Block Copolymer Complex Coacervate Core Micelles for Enzymatic Catalysis in Organic Solvent
Technology #17382

Applications

This invention has applications in the development of methods for on-site decontamination of organophosphate (OP) nerve agents by enzymatic hydrolysis.

Problem Addressed

Bulk stocks of OP nerve agents are commonly found as chemical warfare agents in present and former conflict zones. Existing techniques for OP disposal require the nerve agents to be transported off-site, incurring significant cost and risk. Organophosphate hydrolase (OPH) is a bacterial enzyme that has been proposed as a means to decontaminate a wide range of OP nerve agents. However, the hydrophobic organic solvents in which OP’s are often found significantly degrade OPH’s hydrolytic activity. This has hampered the widespread adoption of OPH for on-site decontamination of OP nerve agents. This invention offers a potential solution to these problems with a method to stabilize and disperse OPH in hydrophobic solvents.

Technology

This invention describes a method to stabilize and disperse OPH in hydrophobic organic solvents by encapsulating them in complex coacervate core micelles (C3Ms). Coacervation refers to the liquid-liquid phase separation driven by electrostatic attraction between oppositely charged molecules. Micelles with a coacervate core can be formed when a block copolymer with neutral and charged blocks is mixed with an oppositely charged macromolecule. In this case, POEGMA-b-qP4VP (a block co-polymer with a cationic block) and PAA (a polyanion) are mixed in an aqueous environment to form C3Ms. When OPH is present during this process, it is incorporated into the coacervate core of the micelles and encapsulated by the micellar corona. In experiments carried out with ethanol and dimethyl methylphosphonate (DMMP) as analogs for OP nerve agents, OPH encapsulated in C3Ms retained 35% and 26% of enzymatic activity after being incubated for 24 hours in DMMP and ethanol respectively. In comparison, non-encapsulated OPH retains less than 5% of activity under these conditions.

Advantages

- Stabilizes OPH to allow over 5-fold improvements in enzymatic activity retention in organic solvents

Categories For This Invention:

- Life Sciences
- Environment

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**Remediation**

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**Publications:**
Complex Coacervate Core Micelles for the Dispersion and Stabilization of Organophosphate Hydrolase in Organic Solvents
Langmuir
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**External Links:**
Olsen Group
http://cheme.scripts.mit.edu/olsenlab/

**Image Gallery:**