Design, synthesis and characterization of chiral water-soluble picket fence and basket-handle porphyrins: applications in enantioselective epoxidation and chiral recognition

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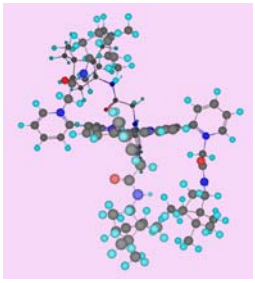
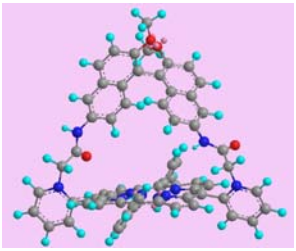
Water-soluble chiral porphyrins can be used as catalysts for enantioselective epoxidation of unfunctionalized olefins and as hosts for chiral recognition of small molecules, such as amino acids in water.



A water-soluble chiral picket fence porphyrin (Chem3D structure shown in figure on left) has been synthesized. The alkylation of tetra-(2-pyridyl) porphyrin with R-(+)-bornyl-bromoacetamide has been carried out to provide a mixture of atropisomers, and the separation and characterization of these isomers have been explored in detail. The major product obtained from the reaction (the αααββ isomer) has been metallated to give the Mn(III) and the Zn(II) compounds. The catalytic activity of the Mn(III) compound in the presence of various oxidants for enantioselective epoxidation of olefins has been studied. The binding of amino acids with the Zn(II)porphyrin in aqueous solution has also been explored.

A basket-handle porphyrin (Chem3D Structure shown in figure on right) has also been synthesized by alkylating tetra-(2-pyridyl) porphyrin with R-6,6'-bis(bromoacetamido)-2,2'-dimethoxy-1,1'binaphthyl. The characterization and application studies are underway.



The details of the synthesis and characterization of these porphyrins will be presented. The chiral recognition studies and rates and selectivity of the catalytic oxidations will also be discussed.