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SECOND REPORT:

From humin wastes to Carbon Quantum Dots (CQDs) based Photocatalytic nanocomposites

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BACKGROUND INFORMATION

- Huge amounts of wastes generated by industrial processes.
- Concept of sustainability.
- Need for new, more ecological, cheaper materials for all fields.
- Valorizing industrial wastes – making the process more efficient.

https://briquettesolution.com/waste-recycling-plant-turn-biomass-waste-to-fuel-briquette/

HUMINS SYNTHESIS

CARBON QUANTUM DOTS – PREPARATION *(HYDROTHERMAL METHOD)*

Reaction time range: 4 up to 12 h.

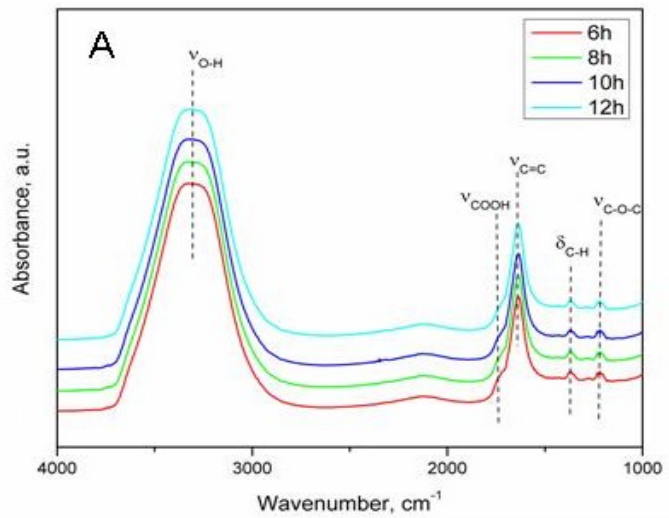
Three different Temperatures: 160, 180 and 200 ^{0}C.

NOTE…

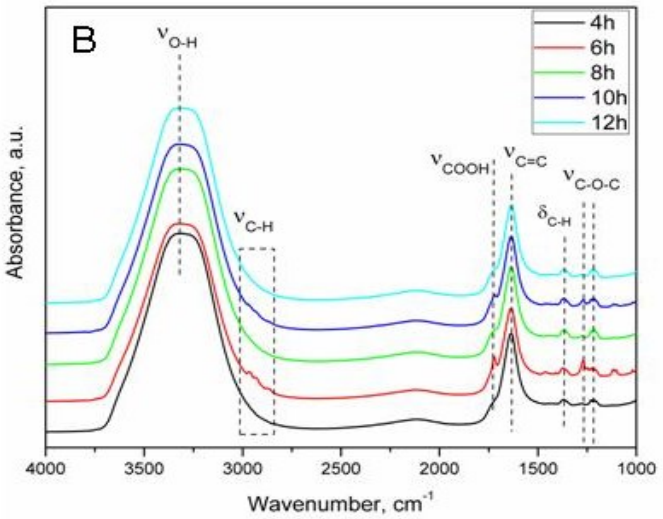
One sample with special treatment – washed with CH_2Cl_2.

