

Cyanide Countermeasures

Highly potent, water-soluble Platinum(II) complexes offer a next-generation intramuscular antidote for cyanide poisoning with enhanced scavenging capacity and no acute cardiotoxicity.

Researchers at Purdue University have developed fast-acting antidotes to reverse cyanide poisoning. Some previous antidotes have involved the use of Pt(II) or Pt(IV) salts formulated with DMSO followed by dilution in phosphate-buffered saline. However, these antidotes are ineffective when administered intramuscularly. The Purdue researchers propose complexes of Pt(II) coordinated with amine and bidentate sulfur ligands. These complexes had enhanced reactivity toward cyanide in vitro and fully recapitulated in vivo cyanide rescue in zebrafish and mouse models. The cyanide addition products yielded tetracyanoplatinate(II), translating to a stoichiometry of 1:4 Pt to each cyanide scavenger. These new agents demonstrate a robust and enhanced potency over the DMSO-containing complexes using intramuscular administration in mouse and rabbit models of cyanide toxicity. Using the zebrafish model with these Pt(II) complexes, no acute cardiotoxicity was detected, and dose levels required to reach lethality were greater than one hundred times the effective dose.

Technology Validation: One of the researchers' compounds recapitulated in vivo cyanide rescue in 5/5 mice and maintained its efficacy 7 days after formulation.

Related Publication: Identification of Platinum(II) Sulfide Complexes Suitable as Intramuscular Cyanide Countermeasures. Chemical Research in Toxicology 2022 35 (11), 1983-1996. DOI: 10.1021/acs.chemrestox.2c00157

Advantages:

- The antidotes are suitable for intramuscular injection
- Complexes coordinate in a 1:4 Pt-to-cyanide ratio, providing higher scavenging action than state-of-the-art
- Many of the antidote complexes are highly water-soluble

Technology ID

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Category

Biotechnology & Life
Sciences/Biomarker Discovery &
Diagnostics
Pharmaceuticals/Drug Discovery
& Development
Biotechnology & Life
Sciences/Analytical & Diagnostic
Instrumentation
Pharmaceuticals/Small Molecule
Therapeutics
Pharmaceuticals/Drug Delivery &
Formulations

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- The antidote complexes demonstrated no cardiotoxicity in vivo testing on zebrafish

Applications:

- Antidotes for cyanide poisoning

TRL: 4

Intellectual Property:

Provisional-Gov. Funding, 2022-07-29, United States | NATL-Patent, 2023-07-28, Europe | PCT-Gov. Funding, 2023-07-28, WO | NATL-Patent, 2023-07-28, Canada | NATL-Patent, 2023-07-28, Australia | NATL-Patent, 2023-07-28, Japan | NATL-Patent, 2025-01-29, United States

Keywords: cyanide antidote, Pt(II) complexes, platinum antidote, intramuscular administration, cyanide poisoning countermeasures, amine and bidentate sulfur ligands, cyanide rescue, tetracyanoplatinate(II), enhanced potency, water-soluble cyanide complexes