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APPENDICES

Appendix A Extinction Coefficient of Natural Dyes

Table A1 Extinction coefficient of natural dyes

Natural dyes	Extinction coefficient (L g^{-1} cm^{-1})
Indigo	0.078
Red orchid	0.076
Spirulina	0.107
Yellow cotton flower	0.098

From the Beer-Lambert Law relationship for absorbance of light:

$$A = \varepsilon c l,$$

Where A = absorbance

ε = extinction coefficient (L g^{-1} cm^{-1})

c = concentration of the dye (g/L)

l = path length of the cell, which is normally 1cm

The absorbance of each dye was obtained using UV-Visible spectrometer and the concentration of dye equaled to 2.5 g/L then put all values in Beer-Lambert equation to get the extinction coefficient (L g^{-1} cm^{-1})

Appendix B Calibration Curve of Kinetic Adsorption Studies

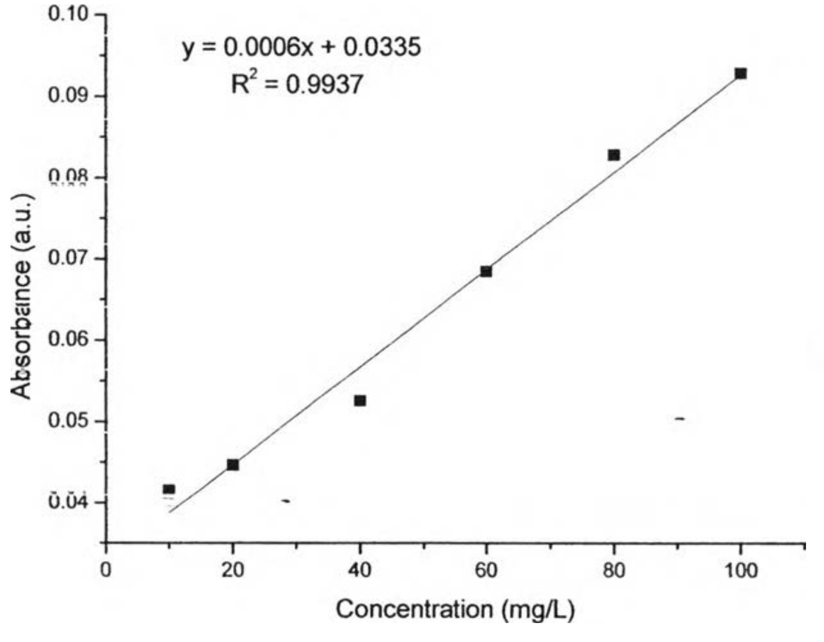

Figure B1 Standard calibration curve of indigo extract.

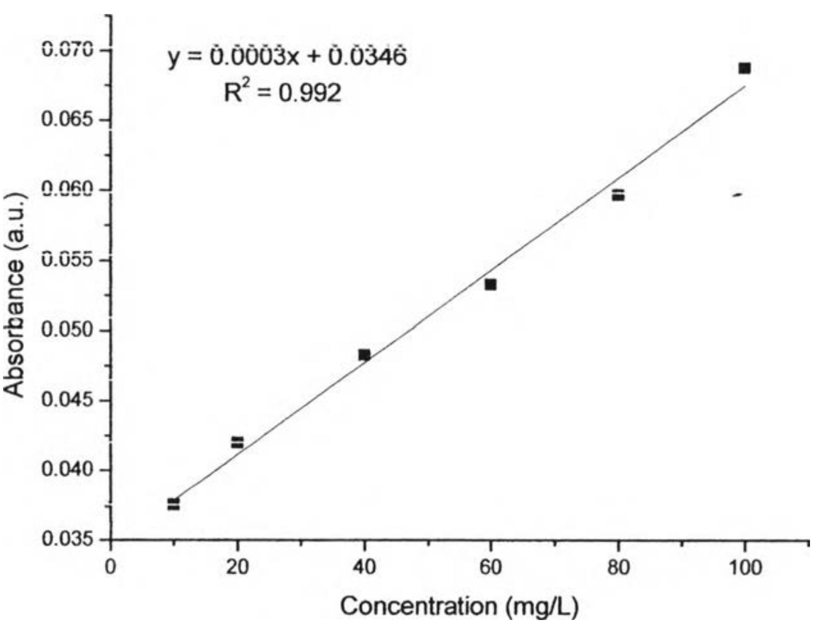

Figure B2 Standard calibration curve of red orchid extract.

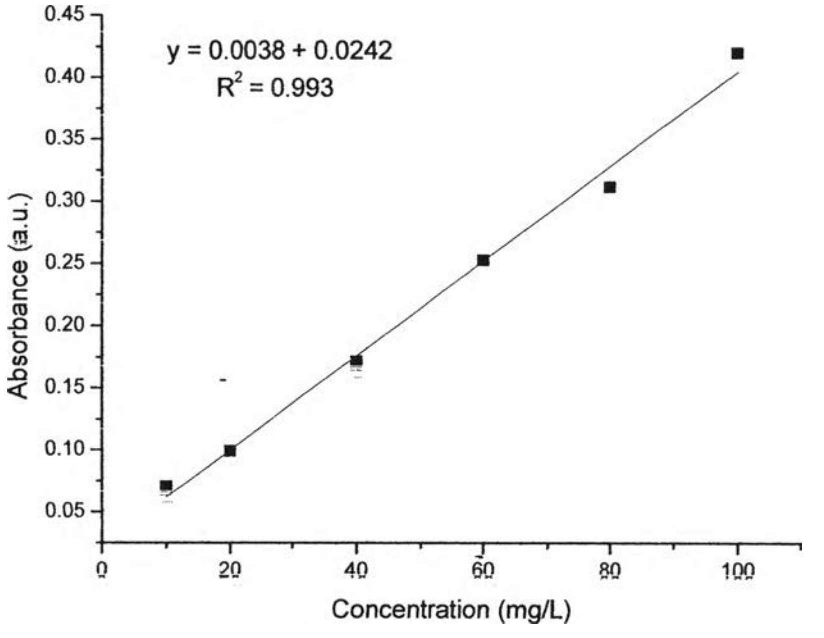

Figure B3 Standard calibration curve of spirulina extract.

