ENCAPSULATION OF QUANTUM DOTS IN COMPLEXES OF POLYELECTROLYTES

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THE GOAL

Formation of nanocapsules by sequential adsorption of oppositely charged polyelectrolytes with quantum dots.

MATERIALS

Two different polyelectrolyte couples were used:
• Cationic poly(allyamine hydrochloride) (PAH) with anionic poly (sodium styrene sulfonate) (PSS)
• Cationic poly-L-lysine hydrobromide (PLL) with anionic poly-D-glutamic acid sodium salt (PGA) or PGA pegylated (PGA-y-PEG)

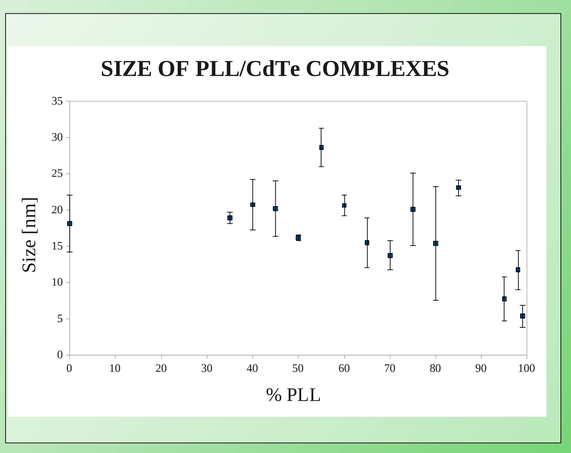
Negatively charged CdTe quantum dots applied in complexes with polyelectrolytes were purchased from PlasmaChem GmBH (Germany).

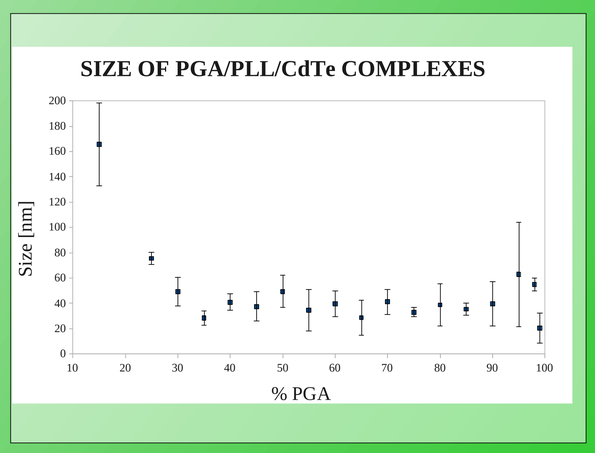
METHODS

• Dynamic light scattering (DLS) - determination of size and zeta potential of complexes
• Atomic force microscope (AFM) measurements of complexes deposited on mica
• Flow cytometer – determination of cytotoxicity of the capsules

