Zinc Selenide Quantum Dots as Intracellular Drug Delivery Vehicles

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Need:
- Chemotherapy → systemic treatment
- Intracellular drug delivery → direct diffusion into cell
- Current issue: endosomal entrapment

Objective: develop a nontoxic nanoparticle to deliver drug into cell without getting stuck in its endosome

Design Inputs: 1) Solution must be non-cytotoxic, i.e. cell viability ≥ 97 ± 2% & 2) Solution must have a positive charge (> 0mV) to enter cells

Solution:
- Zinc Selenide quantum dots (QDot) complexed with polyethylenimine (PEI)
  - Held together by electrostatic interactions
- Innovation: PEI breaks the endosomal entrapment
- Why ZnSe QDot? Non-toxic, successful bioimaging probe*

*bright → great for tracking

Verification:

<table>
<thead>
<tr>
<th>Design Input</th>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trypan Blue Assay</td>
<td>95% cell viability (PASS)</td>
</tr>
<tr>
<td>2</td>
<td>Zetasizer count</td>
<td>9.17 ± 0.93 mV (PASS)</td>
</tr>
</tbody>
</table>

Future Plans & Impact:
- Low dosage = less side effects → betters their quality of life and the progression of their disease
  - The drug costs are reduced for patients
- Further work includes optimizing the brightness of the quantum dots for better tracking

Overview: Quantum dots complexed with PEI prove to be non-toxic drug delivery vehicles with the potential to break their endosomal entrapment due to their positive charge, encouraging further research.