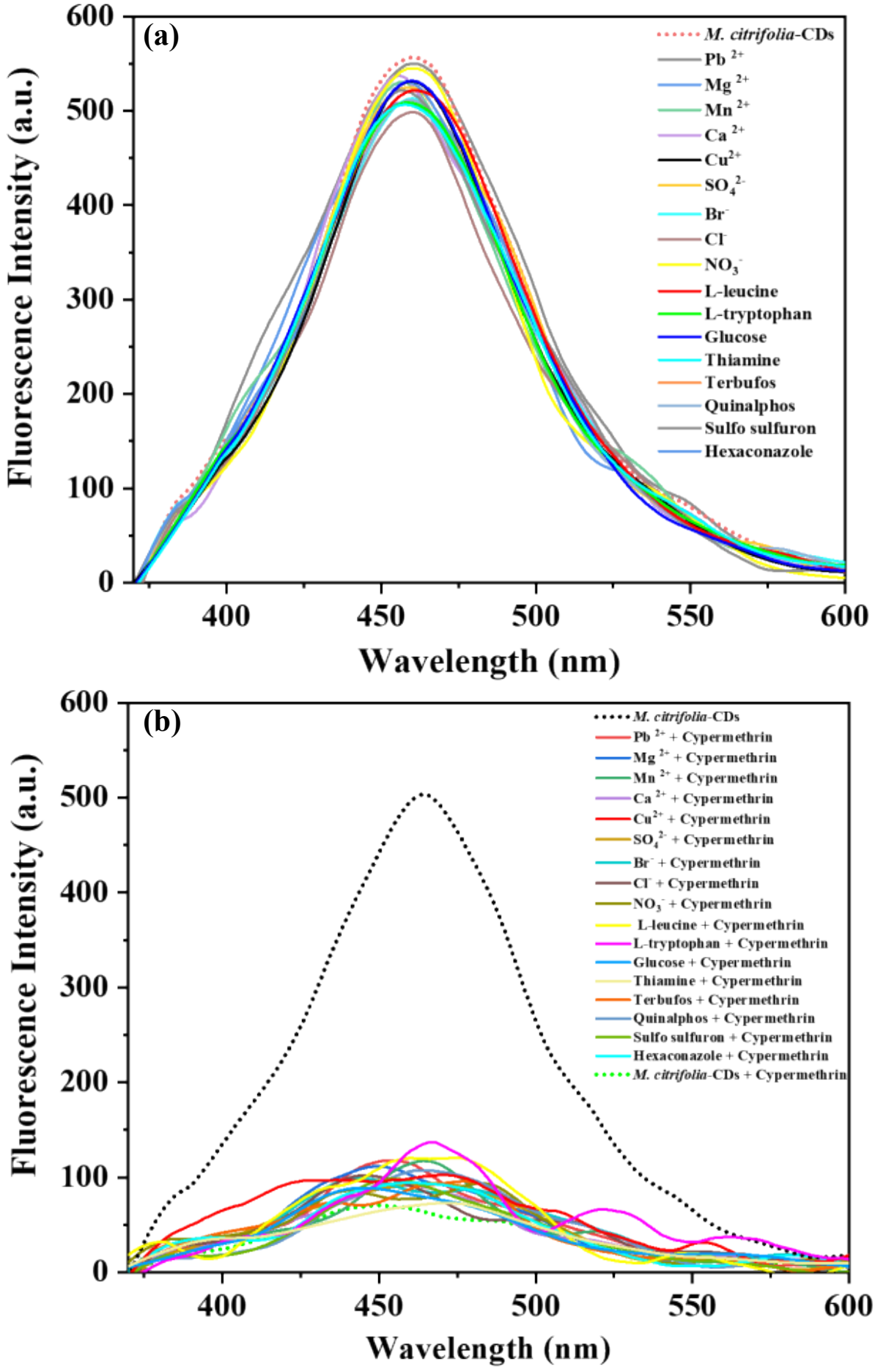

Figure S10. Selectivity study of *M. citrifolia*-CDs in the presence of various interfering chemical species such as Cations (Pb^{2+}, Mg^{2+}, Mn^{2+}, $Cu^{2+,}$ and Ca^{2+}; 1000 µM), anions (SO_4^{2-}, Br^-, Cl^-, and NO_3^-; 1000 µM), biomolecules (L-leucine, L-tryptophan, glucose, thiamine; 1000 µM), and pesticides (terbufos, quinalphos, sulfosulfuron, hexaconazole; 1000 µM) (a) Absence of cypermethrin (b) presence of cypermethrin

