

# Study of the Synthesis of New Complex Organic Heterocycles Using Oxidative Radical Reaction, Aerobic Oxidation, Lewis Acid-Catalyzed Reaction, and Photo-Induced Reaction

key words: oxidation, radicals, cyclization, heterocycles, bond-formation, catalytic reaction, photoreaction, aerobic oxidation, peroxides, Lewis acid

**Hiroshi Nishino** Prof., D.Sc

Organic Chemistry Field, Department of Chemistry

E-mail : nishino@sci.kumamoto-u.ac.jp Tel : +81-96-342-3374 URL : <http://www.nishino-labo.jp/english/index.html>

## Synthesis of Heterocyclic Propellanes (Figure 1)

Propellanes are containing a tricyclic system connected by a carbon-carbon single bond and of significant theoretical interest as well as biologically important basic scaffold. Efforts are currently underway to synthesize functionalized heterocyclic propellanes using Mn(III)-based oxidative radical tandem cyclization.

## Construction of Polyquinane Structure (Figure 2)

Oxidation of a mixture of terminal alkadienes and malonic acid with  $\text{Mn}(\text{OAc})_3$  gives polyquinane derivatives *via* tandem cyclization. Polyquinane structure is important for total synthesis of natural products and the synthesis of heterocyclic polyquinanes is currently in progress.

## Synthesis of Macrocyclic Compounds Using Mn(III)-Based Dihydrofuran-Clipping Reaction (Figure 3)

Electrophilic carbon radicals, produced by the oxidation of carbonyl compounds with metal oxidants, inter- and intra-molecularly attack electron-rich organic molecules to give various cyclic products. Allyloxyoligomethylene 3-oxobutanoates undergo Mn(III)-based dihydrofuran-clipping reaction to give macrocyclic compounds from 11- to 100-members including cyclophane-type huge molecules. Efforts are currently underway to synthesize macrocyclic compounds having various supramolecular behaviors.

## Synthesis of Heterocyclic Compounds Including Peroxides and Alkalids (Figure 4)

The biological activity derives from the peroxide structure. The Mn(III)-based oxidative radical reaction of many 1,3-dicarbonyls gives organic peroxides and we synthesized many nitrogen- and oxygen-heterocycle-fused peroxides. We demonstrated that some synthesized peroxides had cytotoxicity and somewhat antimalarial activity. Further studies on the synthesis of more complicated nitrogen-containing bicyclo- and tricycloperoxides using Mn(III)-based oxidation are now in progress.

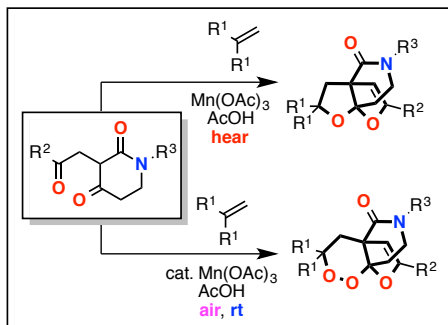


Figure 1

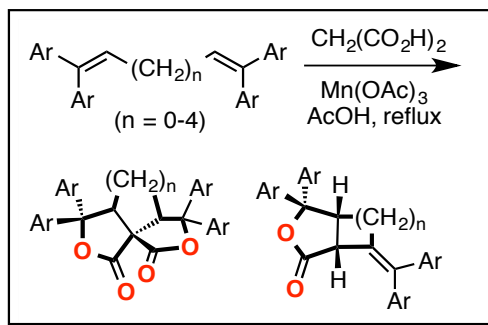


Figure 2

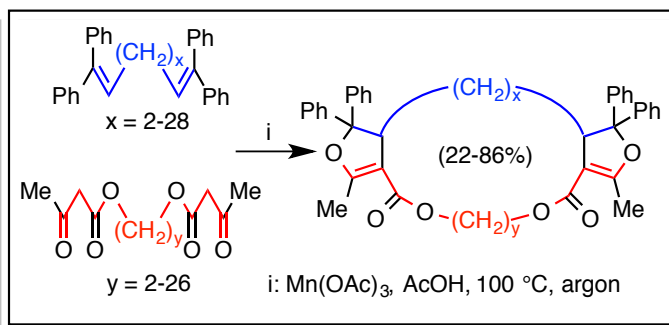


Figure 3

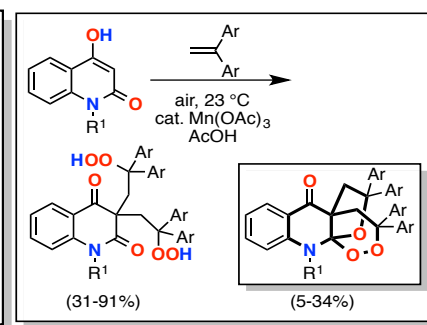


Figure 4