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Biomass Waste-based Quantum Dots from Palm Kernel Shell and Oyster Shell for Bioimaging Application

Organised by:

UPM UNIVERSITI PUTRA MALAYSIA BERILMU BERBAKTI

INSTITUT NANOSAINS DAN NANOTEKNOLOGI

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P05

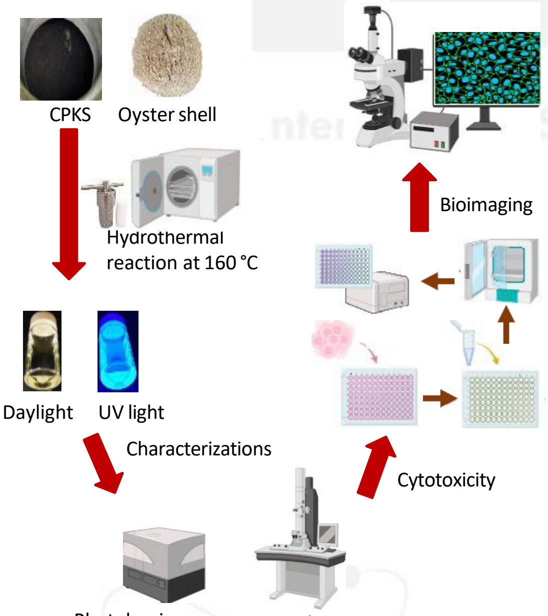
INTRODUCTION

Palm kernel shell

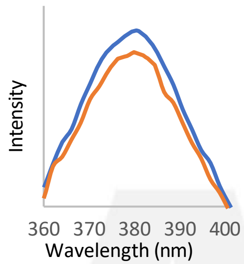
Oyster shell

Carbon Quantum Dots (CQDs) have recently advanced and gained attention for their numerous benefits. These advantages include easy preparation, affordability, small size, safety for living systems, strong light emission, and low harm. This makes them very promising, especially in bioimaging. Using natural waste to create CQDs is a fascinating aspect. In this study, we explored the potential of CQDs utilized from biomass waste of palm kernel shells and oyster shells as bioimaging fluorescent agents.

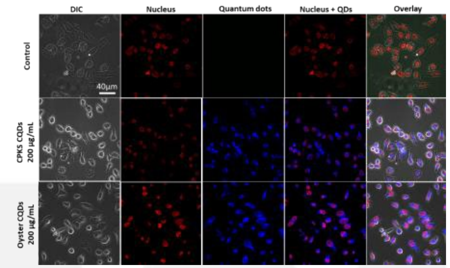
METHODOLOGY



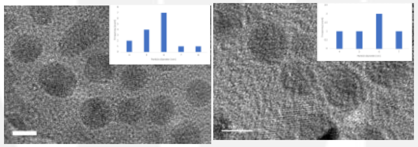
RESULTS & DISCUSSION



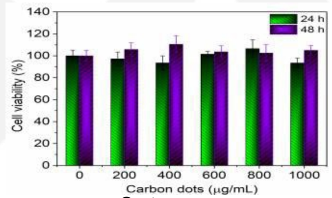
The fluorescence emission spectrum of synthesized CQDs from CPKS and oyster shells was at 380 nm with narrow emission peaks. This kind of very narrow emissive material will be useful for multicolor cell imaging without any spectral overlap.

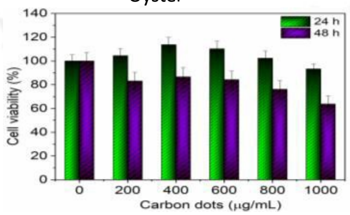


The red represents the cell nucleus and the blue shows CQDs. Mito tracker dye was used for organelle localization, and both the CDs and mlto tracker merged very well. These suggest that the CQDs can enter inside the mitochondria.

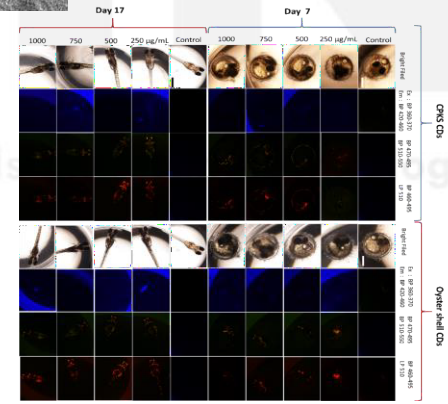


The HR-TEM shows that the CQDs have a roughly spherical form morphology and are evenly distributed without any aggregation. The average size of the particles is 4.5 nm for CPKS and 6.0 nm for Oyster.





HeLa cells were almost 100% viable after 24 h incubation, as no cytotoxicity was observed even with 1 mg mL⁻¹ of CQDs from CPKA and oyster. There was no toxicity observed even after 48 hours of incubation, only oysters showed cytotoxicity at higher concentrations.



The results clearly demonstrate that even at concentrations as high as 1000 µg mL⁻¹, the fish embryo treated with CQDs exhibited no abnormalities. By day 17, the larvae showed normal development and excellent distribution of fluorescence.

CONCLUSION

The biocompatible CQDs utilized from biomass waste of palm shells and oysters have been successfully prepared using a facile method. The prepared CQDs were soluble in water and emitted fluorescent with particle sizes less than 10 nm The cell viability assays of the CQDs towards Hela cells observed no cytotoxicity until 24 hours and only oyster-based CQDs showed cytotoxicity at higher concentrations after 48 hours. The CQDs can enter the mitochondria of HeLa cells without causing any changes in their morphology as observed by a confocal microscope. There is hope that CQDs produced from biomass waste will have practical applications for diagnosis and treatment in the future.

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Norhidayah binti Abu
Postgraduate (PhD)
norhidayahabu@student.usm.my
2. . Dr. Shanmugavel Chinnathambi
chinnathambi.shanmugavel.8s@kyoto-u.ac.jp
3. Assoc. Prof. Dr. Rafidah Hanim Shueb
hanimkk@usm.my
4. Assoc. Prof. Dr. Jaafar Abdullah
jafar@upm.edu.my