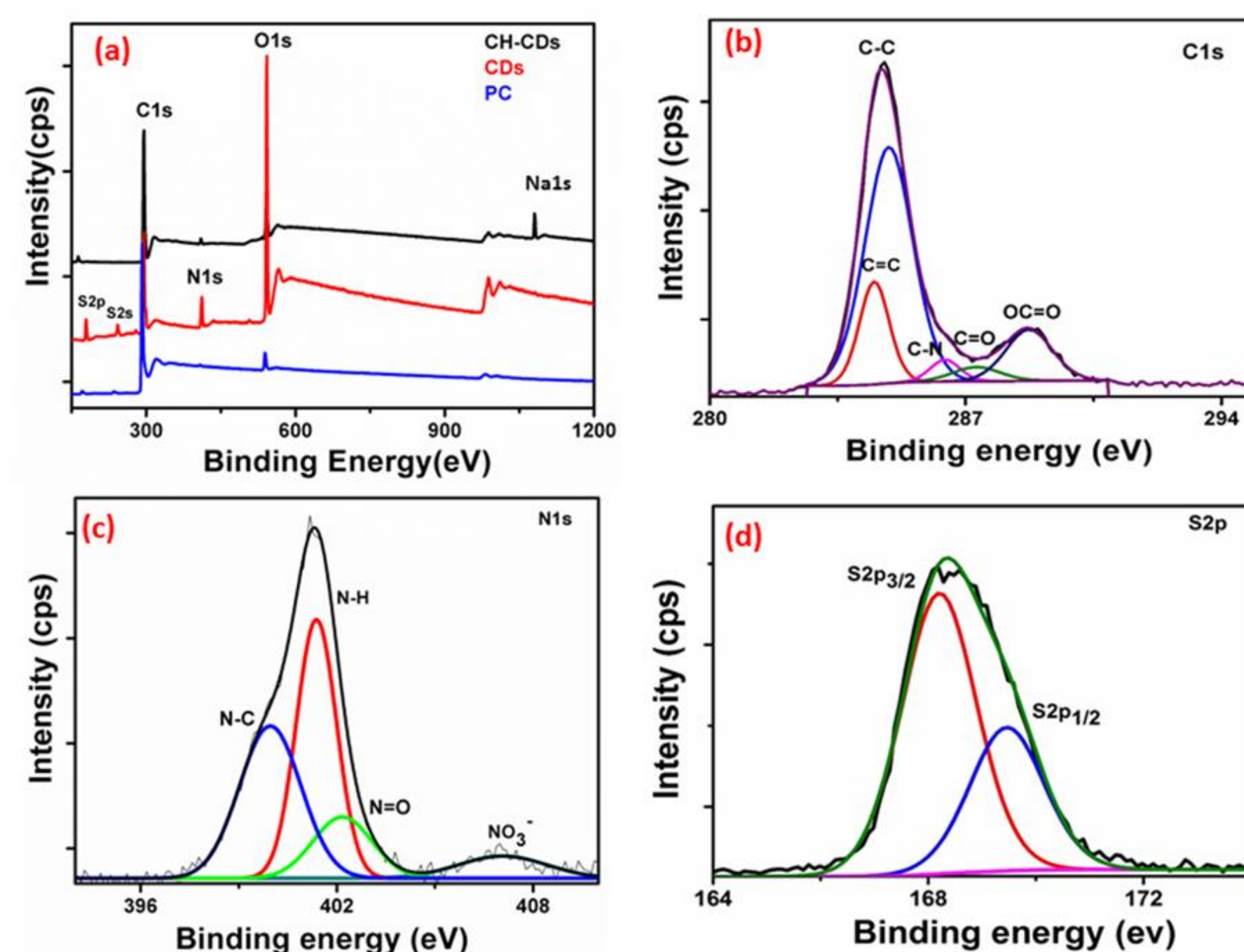


### Abstract

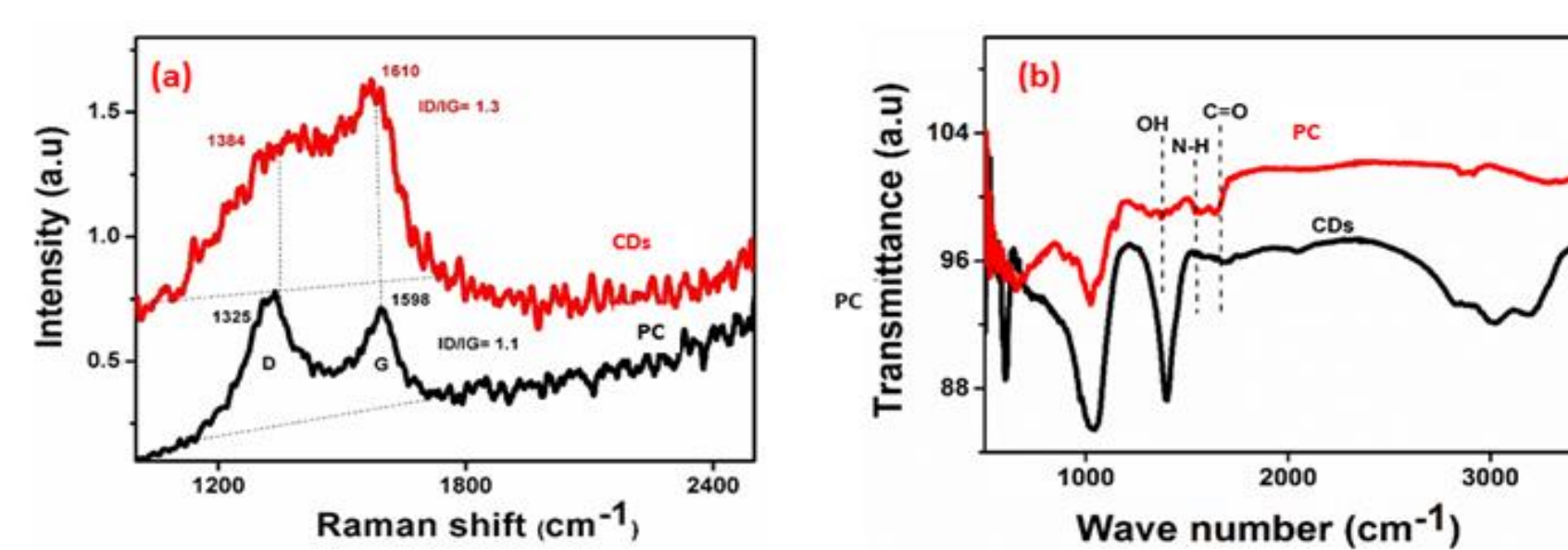
We synthesized CDs from petroleum-coke-waste via hydrothermal treatment in the presence of ammonia (Jlassi et al., 2020). This drove the formation of photoluminescent, water-soluble, biocompatible, and high yield of monodispersed sub-5 nm CDs. The CDs are co-doped with high 10 % of N and 0.2 % of S. The as-prepared CDs possess photoluminescent properties over broad pH range making these dots unique efficient pH sensor. Chitosan (CH)-CDs hybrid hydrogel nanocomposite film were further prepared as a platform membrane for the removal Cd<sup>2+</sup> metal from wastewater. The as prepared CH-CDs membranes show a relatively good mechanical properties, based on stress-resistant and flexibility in order to facilitate handling. The equilibrium state was reached within 5 minutes. The UV-light illuminations enhanced the Cd<sup>2+</sup> removal efficiency of the photoluminescent CDs substantially by four times faster under. It was found that adsorption followed pseudo-second-order kinetic and Langmuir isotherm models. The maximum adsorption capacity at 25 °C was found to be 112.4 mg g<sup>-1</sup> at pH 8.

### Chemical structure

(a) XPS survey regions of pristine, CDs and CH-CDs, High resolution (b) (a) C1s, (b) N1s region and (d) S2p of the prepared CDs.