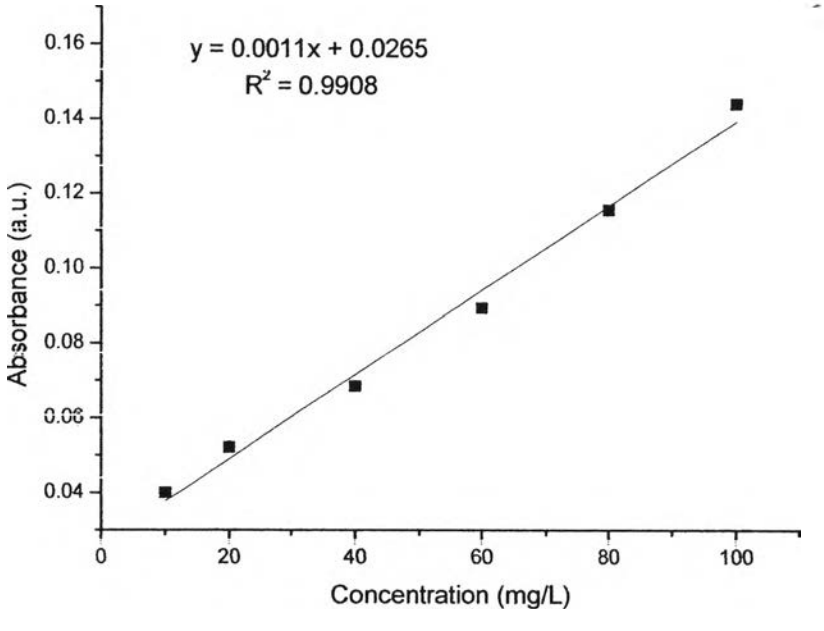

Figure B4 Standard calibration curve of yellow cotton extract.

Appendix C Calibration Curve of Isothermal Adsorption Studies

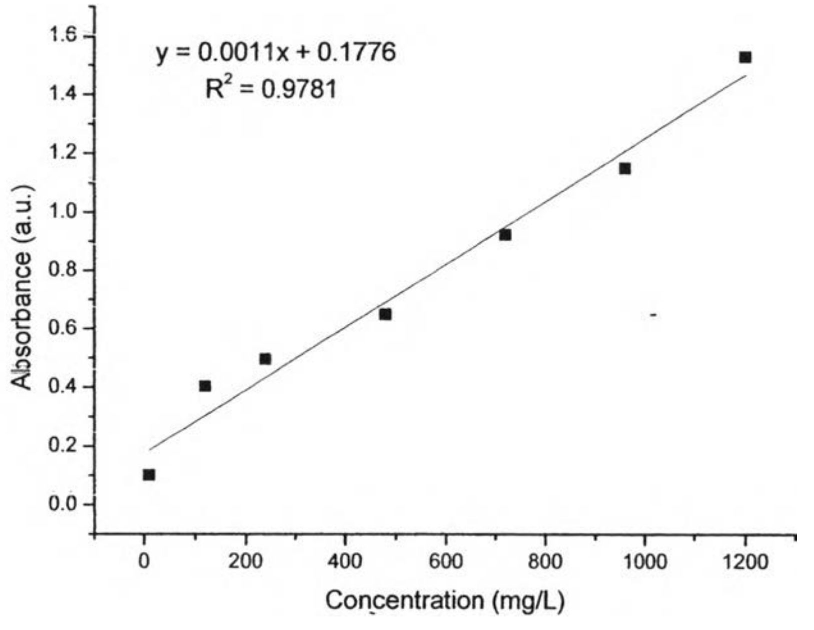

Figure C1 Standard calibration curve of indigo extract.

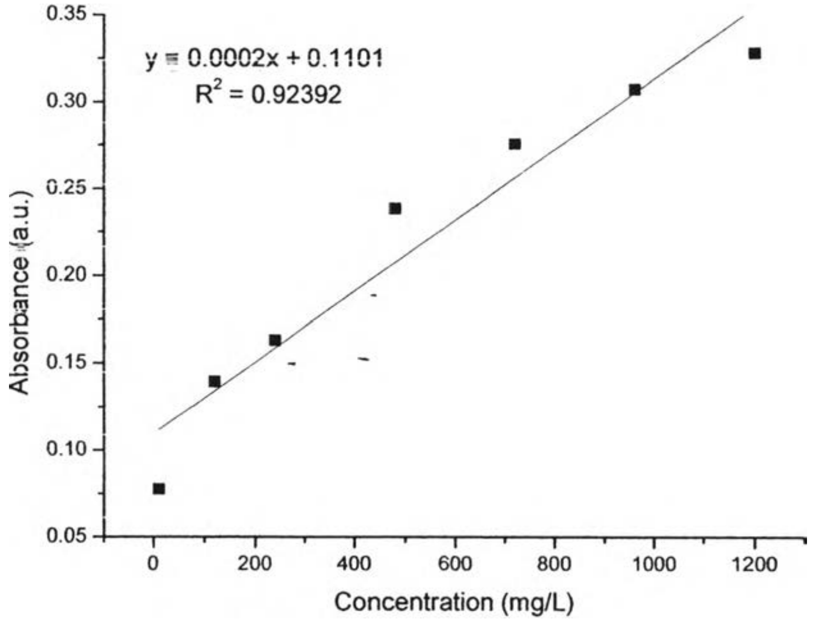

Figure C2 Standard calibration curve of red orchid extract.

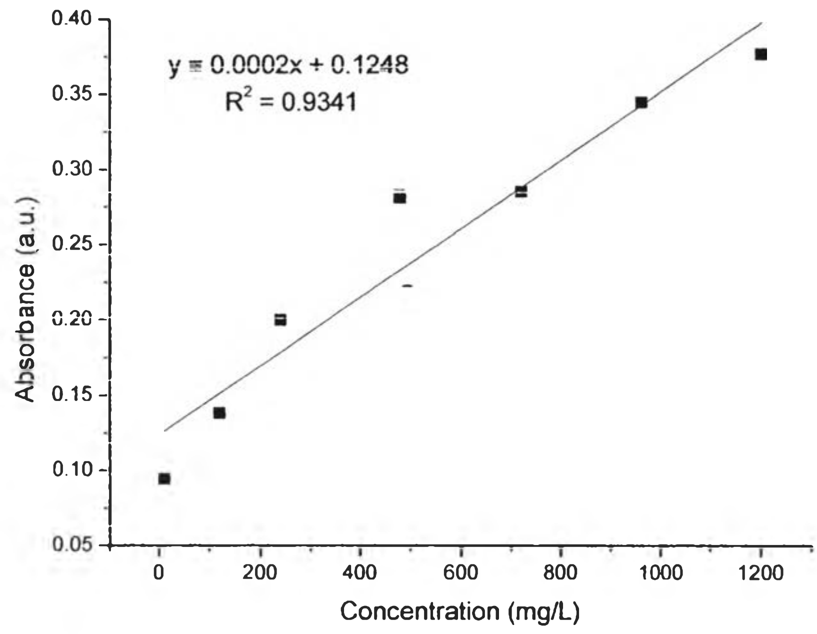

Figure C3 Standard calibration curve of spirulina extract.

