



The **Thorpe Nitrile Condensation Reaction** is a chemical reaction involving the self-condensation of nitriles (compounds containing the $-C\equiv N$ group) in the presence of a base, leading to the formation of α,β -unsaturated imines or cyclic compounds. This reaction is commonly used in the synthesis of heterocycles and is related to the Thorpe reaction, which involves ketones.

Reaction Mechanism:

1. Base Activation:

- A strong base (e.g., sodium ethoxide, potassium tert-butoxide) deprotonates the α -hydrogen of the nitrile, forming a nitrile anion.

2. Nucleophilic Attack:

- The nitrile anion attacks the carbon of another nitrile group, leading to a C-C bond formation and the generation of an intermediate.

3. Product Formation:

- The intermediate rearranges to form α,β -unsaturated imines, or subsequent reactions like hydrolysis can yield corresponding α,β -unsaturated acids or other derivatives.
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General Reaction:



Applications:

1. Cyclic Compound Synthesis:

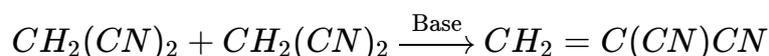
- Thorpe nitrile condensation is widely used to synthesize cyclic compounds such as pyrimidines and other nitrogen-containing heterocycles.

2. Intermediate Formation:

- The α,β -unsaturated imines formed can be further hydrolyzed to carboxylic acids or converted into other useful organic intermediates.
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Example:

For example, when **malononitrile ($\text{CH}_2(\text{CN})_2$)** is treated with a base, it undergoes Thorpe nitrile condensation to form **1,1-dicyanoethylene**.



This reaction is a valuable tool in organic synthesis, especially in building complex molecular frameworks.