The Effects of Polymeric Coatings on the Antioxidative Abilities of Cerium Oxide Nanoparticles

By

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Nanoceria

- Cerium Oxide Nanoparticles
- Known for antioxidant abilities
- Scavenges Reactive Oxygen Species (ROS)
  - Shifts between oxidation states
  - Haber-Wiess Reaction
- Polymeric coatings improve effectiveness
- Benefits:
  - Increased antioxidant abilities
  - Lower cytotoxicity
  - Possible treatment for degenerative diseases

\[
\text{O}_2^- + \text{H}_2\text{O}_2 \rightarrow \text{OH}^- + \text{OH}^- + \text{O}_2
\]
ROS

- Reactive Oxygen Species
  - Oxygens with unpaired e⁻
- Endangers cell
  - Cell damage
  - Cell death
- Linked to degenerative diseases
BSO

- Buthionine Sulfoximine
- Induces oxidative stress
- Depletes Glutathione (GSH) levels
  - GSH is the natural ROS defense
  - BSO inhibits the GSH synthesis
- Cells can no longer protect against oxidative stress
Method:

- Synthesize the nanoparticles
  - Dextran (DNC)
  - Polyethylene Glycol (PEG)
  - Polyvinylpyrrolidone (PVP)
- Culture and seed the cells
  - Mouse Fibroblast cells were used
- Treat cells with nanoparticles and vehicles
- Treat cells with BSO and DCFDA dye
- Test the ROS’s effect using the microplate reader
Results: Control

Average Fluorescence of the Experimental Control with no NPs or Vehicles

<table>
<thead>
<tr>
<th>[BSO] mM</th>
<th>Average Fluorescence</th>
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<tbody>
<tr>
<td>5</td>
<td>110</td>
</tr>
<tr>
<td>10</td>
<td>180</td>
</tr>
<tr>
<td>20</td>
<td>200</td>
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</tbody>
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Results: DXN Coating vs ROS

Average Fluorescence of Dextran Nanoparticles vs. ROS

Average Fluorescence

- Dextran with no NPs
- Dextran Coated NPs

[BSO] mM: 5, 10, 20
Results: PEG Coating vs ROS

Average Fluorescence of PEG coated Nanoparticles vs. ROS

[Graph showing average fluorescence vs. [BSO] mM for PEG with no NPs and PEG coated NPs]
Results: PVP Coating vs ROS

Average Fluorescence of PVP Coated Nanoparticles vs. ROS

[Bar chart showing average fluorescence for PVP with no NPs and PVP coated NPs at different [BSO] mM concentrations (5, 10, 20).]
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