High Yielding and Low Cost Synthesis of Polyphosphorylated Molecules
Technology #20486

Applications

This invention is immediately suitable for commercialization as a reagent to triphosphorylate nucleophilic substrates. The chemical species generated by this invention allows for much easier synthesis of triphosphorylated molecules utilized in the biochemistry and pharmacological communities. The invention can be used in lieu of existing commercial methods for the large scale production of triphosphorylated molecules. Additionally, an extremely broad class of molecules can be synthesized using this invention, including mono, di, tri, tetra, and hexaphosphorylated molecules.

Problem Addressed

Intense, and therefore costly synthesis is needed to generate many polyphosphorylated biomolecules relevant to biochemical and pharmacological research, due to the difficulty of obtaining these molecules from biological sources. Additionally, no single phosphorylation method is acceptable for all desired biological substrates. As a result, even relatively common polyphosphorylated substrates are extremely expensive from commercial sources. Known reactions to triphosphorylate substrates in one step are low yielding and require costly purification of products. These inventors have developed a high yielding method for the synthesis of triphosphorylated molecules directly from trimetaphosphate combined with a simple isolation and purification procedure for products. As a result, the generation of triphosphorylated molecules is much more cost efficient than current methods, and can be extended to a variety of previously excluded substrates.

Technology

In one step, this invention triphosphorylates nucleophilic substrates like alcohols, amines, and phosphates. Trimetaphosphate serves as the phosphate source and is combined with a coupling reagent to generate an activated species. The activated species can be reacted with nucleophilic substrates to produce functionalized trimetaphosphate derivatives that can be easily isolated and purified by crystallization. Rapid hydrolysis of trimetaphosphate derivatives in water is finally used to generate linear triphosphate products. The invention can also be applied to generate linear, branched, and cyclic polyphosphates (including mono, di, tri, tetra, and hexaphosphorylated molecules).

Advantages

- First of its kind activated species generated from trimetaphosphate
- High yielding, one step synthesis of triphosphates derivatives that is more cost effective and easier to purify than current methods
- Novel access to previously inaccessible substrates facilitates the generation and commercialization of highly desired polyphosphorylated entities
Categories For This Invention:
Life Sciences
Chemicals
Biochemicals
Specialty Chemicals
Research Tools
Reagent

Intellectual Property:
Synthesis of polyphosphorylated molecules directly from polyphosphates
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Synthesis of polyphosphorylated molecules directly from polyphosphates
PCT

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Publications:
Functionalization of Intact Trimetaphosphate: A Triphosphorylating Reagent for C, N, and O Nucleophiles
Journal of the American Chemical Society
January 15, 2019

External Links:
Cummins Lab
https://ccclab.mit.edu/