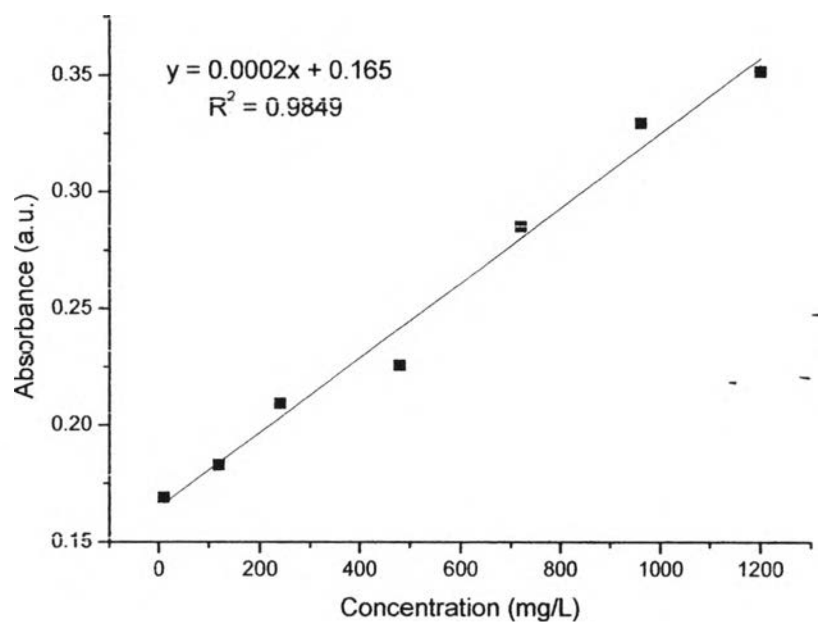

Figure C4 Standard calibration curve of yellow cotton extract.

Appendix D FE-SEM Cross-section Images with Particle Size Analysis of ZnO and ZnO/QDs

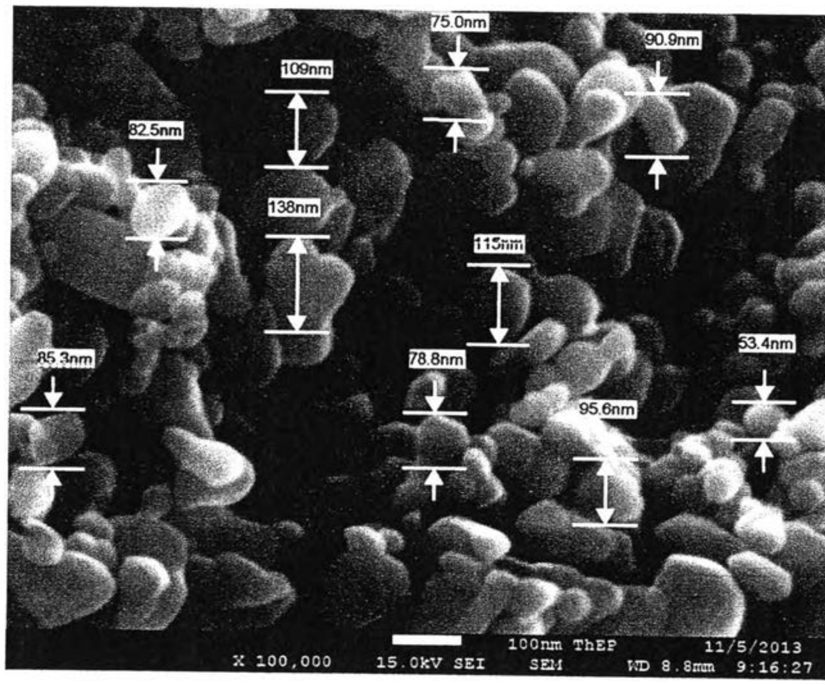

Figure D1 ZnO.

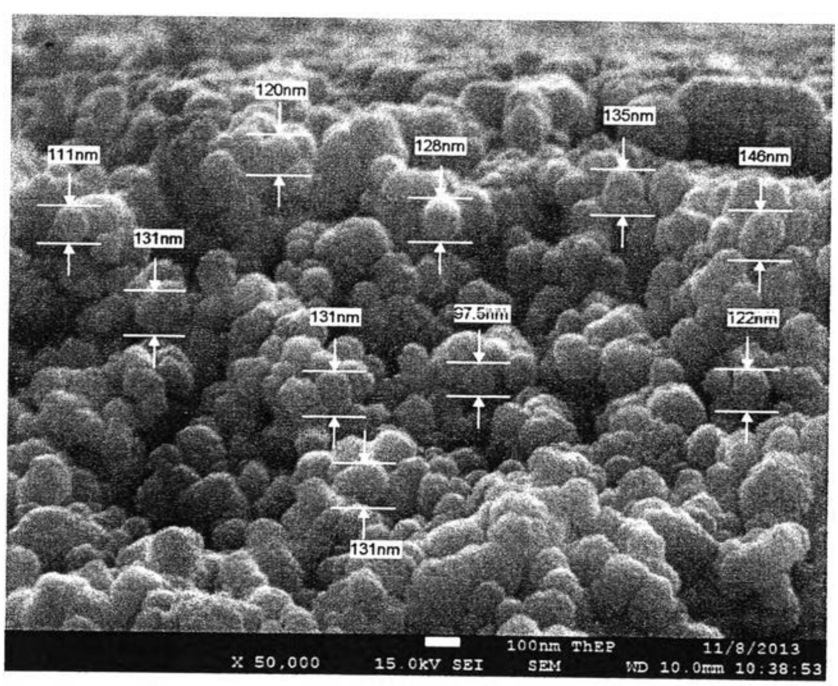

Figure D2 ZnO/CdS QD at 1 min.

