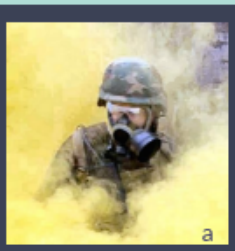
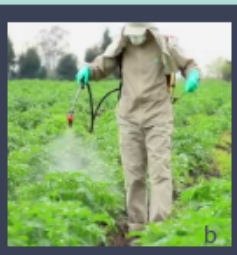
THE

CHEMISTRY OF FLUORESCENT ORGANOMETALLIC SENSORS

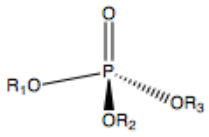
The Detection of Pesticides and Chemical Warfare Agents



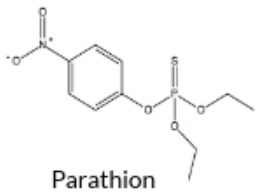
With nearly 3,000,000 incidents per year, organophosphate poisoning is one of the most common types of poisoning worldwide. [1] Fortunately, the toxic organophosphate compounds can be detected in straightforward way using fluorescent organometallic sensors. Upon binding with organophosphates, the sensors undergo a fluorescent color change.



Organophosphates

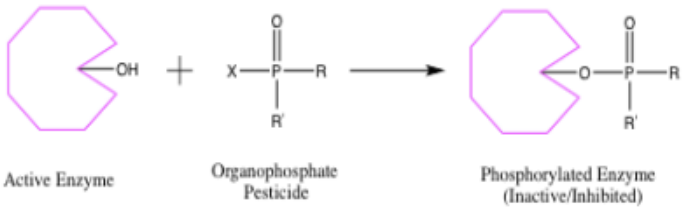


General Organophosphate Structure



Parathion

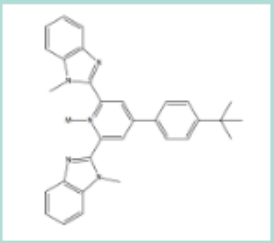
Organophosphates are dangerous compounds found in pesticides and chemical warfare agents. Parathion is one of the most common organophosphates used in the U.S. and is used in various insecticides manufactured by Monsanto. [2,3]

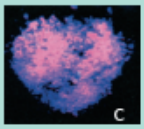


Active Enzyme | Organophosphate Pesticide | Phosphorylated Enzyme (Inactive/Inhibited)

Their toxicity stems from their ability to bind to the enzyme acetylcholinesterase, a key component of our brains. Inactivation of this enzyme results in neurotoxic symptoms such as muscle tremors, fatigue, and paralysis.

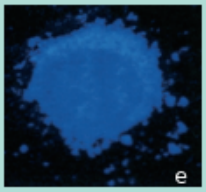
Detection





PINK fluorescent organometallic sensor (Metal Center=Eu, La, Zn) [4]

Toxic organophosphate containing substance



BLUE complex

If the pink organometallic sensor turns blue, an organophosphate has bound to the sensor, and a toxic species has been detected.

Sources:
[1] Berg, S.; Bittner, E. The MGH Review of Critical Care Medicine. Lippincott Williams & Wilkins: Philadelphia, 2014.
[2] Maugh, T. H. Study Links Pesticide to ADHD in Children. Los Angeles Times. May 16, 2010.
[3]https://www.epa.gov/pesticides/chem_search/ppls070506-00193-20090414.pdf
[4] Knapton, D. et al. Angew. Chem. Int. Ed. 2006, 45, 5825-5829.

Images:
a: https://www.pinterest.com/pin/542613455077865153/
b: Pesticidewise: https://www.youtube.com/watch?v=TenRNA_usxA
c,e: Knapton, D. et al. Angew. Chem. Int. Ed. 2006, 45, 5825-5829.
d: Wikimedia Commons: https://en.wikipedia.org/wiki/Biological_warfare