

Public Abstract

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Title:PHOSPHINIMINES AS POTENTIAL TECHNETIUM ENVIRONMENTAL SENSORS

Phosphinimines, $R_3P=NSi(CH_3)_3$, react with water to form the positively charged phosphiniminium, $R_3P=NH_2^+$, which can then form the ion pair $[R_3P=NH_2^+][X^-]$ in the presence of an anion. Technetium-99 is present as environmental contamination in the form of $^{99}TcO_4^-$, which is extremely mobile and can enter drinking water and the food supply chain. Currently available methods to measure this contamination from technetium-99 are time consuming and tedious. A method to concentrate and measure technetium-99 environmental contamination in a quick and efficient manner is needed. The selectivity of the phosphiniminium cation for TcO_4^- may make phosphinimines suitable for such concentration and possibly for measurement. Several phosphinimines were synthesized and characterized for their stability and selectivity with $^{99}TcO_4^-$, $R_3P=NSi(CH_3)_3$ where R = phenyl, 9-anthracenyl, 1-naphthyl, or p-COOCH₃-phenyl. (9-anthracenyl)Ph₂P=NSi(CH₃)₃ and (1-naphthyl)Ph₂P=NSi(CH₃)₃ include possible reporter groups and (p-COOMe)C₆H₄Ph₂P=NSi(CH₃)₃ contains a linking moiety for incorporating reporter groups or attaching the phosphinimine to a polymer support. The reporter groups should produce some type of signal in the presence of TcO_4^- but not in the presence of other anions present in the environment, such as nitrate (NO₃⁻) or phosphate (PO₄⁻). Two of the phosphinimines, Ph₃P=NSi(CH₃)₃ and (9-anthracenyl)Ph₂P=NSi(CH₃)₃, demonstrated the ability to bind and remove TcO_4^- in the presence of a variety of anions that would be present in the environment. The ability of the phosphinimines to remove TcO_4^- contamination was demonstrated and could be used to remove environmental contamination to protect wild life and food supplies in areas of the United States and other countries that have significant contamination, such as Hanford, WA.