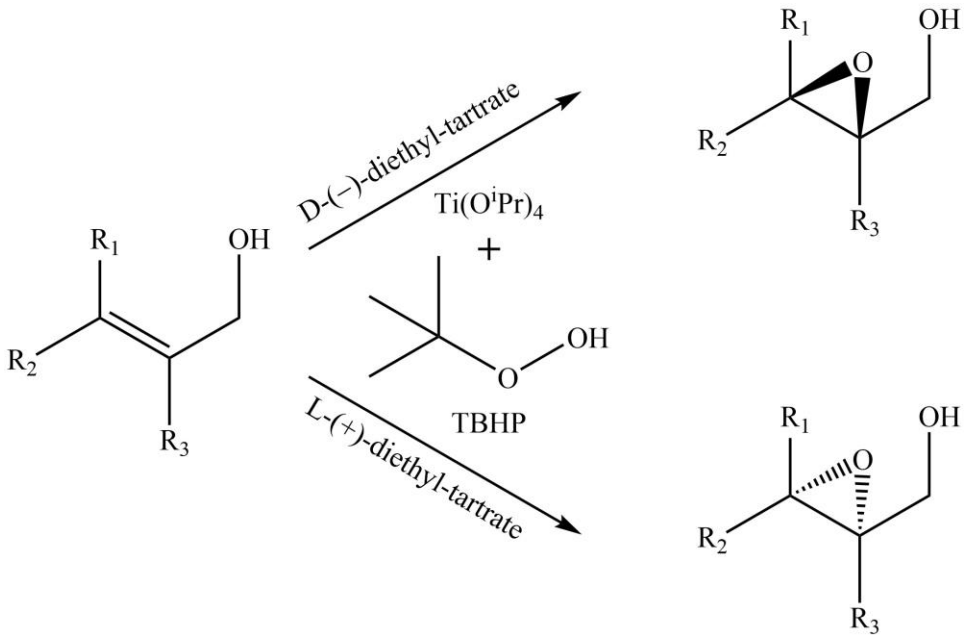
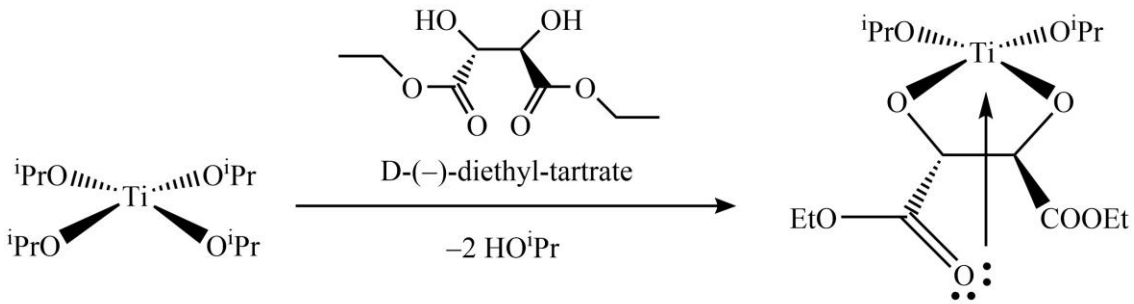
❖ Sharpless Asymmetric Epoxidation

The Sharpless asymmetric epoxidation may simply be defined as an enantioselective chemical reaction where primary and secondary allylic alcohols are converted into epoxy-alcohols using tert-butyl hydroperoxide (TBHP), chiral diethyl tartrate (DET), and titanium tetra(isopropoxide) as the catalyst.