ATR-IR SPECTROSCOPY

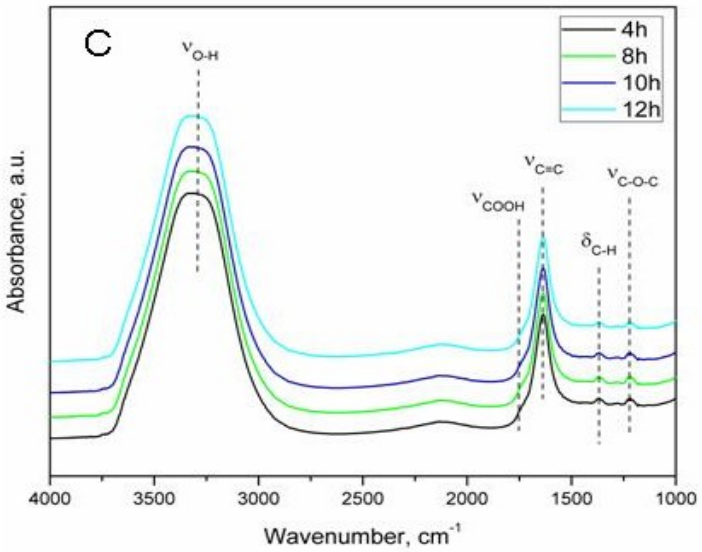
160 ^{0}C



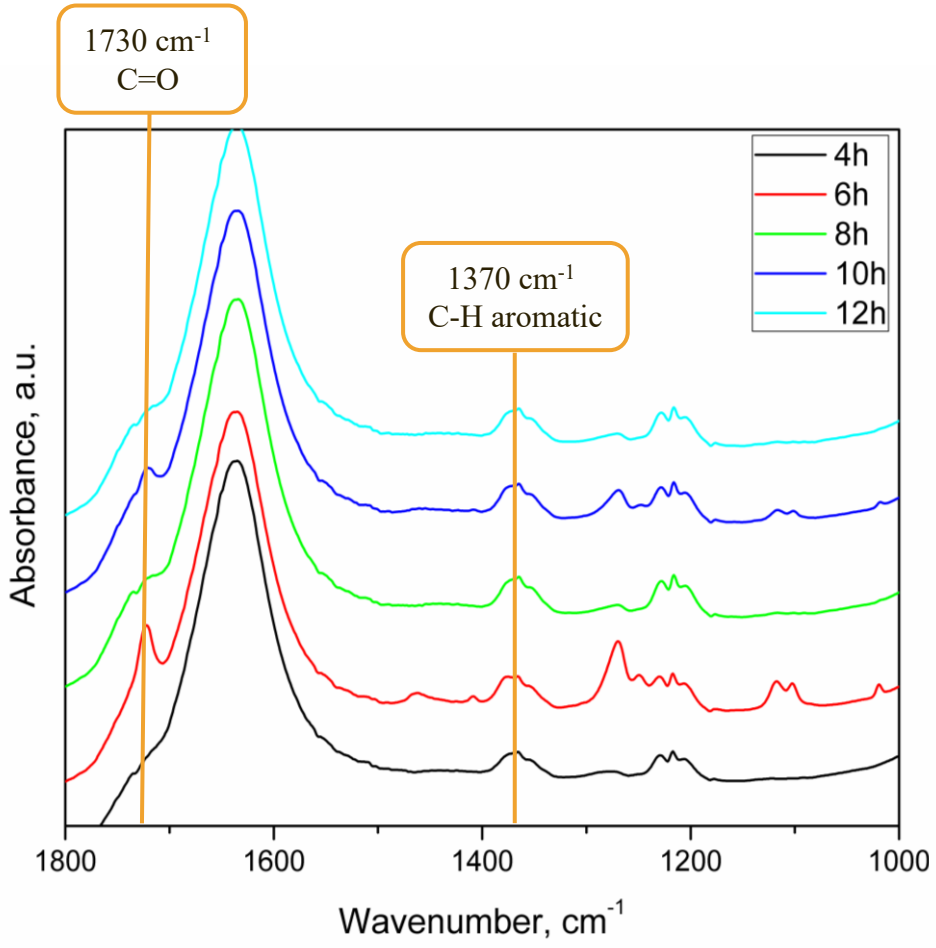
180 ^{0}C



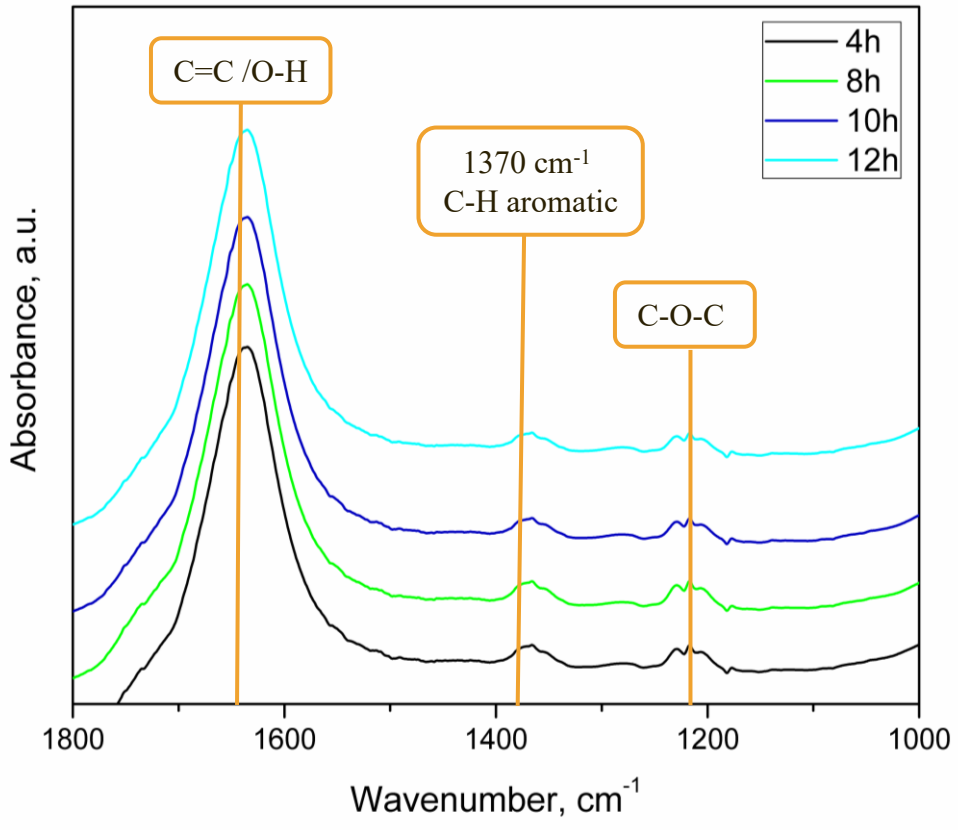
200 ^{0}C



ATR-IR SPECTROSCOPY

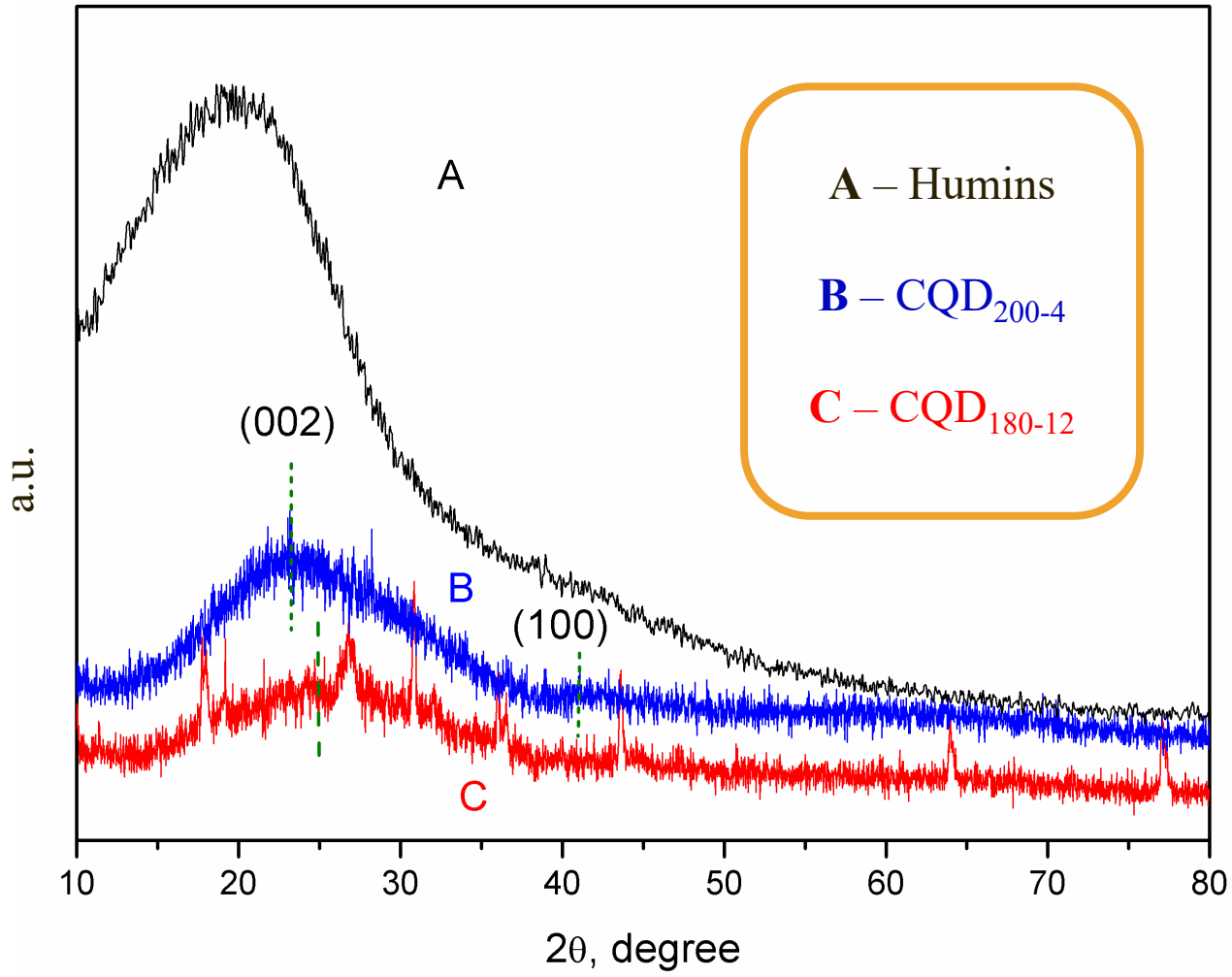


180 ^{0}C



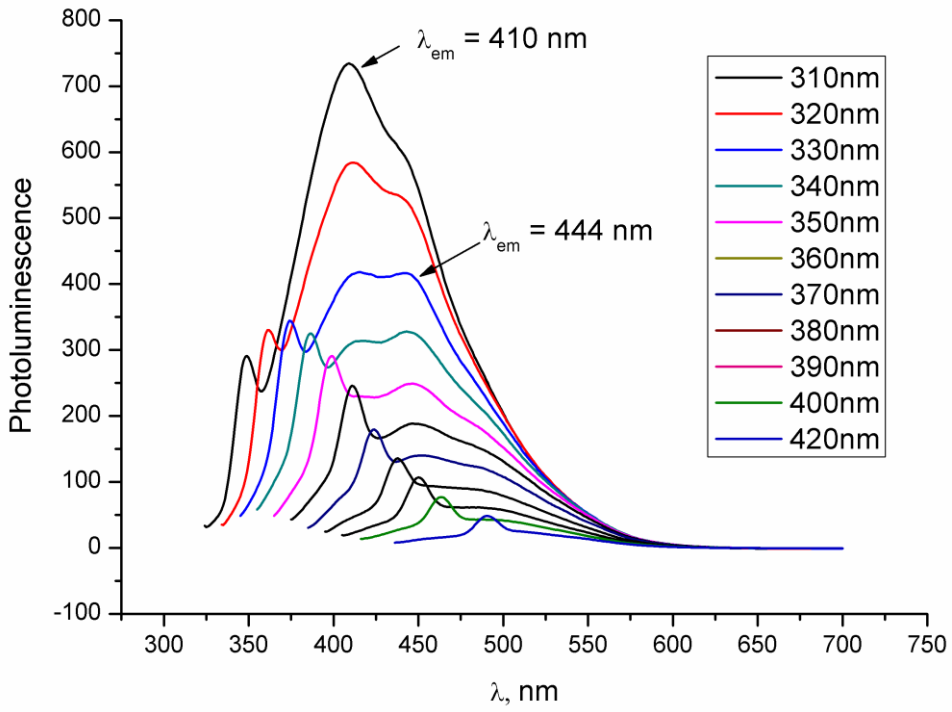