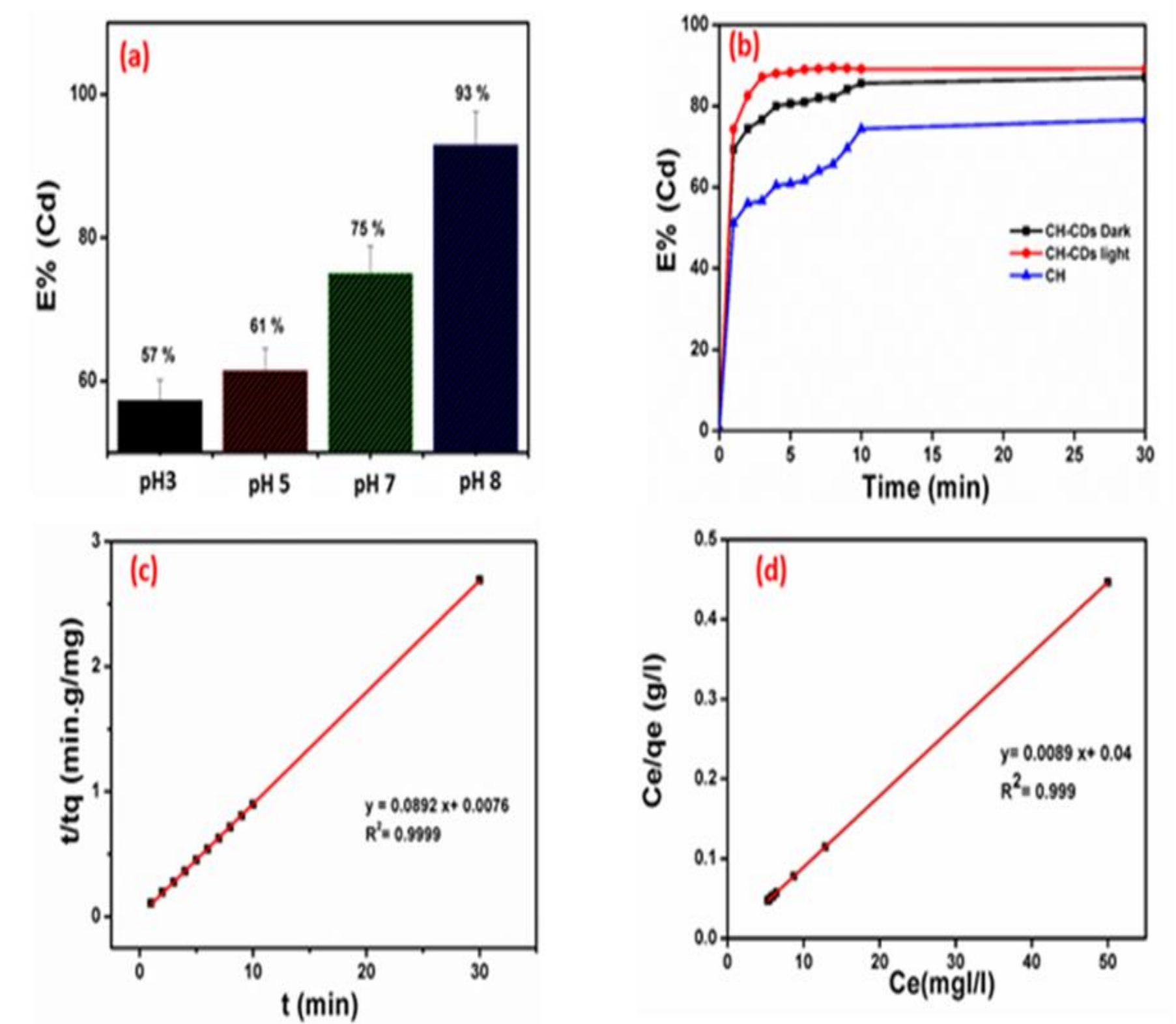


(a) Raman spectra (a) and FTIR (b) spectra of CDs and CH-CDs.