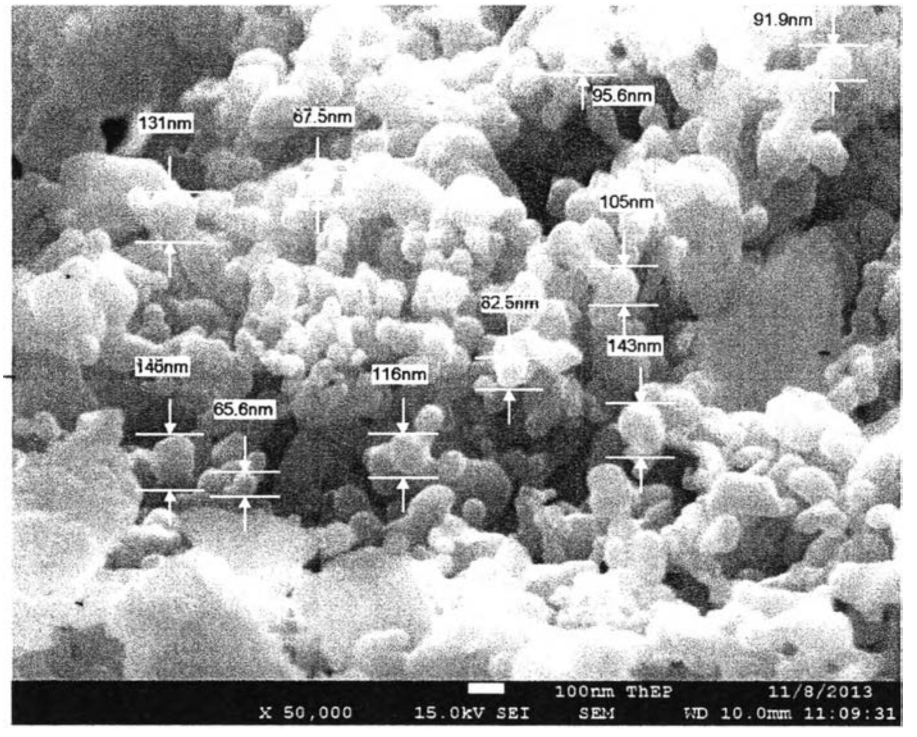

Figure D3 ZnO/CdS QD at 3 min.

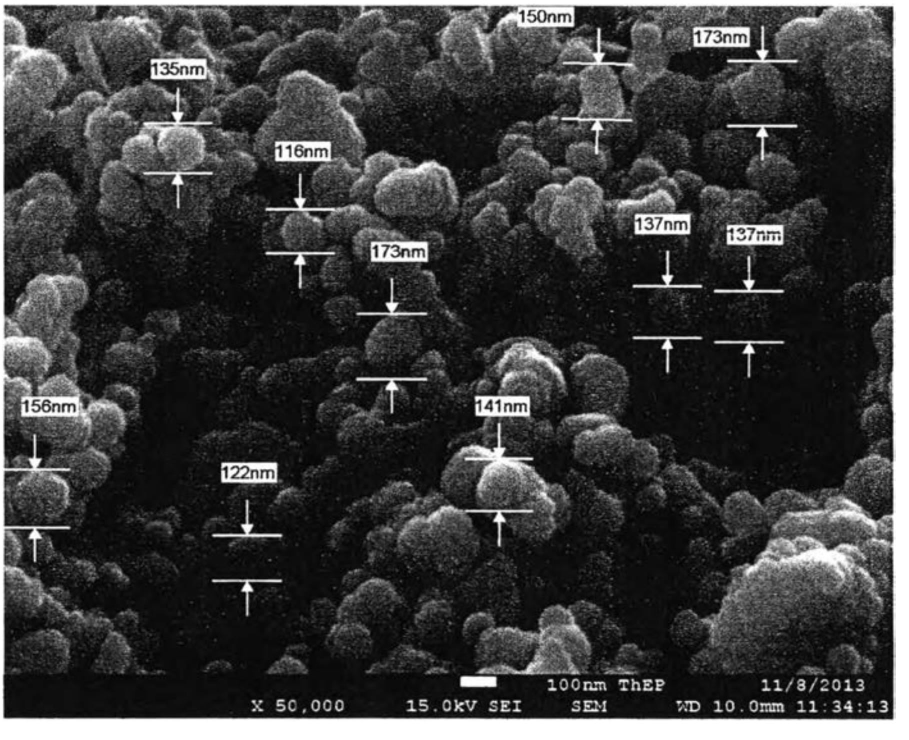

Figure D4 ZnO/CdS QD at 5 min.

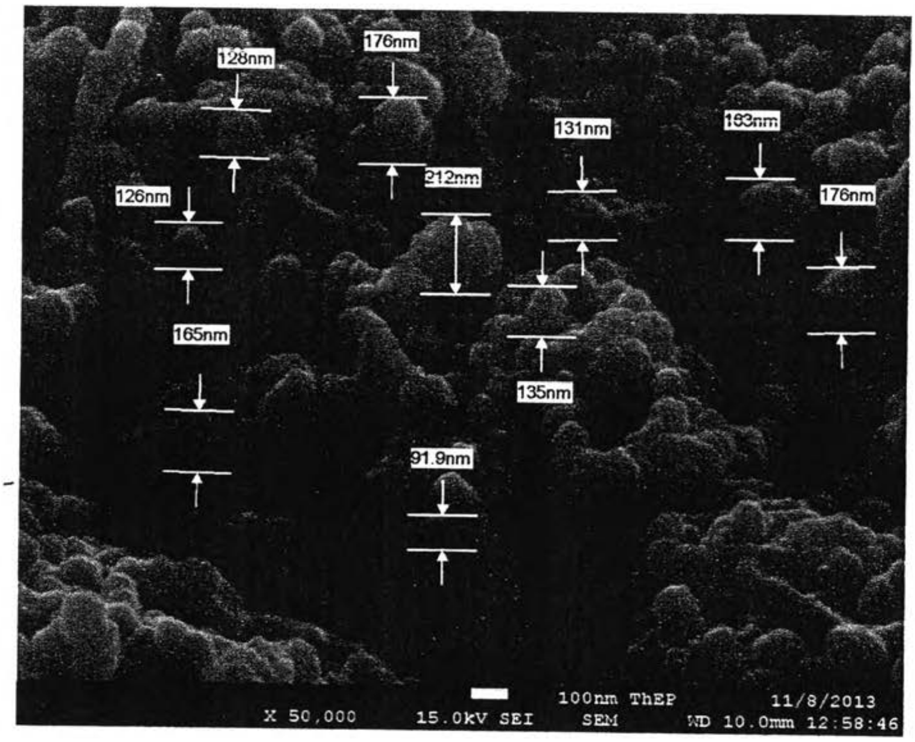

Figure D5 ZnO/CdS QD at 7 min.