200 ^{0}C

X-RAY DIFFRACTION

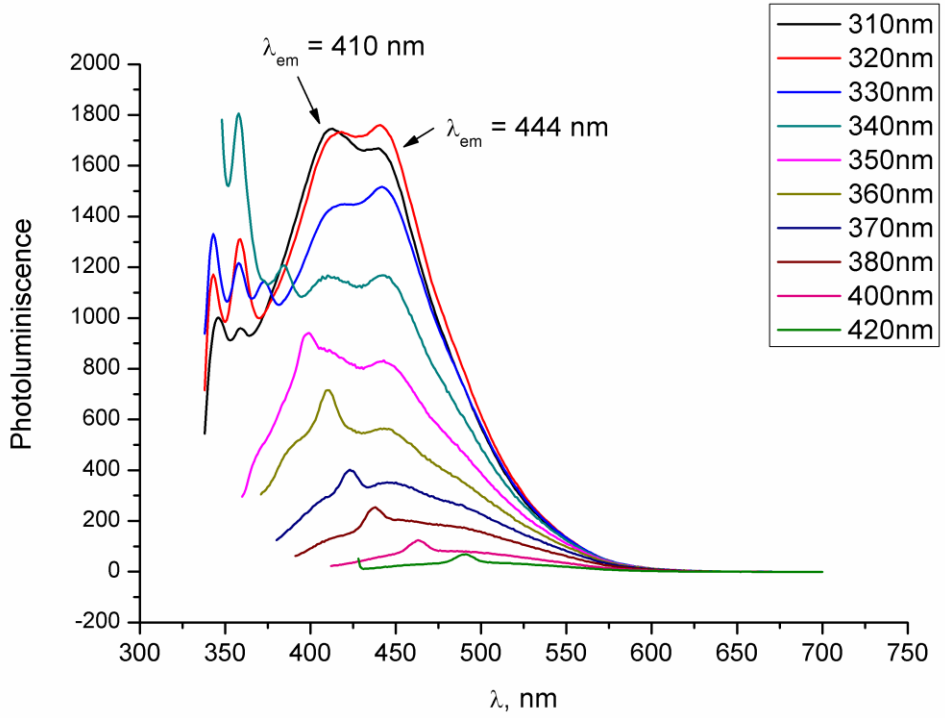


PHOTOLUMINISCENCE

CQDs 180 ^{0}C

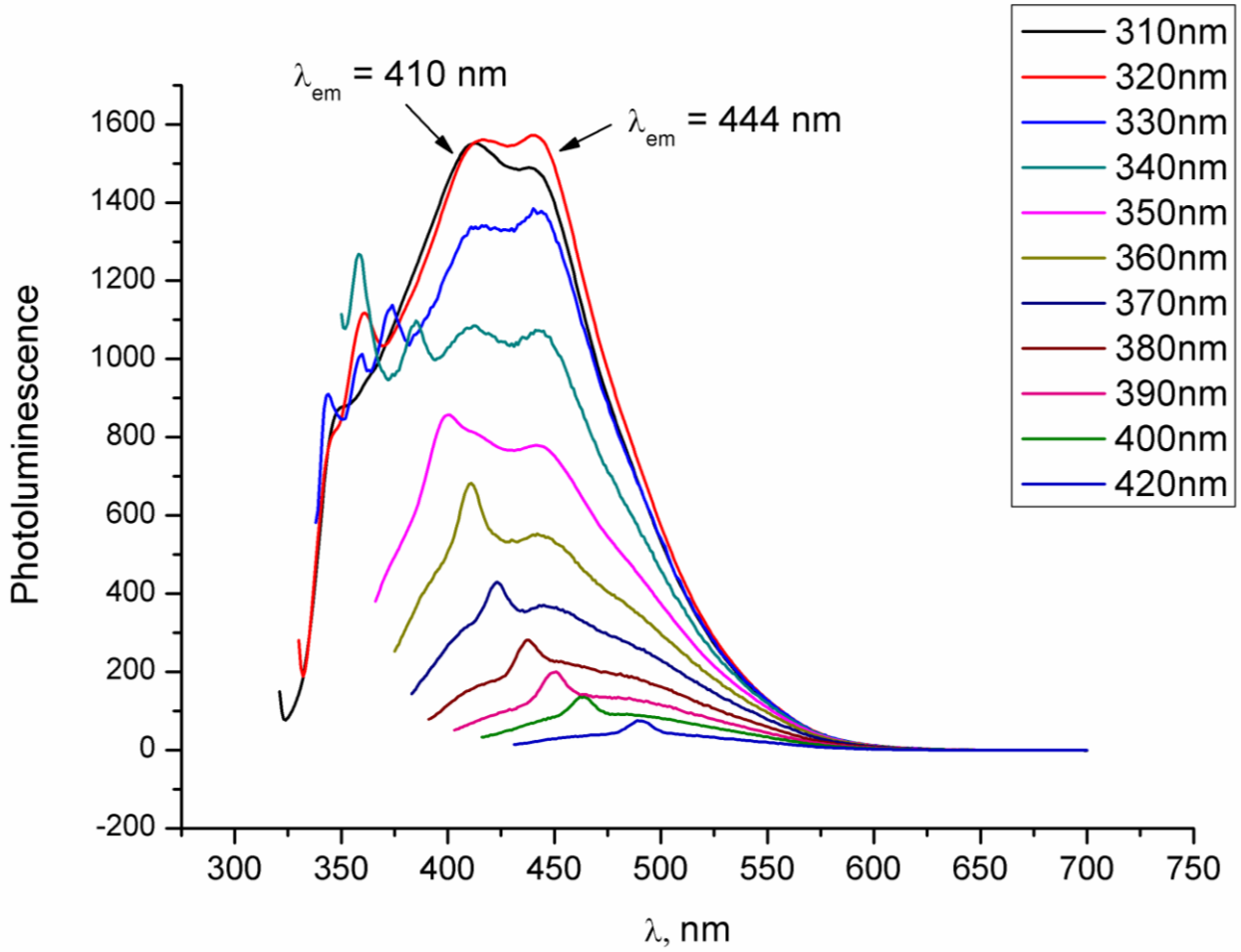


4 h



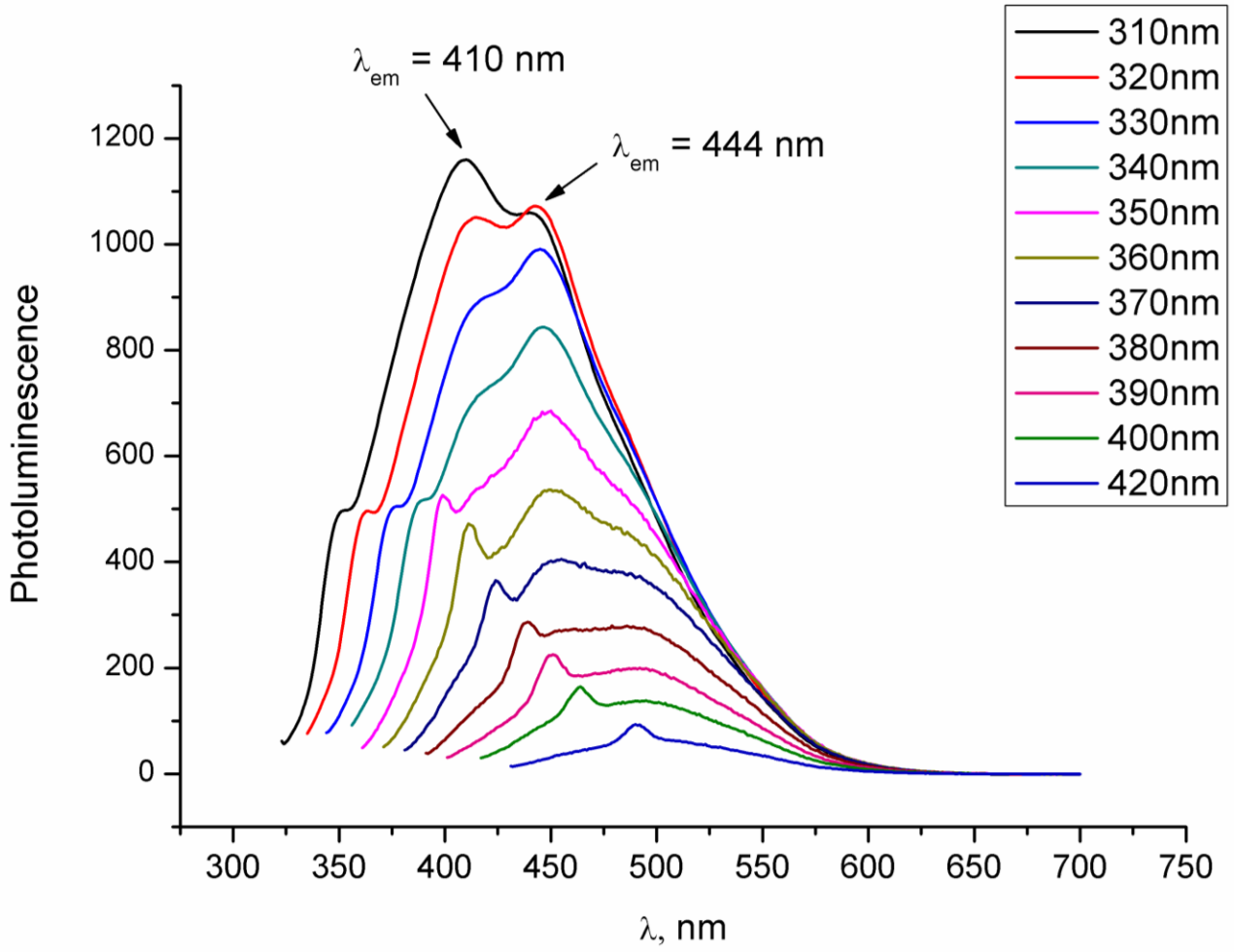
12 h

PHOTOLUMINISCENCE



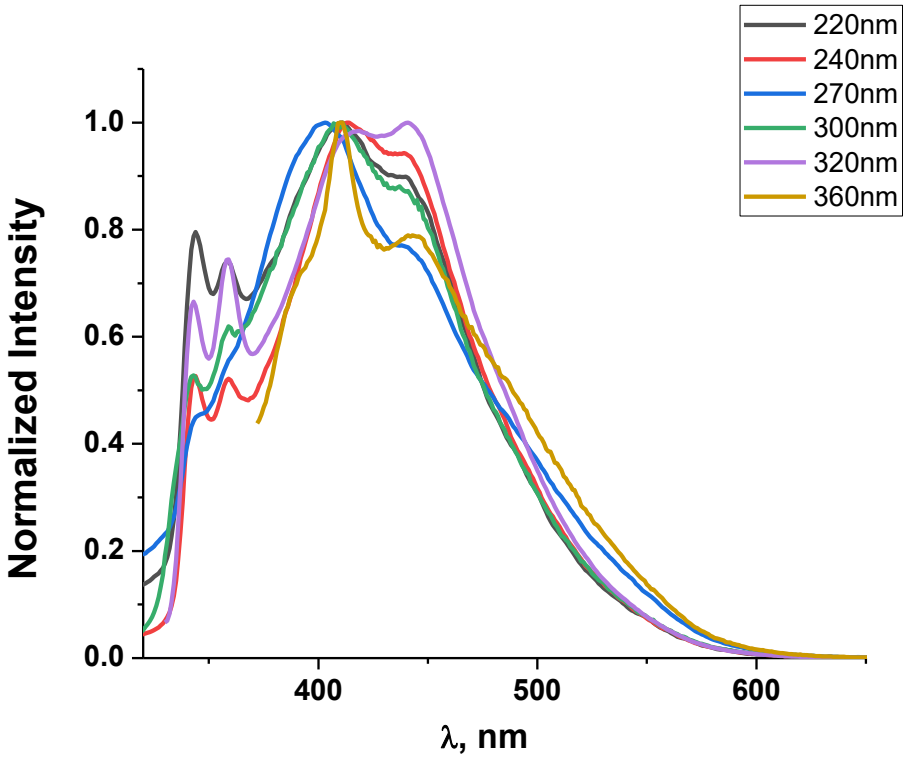
