

Quantum dots as bio-imaging agents for detection of cancer cells

Isabella Arcos

In the last several decades, technology has continued to decrease in size. Subsequently, the field of nanotechnology, specifically the application of nanomaterials in the area of electronics, has seen recent growth. One particularly interesting nanomaterial is known as quantum dots (QDs), which are miniscule semiconductor nanoparticles that range in size from two to ten nanometers in diameter. Quantum dots are known to become fluorescent when exposed to ultraviolet (UV) light. The interesting property of QDs is that their emission color is dependent on their size, not their material. The different colors are a result of different band gap energies in each different sized quantum dot, which is the amount of energy required for the electrons in a semiconductor to enter an excited state and jump energy levels. Although QDs were discovered in 1980, they have only been recently incorporated into fields such as medicine and display technology, the most famous being Samsung's QLED TVs.

In this study, 3-mercaptopropionic acid (MPA) capped Cadmium Tellurium (CdTe) quantum dots were synthesized using a simple, one-step method. Five different colors of quantum dots were synthesized: blue, green, yellow, orange, and red. The fluorescence of these quantum dots was further characterized using an Absorbance and Photoluminescence study. The synthesized QDs were then employed for tagging cancer cells and measuring the fluorescence using a photodiode, which is directly correlated to the number of cancerous cells. Along with this, microscopy techniques were used to visualize the cancer cells. These techniques can be translated for detection of cancerous versus non-cancerous cells and has immense application in diagnostics.