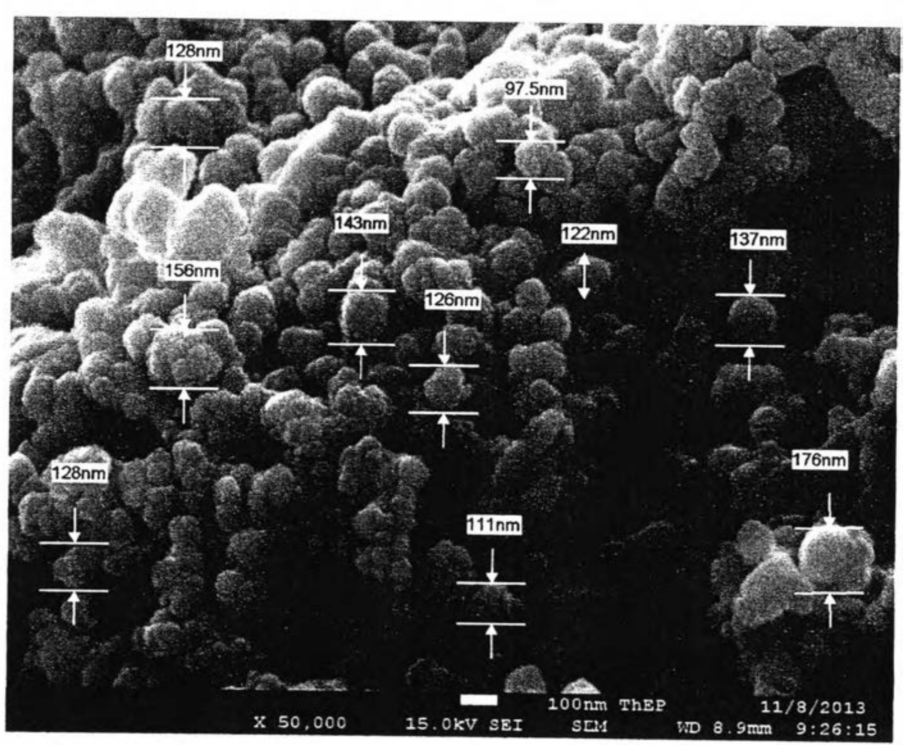

Figure D6 ZnO/CdS QD at 9 min.

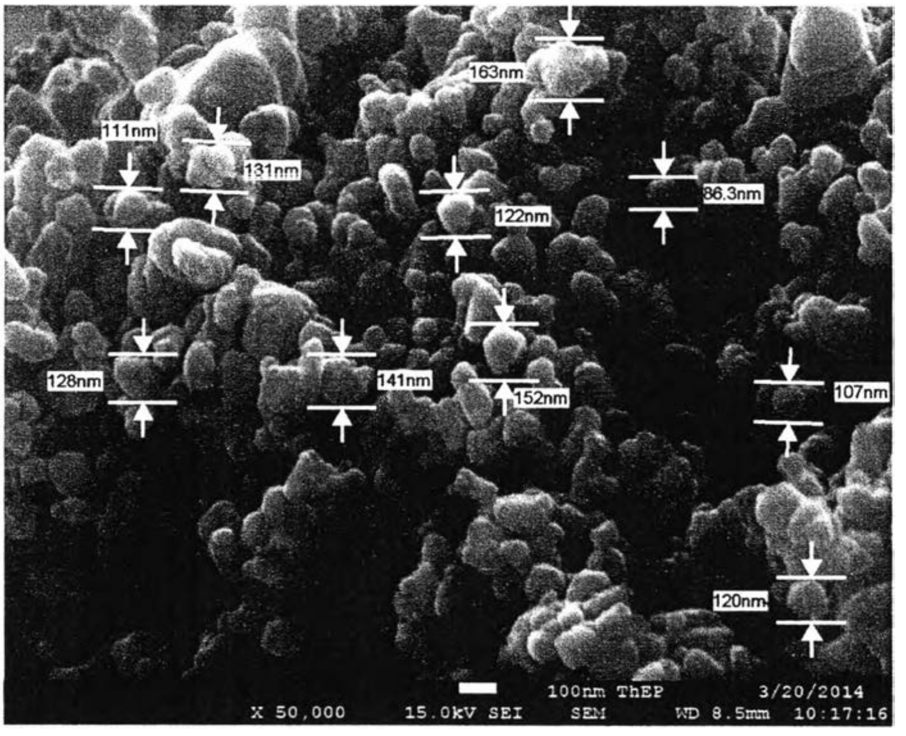

Figure D7 ZnO/ZnS QD at 1 min.

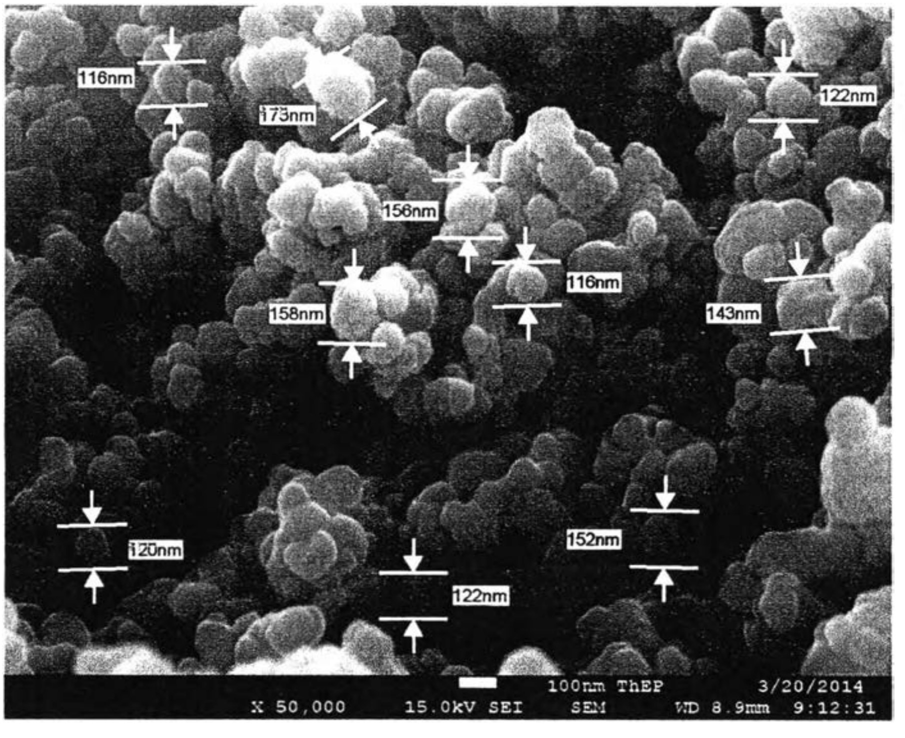

Figure D8 ZnO/ZnS QD at 3 min.