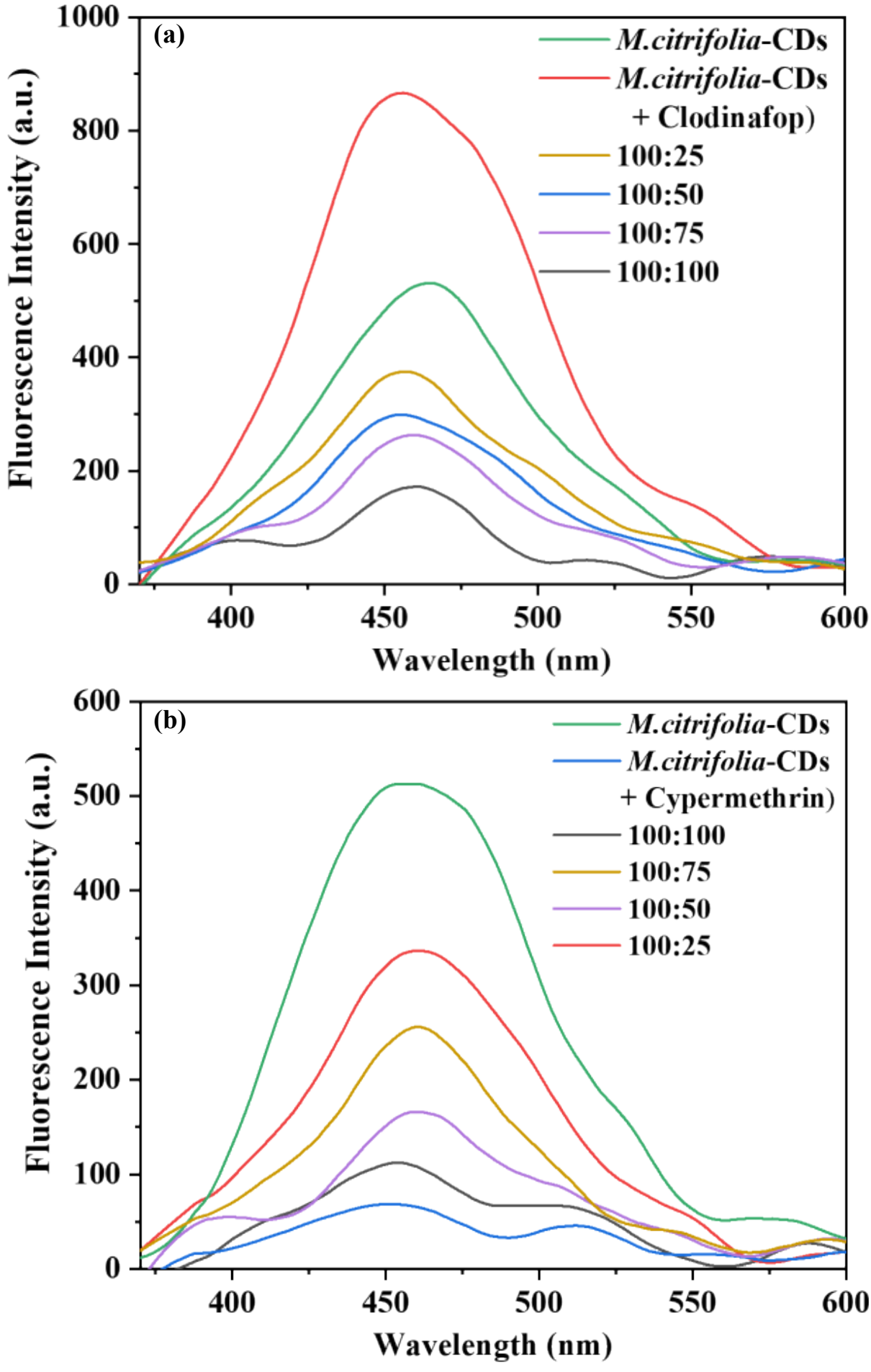

Figure S11. Anti-interference study of *M.citrifolia*-CDs in the existence of both pesticides at different concentrations of clodinafop and cypermethrin (a) cypermethrin: clodinafop (100:25,100:50, 100:75, 100:100 µM) and (b) clodinafop: cypermethrin 100:100, 100:75, 100:50, 100:25 µM, respectively.