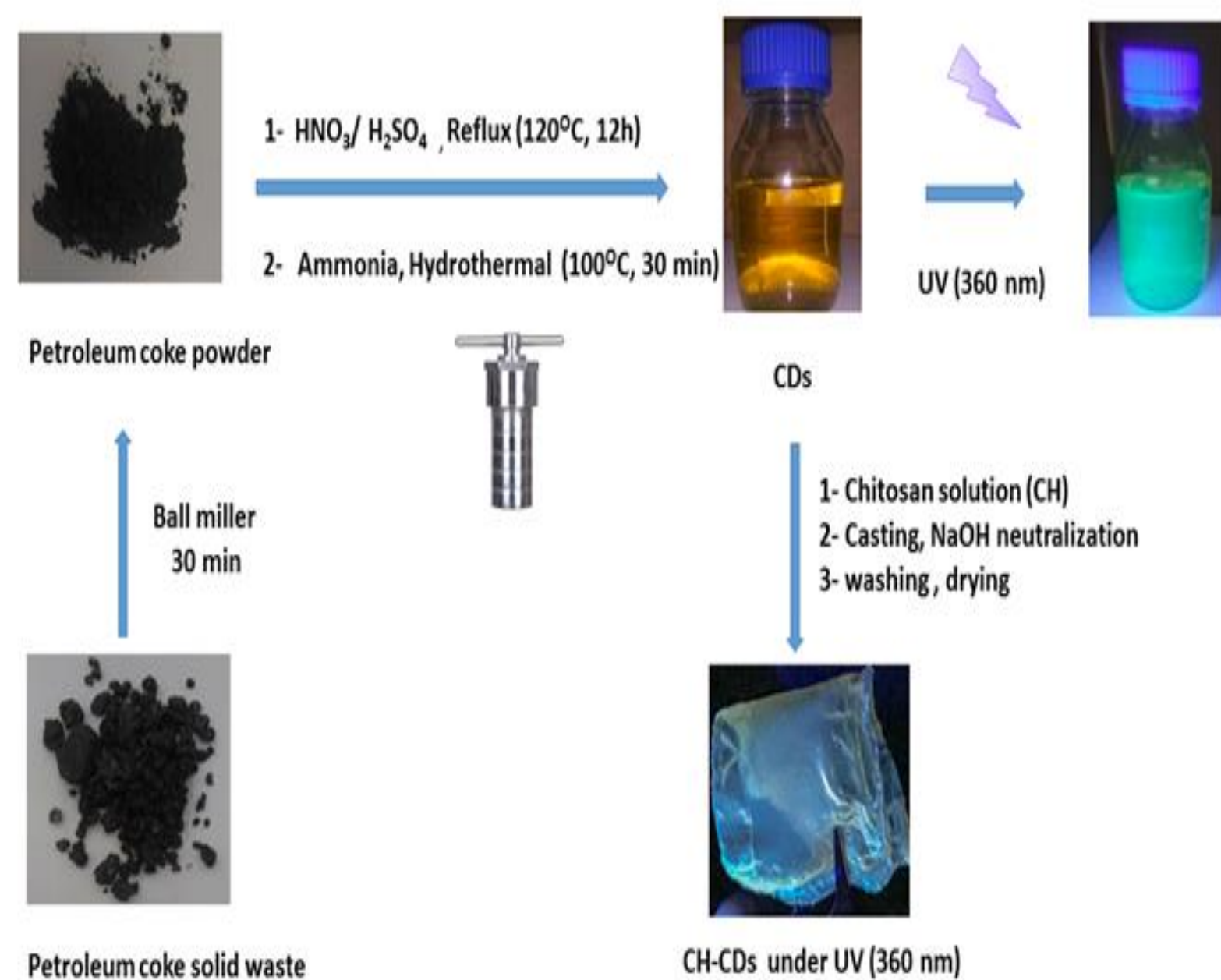


### Heavy metal extraction Using CH-CDs hybrid films

(a) Trends of the extraction efficiency percentages: (a) for Cd<sup>2+</sup> at different pH, (b) for Cd<sup>2+</sup> using CH, CH-CDs under dark and light at pH=8, (c) Pseudo-second-order mode for Cd<sup>2+</sup> adsorption onto CH-CDs, (d) The linear fitting results of Langmuir models.