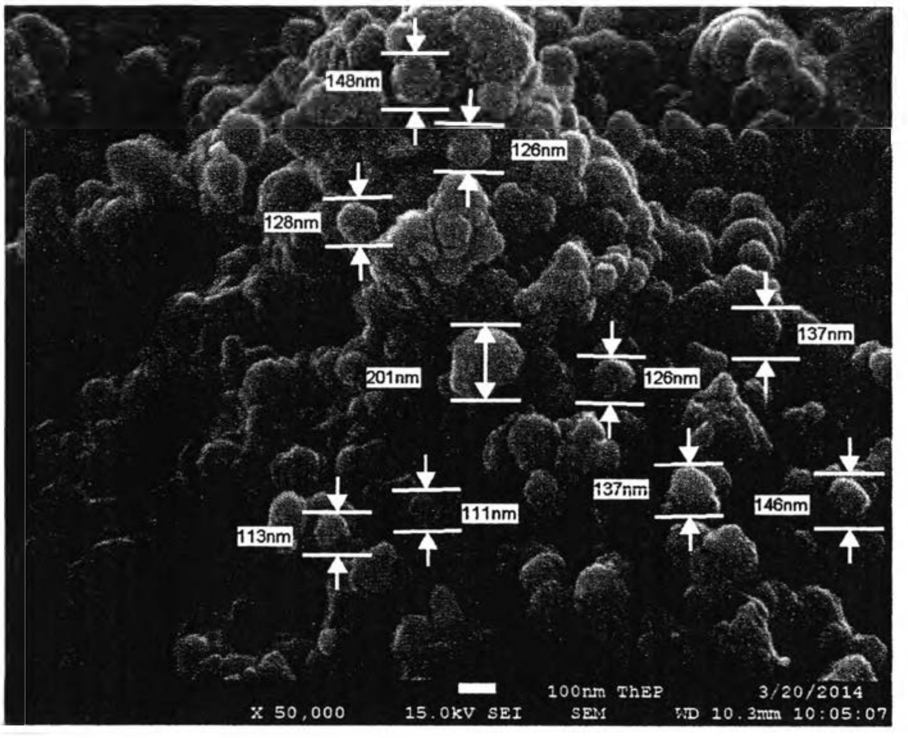

Figure D9 ZnO/ZnS QD at 5 min.

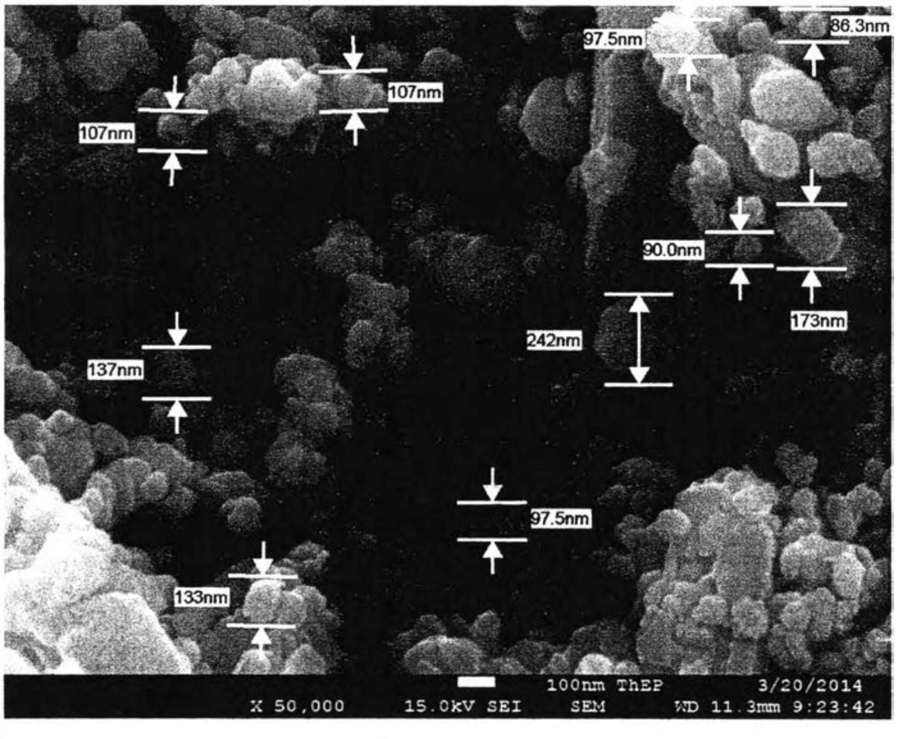

Figure D10 ZnO/ZnS QD at 7 min.

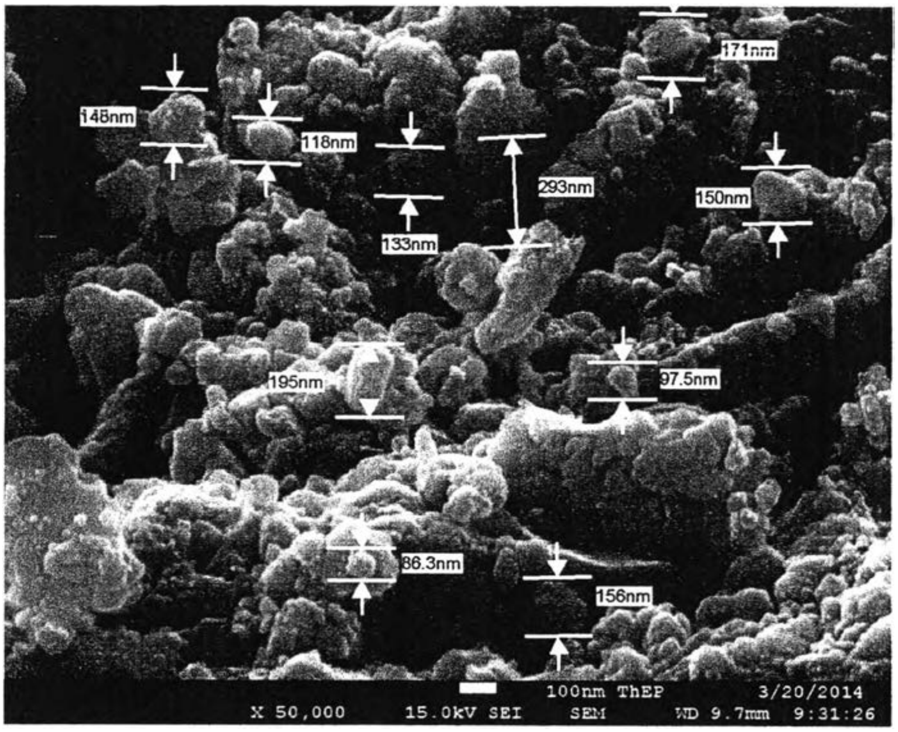

Figure D11 ZnO/ZnS QD at 9 min.