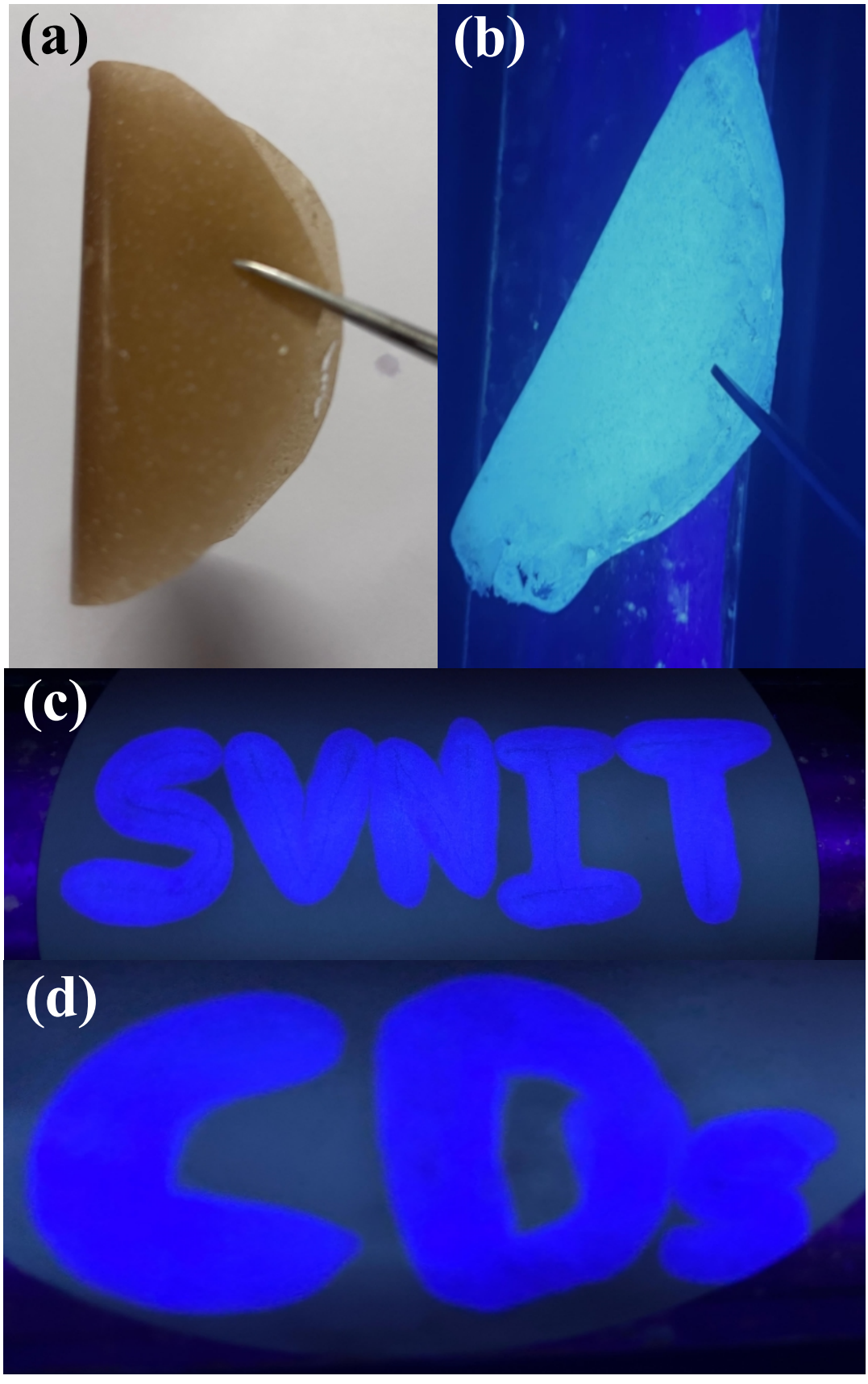

Figure S12. Polymer thin film (a) under daylight (b) under UV-light, Fluorescent ink under UV-light (c) SVNIT calligraphed (d) CDs calligraphed

(a)

Sr. No.	Characteristics	Parameters
1.	**Types of analysis**	Quantitative and confirmatory
2.	Multi – or single-elements analysis	**Multi- element analysis for 2-5 compounds of the same chemical class**
3.	**Analytical technique**	Sophisticated instrumentation (LC-MS, GC-MS, ICP-MS, homemade interfaces, homemade automatic systems etc.)
4.	Simultaneous sample preparation	**2-12**
5.	**Sample preparation**	Nor required or on-site sample preparation if required
6.	Sample per h	**5-10**
7.	**Reagents and materials**	Need to be synthesized in the lab with advanced equipment or know how
8.	Preconcentration	**No preconcentration required. Required sensitivity and /or legislation criteria are met directly.**
9.	**Degree of automation**	Manual treatment and analysis
10.	Amount of sample	**100-500 µL (or mg) bioanalytical sample; 10.1-50 mL (or g) food/environmental**

(b)