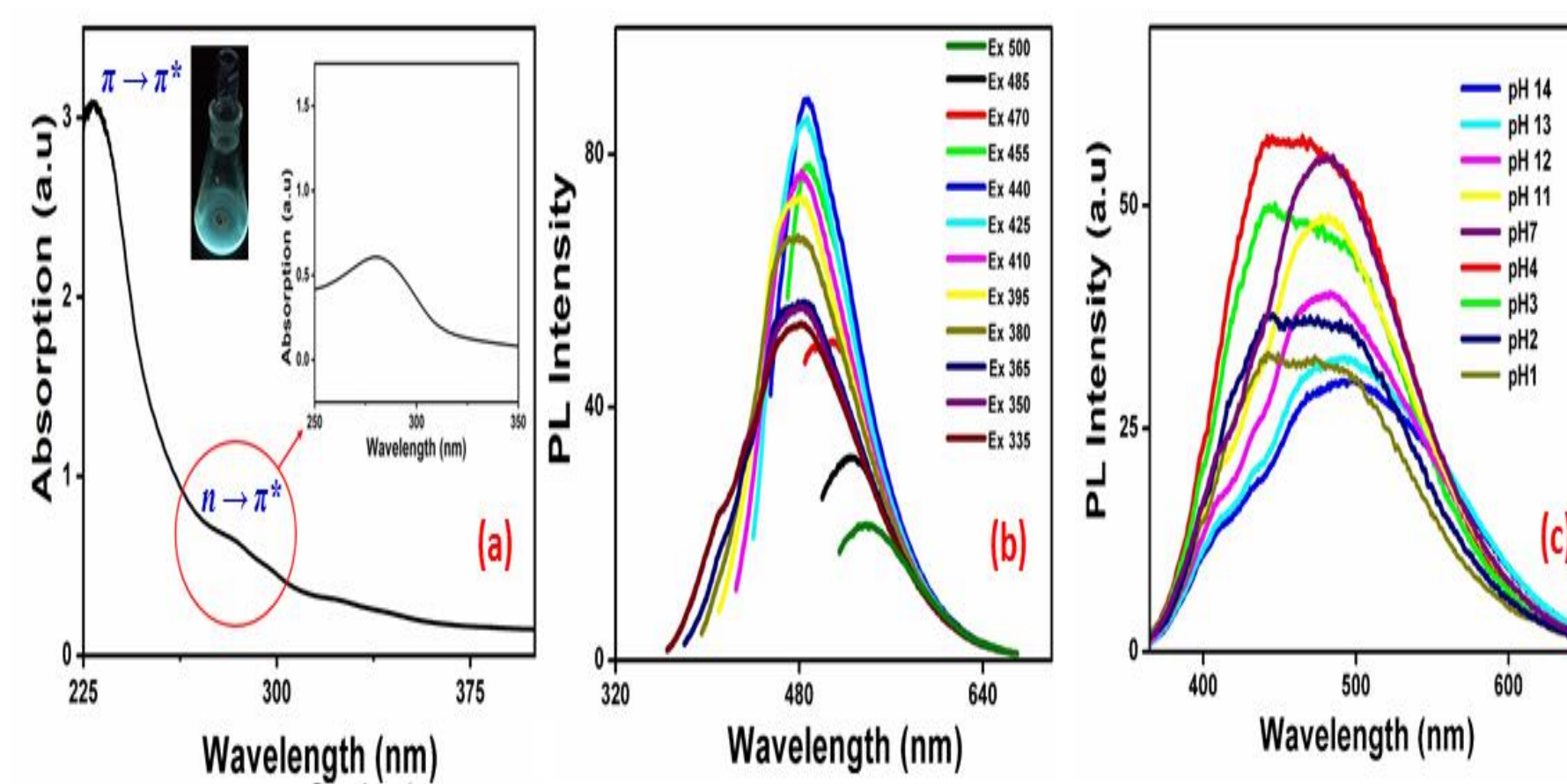


### Schematic illustration

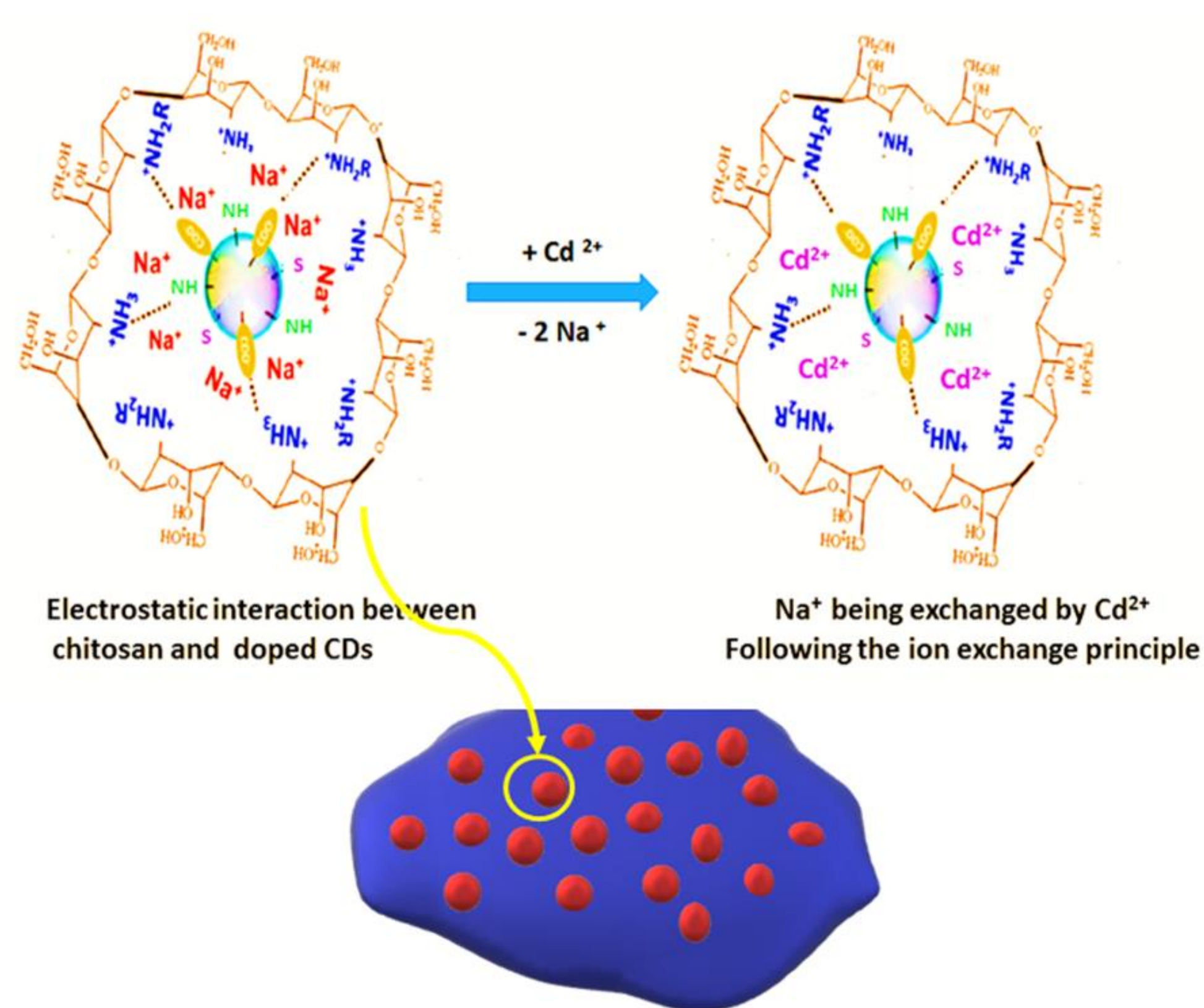


### Optical properties of CDs

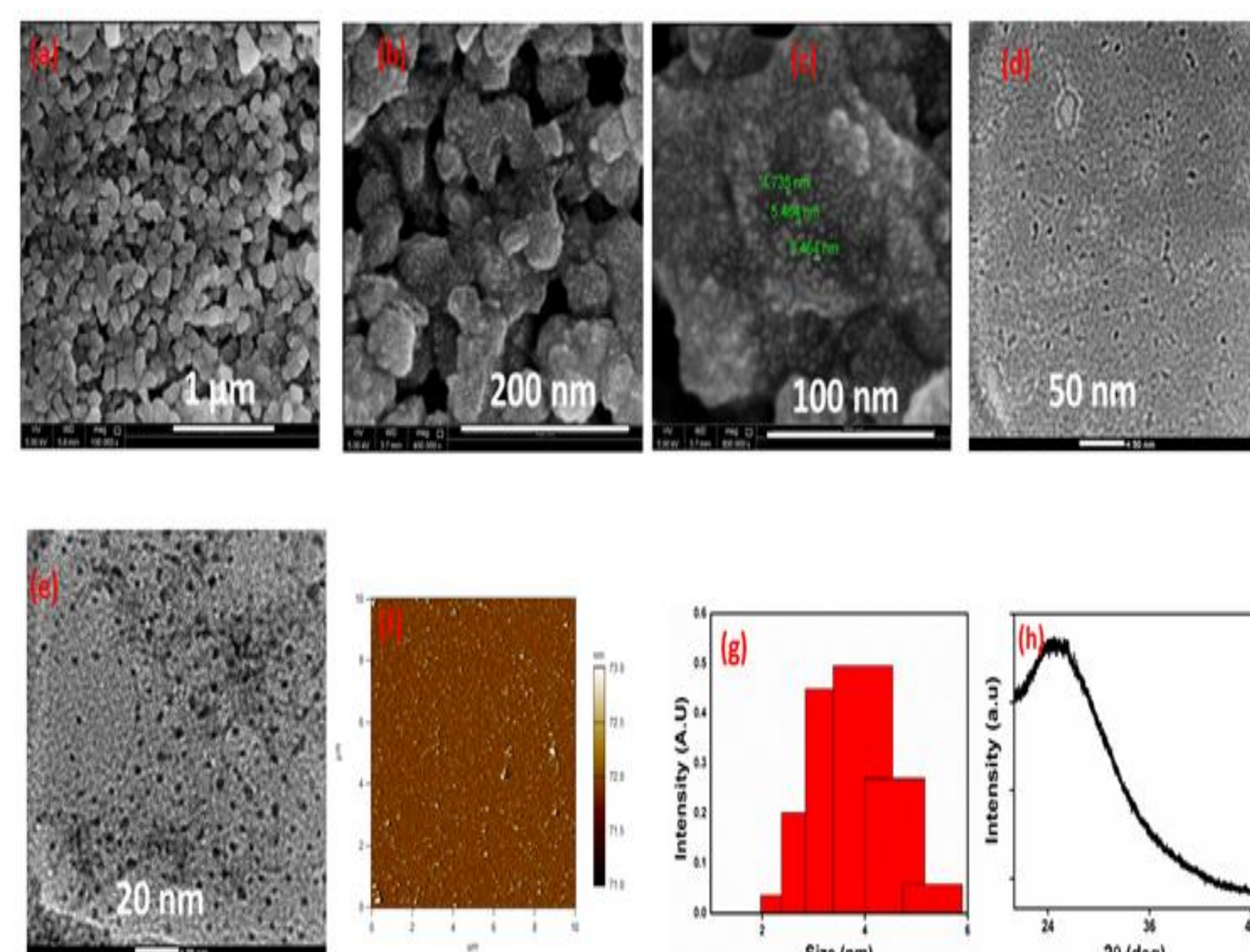
(a) UV-Vis absorption spectrum (b) excitation-dependent emission spectra of CDs, (c) excitation-dependent emission spectra of CDs at different pH



### Mechanism



### SEM, TEM, AFM and XRD patterns of the prepared CDs



### conclusion

- Novel Photoluminescent CDs were produced from petroleum coke waste by hydrothermal simple method.
- The as-made CDs are rich in oxygen, nitrogen, and sulfur functional groups and high yield of monodispersed sub-5 nm CDs, outstanding water solubility and sensitive to pH in a wide range of 1–14.