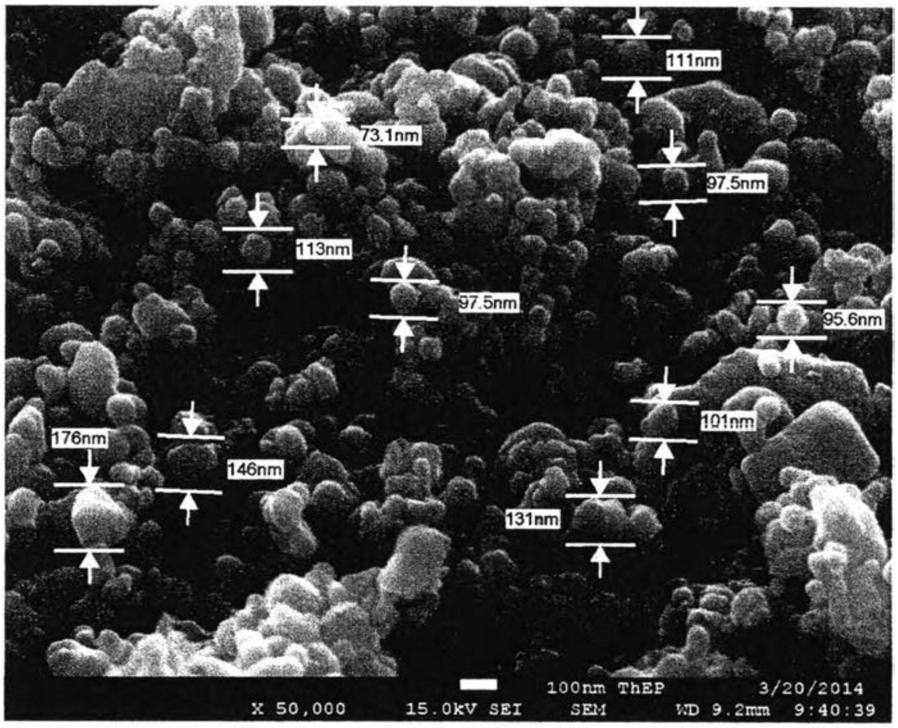

Figure D12 ZnO/Ag_2S QD at 1 min.

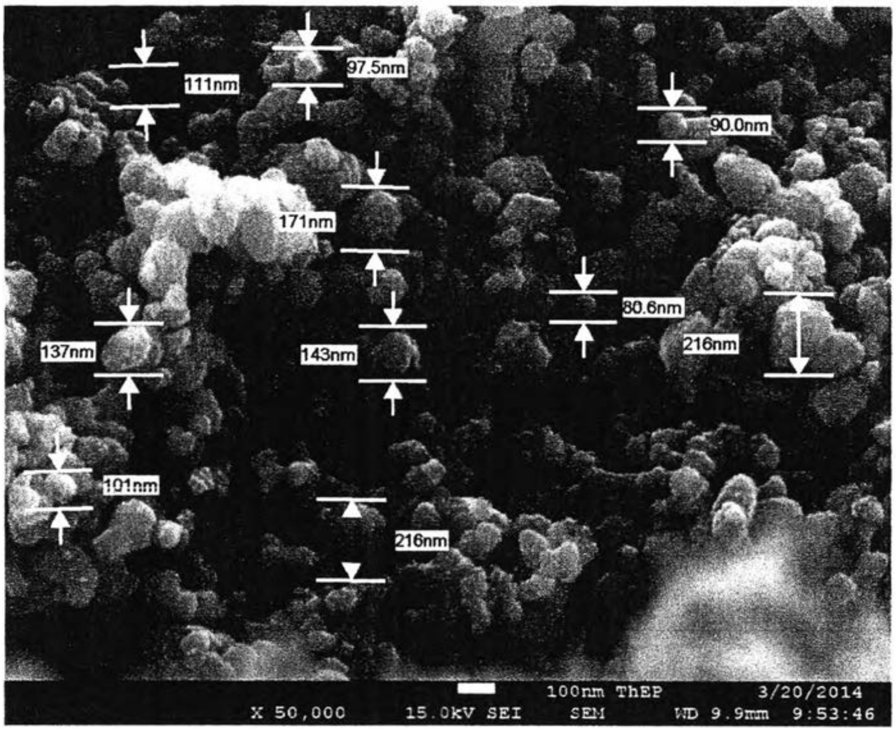

Figure D13 ZnO/Ag_2S QD at 3 min.

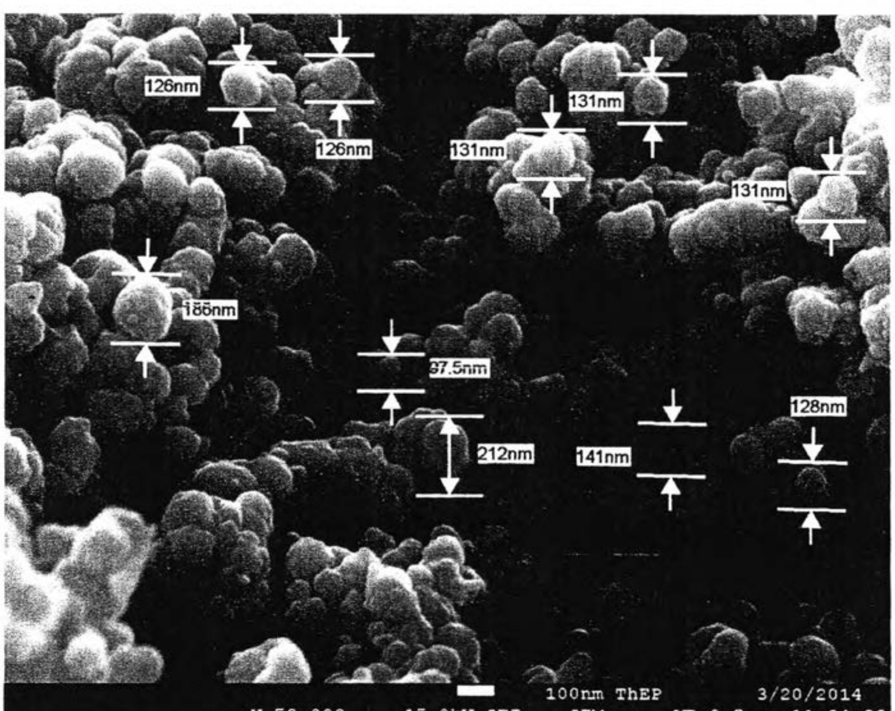

Figure D14 ZnO/Ag_2S QD at 5 min.