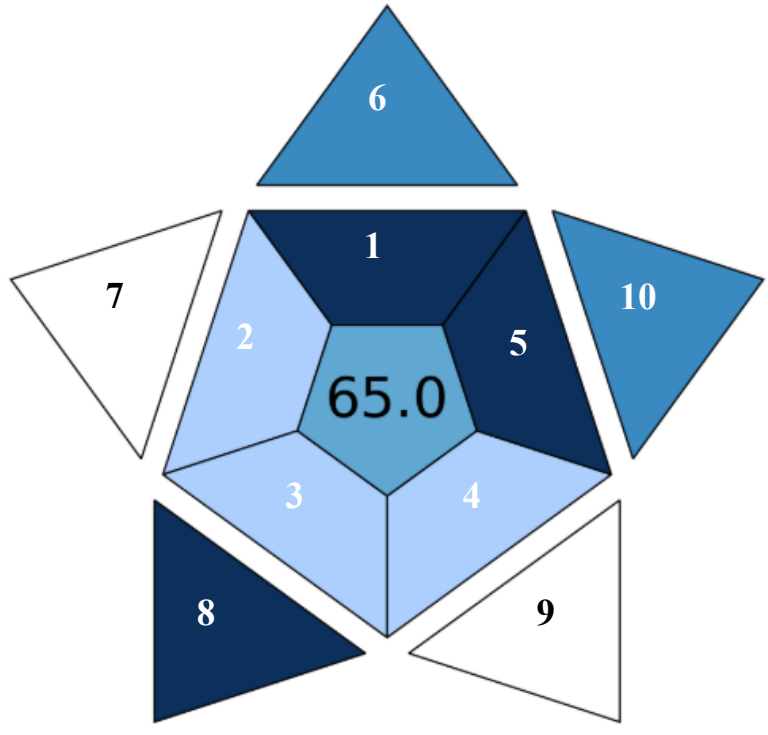

Figure S13. Evaluation of practicability by blue applicability grade index (BAGI), (a) Various characteristics and parameters on which the proposed method was evaluated for practicability index, (b) 65.0 score on the basis of the selected parameter of the given characteristic, suggesting the practical ability of the proposed method

Figure S14. Evaluation of sustainability by ComplexMoGAPI, which scores 84.0, suggesting the greenness of the proposed method, the numbers 1-8 is for the sample preparation, 9-11 is for reagent and solvents, 12-15 is for instrumentations, 16- Quantification is further divided into Yield- I and Temperature/Time-II, III-number of rules met for green economy, IV-a for health hazard, IV-b for Safety Hazard, Va-c for instrumentation, VIa-b for workup and purification

Table S1. Comparative analysis of the developed *M. citrifolia*-CDs-based fluorescence method for the detection of clodinafop with the reported methods

Sr. No.	Analytical Method	Linear range	LOD	Reference
1.	Dispersive liquid liquid micro extraction	20–1000 µg/kg	10 µg/kg	[41]
2.	QuEChERS + LC-MS/MS	2-200µg/L	0.02 µg/kg	[42]
3.	high performance liquid chromatography	-	1.0×10^{-9} g	[43]
4.	Flow injection chemiluminescence	0.001–2.0 mg/L	3.5×10^{-4} mg/L	[44]
5.	Micro-solid phase extraction	6-700 µg/L	2 µg/L	[45]
6.	Perovskite Quantum Dots	0.1-5 µM	0.034 µM	[46]
7.	Fluorescence Spectroscopy	0.025-0.5 µM	0.079 µM	Present Study

Table S2. Comparative analysis of *M. citrifolia*-CDs-based fluorescence method for the detection of cypermethrin with the reported methods

Analytical Technique	Probe	Linear Range	LOD	Reference
Electrochemical	Ag-N@ZnO	2×10^{-13} – 8×10^{-9} M	6.7×10^{-14} M	[47]
SERS	Ag nanoislands/ moth wing SERS -active substrate	10^{-13}-10^{-12} M	10^{-10} M	[48]
Smartphone-based dual-channel immunochromatographic test	Polymer QDs	1 to 100 ng/mL	0.35 ng/mL	[49]
Enzyme-linked immunosorbent assay	Immunogen Hapten	-	0.0031×10^{-6} M	[50]
Fluorescence	MIP-CdSe@CdS@ZnS QDs	2.40×10^{-6} – 4.80×10^{-6} M	-	[51]
SERS	Silver nanorods	10^{-6}-10^{-3} M	10^{-6} M	[52]
Fluorescence	Thioglycolic acid capped Mn doped ZnS QD	1.2×10^{-6} – 28.84×10^{-6} M	0.132×10^{-3} M	[53]
Fluorescence	*W. somnifera*-CuNCs	0.01×10^{-6} – 10×10^{-6} M	27.06×10^{-9} M	[54]
Fluorescence	*M.Citrifolia*-CDs	0.05-2 µM	0.028 µM	Present work