- The as-prepared CDs were successfully introduced into the chitosan polymer matrix and form a well dispersed CH-CDs fluorescent films.
- The latter are promising platforms for the removal of Cd<sup>2+</sup> from industrial wastewater for a current project.
- The CH-CDs membranes show a relatively good mechanical properties, based on stress-resistant. Interestingly the UV-light illuminations, enhanced the Cd<sup>2+</sup> removal efficiency of the photoluminescent CDs substantially five times faster under
- The adsorption process could be described using pseudo second order kinetics and Langmuir isotherm model.
- The equilibrium time of adsorption was ultra fast (only 5 min). In addition, the optimal pH of the solution was 8 which is close to neutral.
- The maximum adsorption capacity at RT was found to be 112.4 mg g<sup>-1</sup> at pH 8.
- This work opens new avenues for producing low cost and rapid separation for practical adsorbent films based on green and low cost fluorescent carbon quantum dots.

### References

11. Jlassi, K.; Eid, K.; Sliem, M. H.; Abdullah, A. M.; Chehimi, M. M.; Krupa, I., Rational synthesis, characterization, and application of environmentally friendly (polymer-carbon dot) hybrid composite film for fast and efficient UV-assisted Cd<sup>2+</sup> removal from water. *Environmental Sciences Europe* **2020**, *32* (1), 1-13.

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