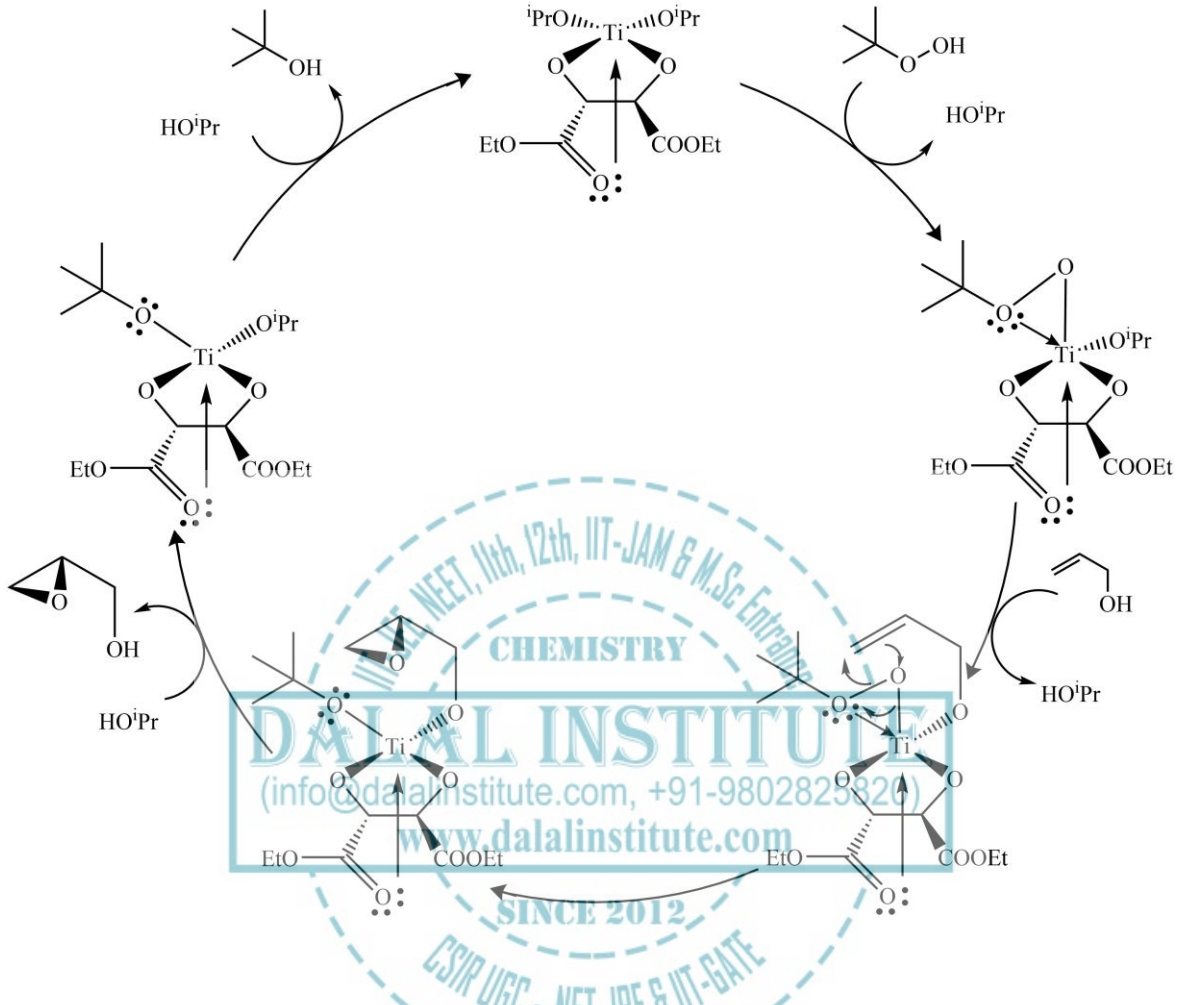
Illustrative Reaction: The typical organic chemical reaction showing Sharpless asymmetric epoxidation is given below.



Mechanism Involved: The mechanism for asymmetric epoxidation starts with the substitution of the isopropoxide ligands in titanium tetra(isopropoxide) catalyst by the chiral diethyl tartrate, which is followed by the further displacement via TBHP in the resulting complex.



In the last, the allylic alcohol reagent displaces the fourth isopropoxide ligand (the only remaining). Although the resulting titanium complex is supposed to be a dimer, the monomer unit is much easier to tackle as far as the mechanism is concerned. After that, the olefin part gets oxidized byTBHP with the face of attack dictated by the chiral DET resulting in the final product i.e., stereoselective epoxy-alcohol.



The Sharpless asymmetric epoxidation can be employed to synthesize different pheromones, leukotrienes, saccharides, terpenes, and antibiotics.

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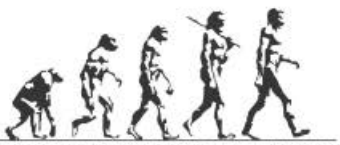

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