The **Thorpe Nitrile Condensation Reaction** is a chemical reaction involving the self-condensation of nitriles (compounds containing the -C≡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.

General Reaction:

$$2\ \mathrm{RCH_2}CN \xrightarrow{\text{Base}} \mathrm{RCH{=}C(NH)R} \quad (\alpha,\beta\text{-unsaturated imine})$$

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.

Example:

For example, when **malononitrile (CH2(CN)2)** is treated with a base, it undergoes Thorpe nitrile condensation to form **1,1-dicyanoethylene**.

$$CH_2(CN)_2 + CH_2(CN)_2 \xrightarrow{\text{Base}} CH_2 = C(CN)CN$$

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