RESULTS

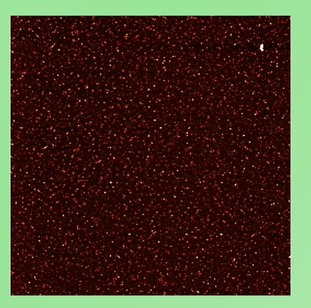
Dynamic Light Scattering





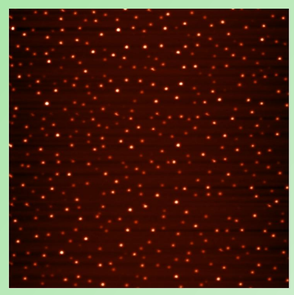
Atomic Force Microscope

CdTe ON MICA, TAPPING MODE

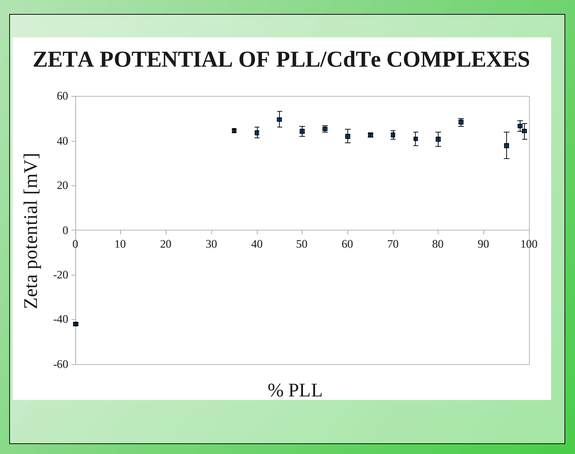


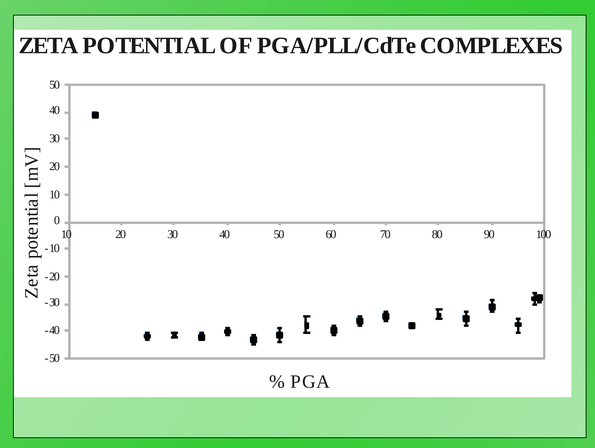
20x20 µm, CdTe deposited on mica covered with PEI.
Vertical scale = 30 nm

PLL/CdTe ON MICA, TAPPING MODE



10x10 µm, complex of PLL/CdTe deposited on mica.
Vertical scale = 30 nm

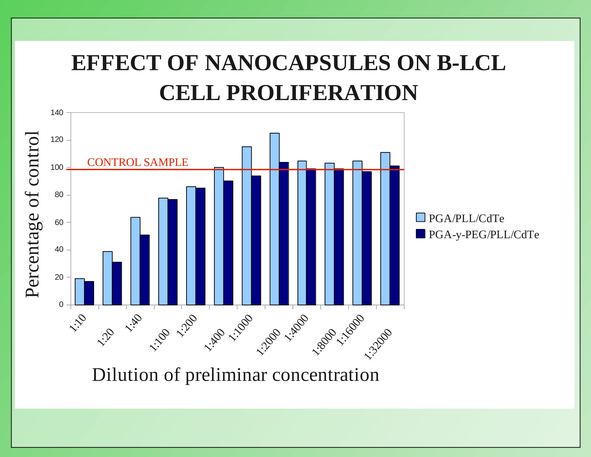


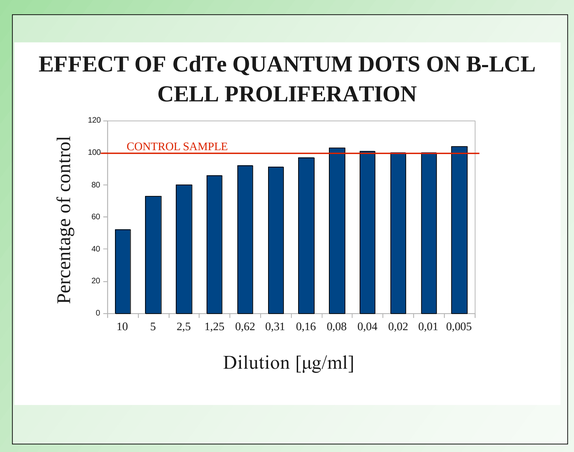


IN VITRO STUDIES

CdTe nanoparticles, plain capsules (PGA/PLL, PGA-y-PEG/PLL,) and CdTe-labeled capsules (PGA/PLL/CdTe, PGA-y-PEG/PLL/CdTe) were examined on flow cytometer in respect of their influence on B-lymphoblastoid (B-LCL) cell line proliferation. Control sample was incubated only with cell culture medium and antibiotics.

COMPLEX	RATIO	ZETA POTENTIAL [mV]	SIZE [nm]
PAH/CdTe	15:85	54	18
PSS/PAH/CdTe	60:6:34	-50	55
PLL/CdTe	35:65	44	19
PGA/PLL/CdTe	25:26:49	-41	76
PGA-y-PEG/PLL/CdTe	30:25:45	-5	50





CONCLUSIONS

• Succesful production of different polyelectrolyte – quantum dots fluorescent complexes of sizes within range 20 – 75 nm
• Plain capsules do not affect B-LCL cells proliferation, thus they are biocompatible at all concentrations tested
• QDs stop affecting the proliferation of B-LCL cells at a concentration of 0.08 µg/ml
• PGA/PLL capsules labelled with QDs stop affecting the B-LCL cell proliferation at a dilution of 1:400, which corresponds with 0.25 µg/ml CdTe concentration

Acknowledgements: this work was supported by the "Krakow Interdisciplinary PhD – Project in Nanoscience and Advanced Nanostructures" operated within the Foundation for Polish Science MPD Programme co-financed by the EU European Regional Development Fund and ERA-NET MATERA « NANOMEDPART » project.