$CQD_{180\text{-}S}$

PHOTOLUMINISCENCE

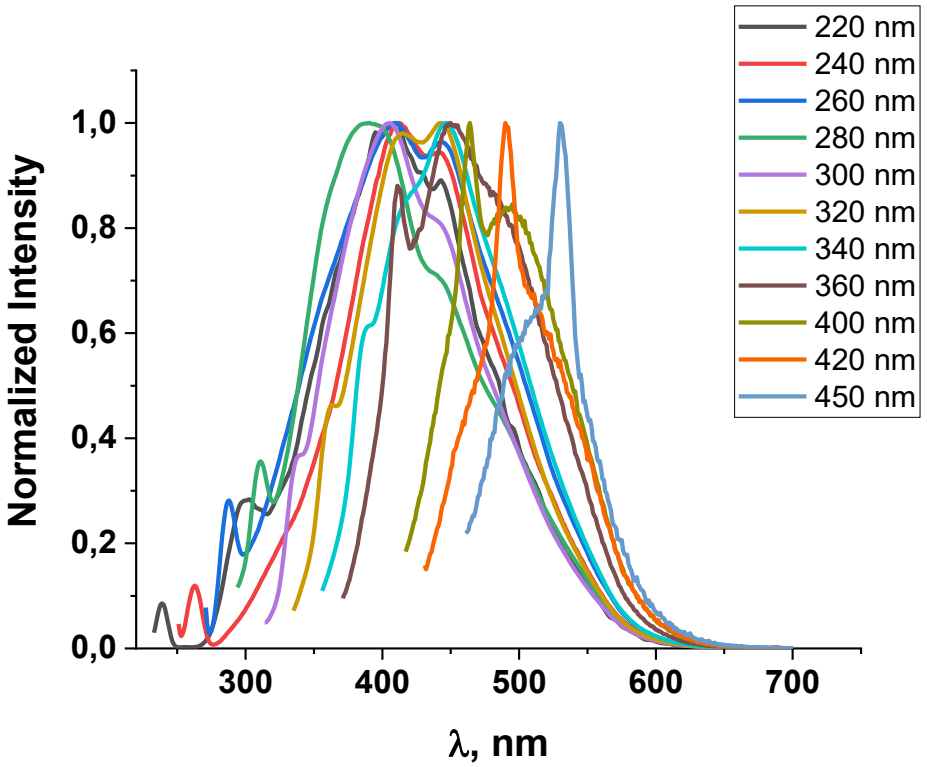


$CQD_{200\text{-}4}$

PHOTOLUMINISCENCE - NORMALIZED

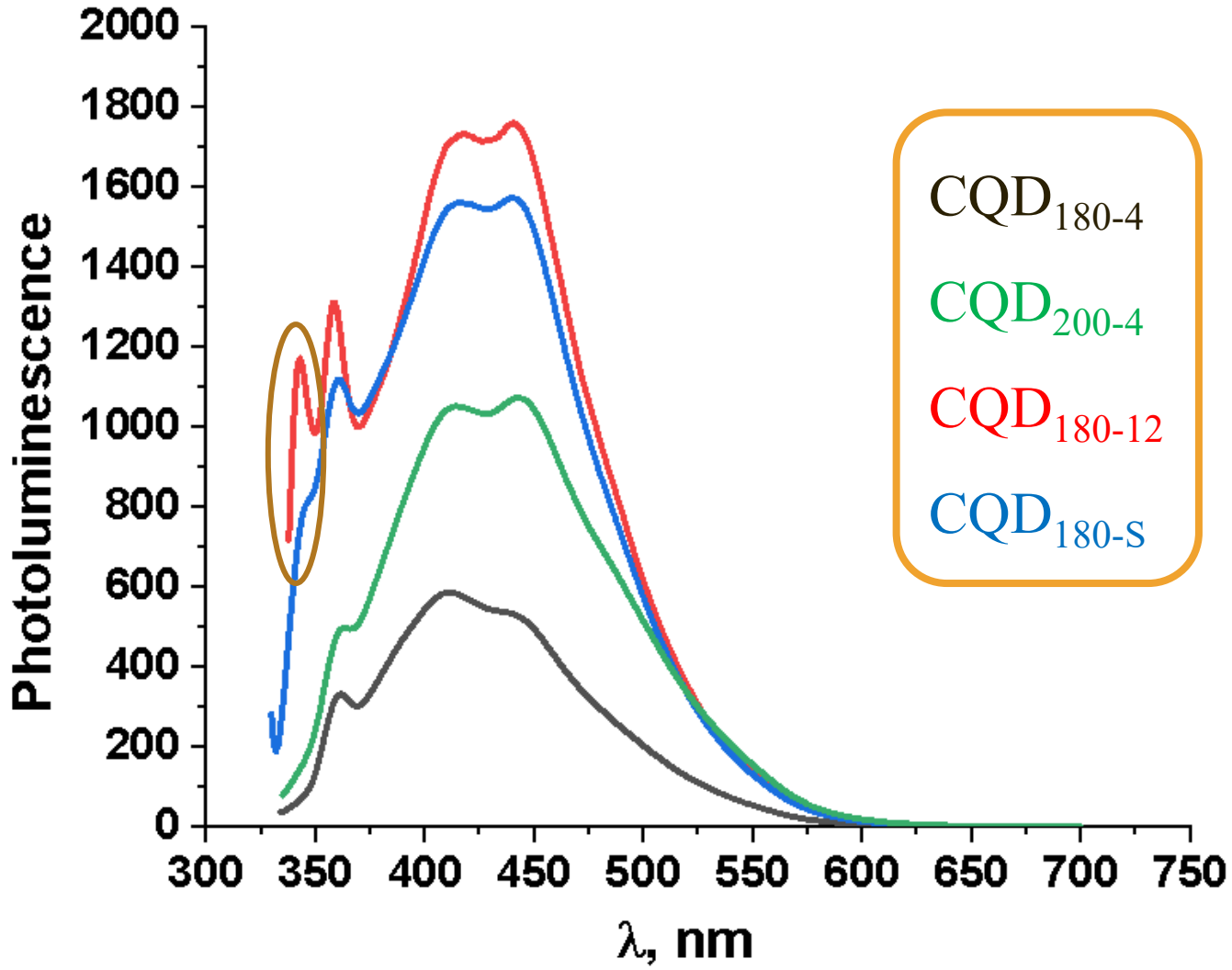


$CQD_{180\text{-}12}$

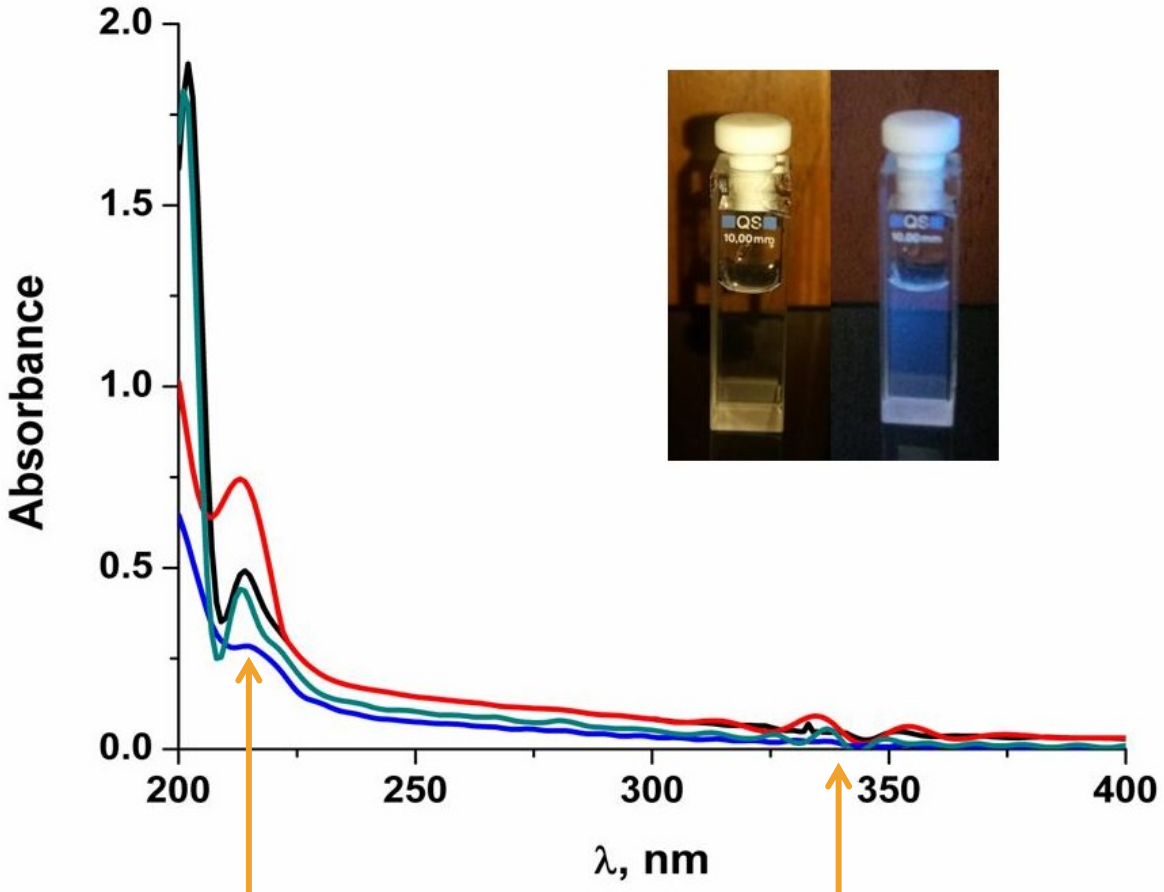


$CQD_{200\text{-}4}$

PHOTOLUMINISCENCE



UV-VIS SPECTROSCOPY



Quantum yield

CQD_{180-4}	8%
CQD_{180-12}	21%
$CQD_{180-12S}$	20%
CQD_{200-4}	15 %

π-π* transitions of C=C bonds

n – π* transitions of functional groups

CONCLUSIONS

- XRD patterns showed a lower temperature favors the formation of small amorphous nanoparticles ($CQD_{180\text{-}12}$) while increased temperatures lead to larger carbon cores with graphite-like structure ($CQD_{200\text{-}4}$).
- IR results confirmed the presence of more carboxyl groups along the hydroxyl groups at the $CQD_{180\text{-}12}$ surface compared with the $CQD_{200\text{-}4}$
- The fluorescence emission study found that CQDs with bright luminescence can be achieved after a reaction time of 4 h at 200 ^{o}C ($CQD_{200\text{-}4}$) or after a reaction time of 12h, at 180^{o}C ($CQD_{180\text{-}12}$)
- The effective excitation wavelength is between 310-360 nm and the humin-based CQDs display a blue fluorescence color (444 nm) under the excitation wavelength of 330 nm.
- The better fluorescence properties and higher QYs of $CQD_{180\text{-}12}$ was aroused by oxygen group decorated on its surface.

Thank You!