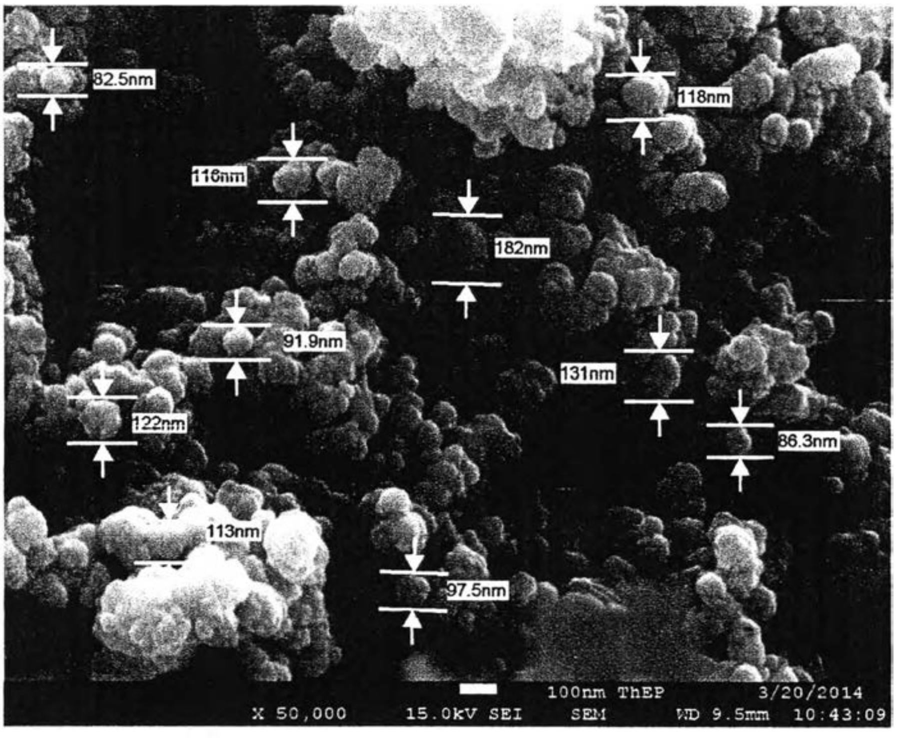

Figure D15 ZnO/Ag_2S QD at 7 min.

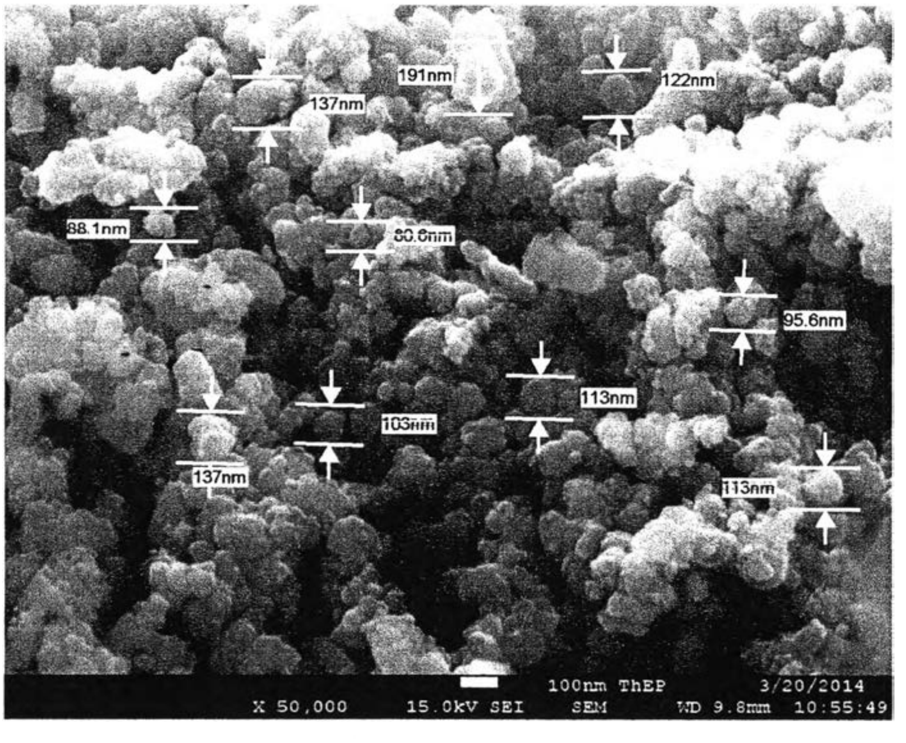

Figure D16 ZnO/Ag_2S QD at 9 min.

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2. Junhom, W.; and Magaraphan, R. (2014, June 8-12) Co-sensitization of ZnO by CdS quantum dots in natural dye-sensitized solar cells with polymeric electrolyte to improve the cell stability. The 30th International Conference of the Polymer Processing Society (PPS-30). Cleveland,Ohio, United state

Presentations:

1 Junhom, W.; and Magaraphan, R. (2014, April 8--12) Study of different natural pigments in dye-sensitized solar cells. Poster presented at The 5th Research Symposium on Petrochemical and Materials Technology and the 20th PPC Symposium on Petroleum, Petrochemicals, and Polymers. Queen Sirikit National Convention Center, Banhkok, Thailand

2. Junhom, W.; and Magaraphan, R. (2014, June 8-12) Co-sensitization of ZnO by CdS quantum dots in natural dye-sensitized solar cells with polymeric electrolyte to improve the cell stability. Poster presented at The 30th International Conference of The Polymer Processing Society (PPS-30). Cleveland,Ohio, United state