High yield synthesis of terpene oxide
Environmentally benign oxidation using hydrogen peroxide

We have developed a high yield synthesis method of terpene oxides by oxidation of terpenes using H_2O_2 with a new catalytic system. The formation of fine chemicals from biomass with an environmentally benign system is studied energetically these days. Terpene, which is generated from gum turpentine, is one of the widely used kinds of biomass. Acid-labile terpene oxides such as α-pinene oxide are synthesized in high yield from the epoxidation of terpenes with aqueous H_2O_2 catalyzed by Na_2WO_4, $[Me(n\text{-}C_8H_{17})_3N]HSO_4$, and $PhP(O)(OH)_2$ in the presence of Na_2SO_4 as an auxiliary additive. Origin of the salt effect is considered to be the addition of a saturated amount of Na_2SO_4 to the aqueous H_2O_2 strongly inhibiting the undesired hydrolysis of the acid-labile epoxide products, despite the highly acidic reaction conditions. Generated terpene oxides are expected to be used as a perfume and a building block of sealing materials.

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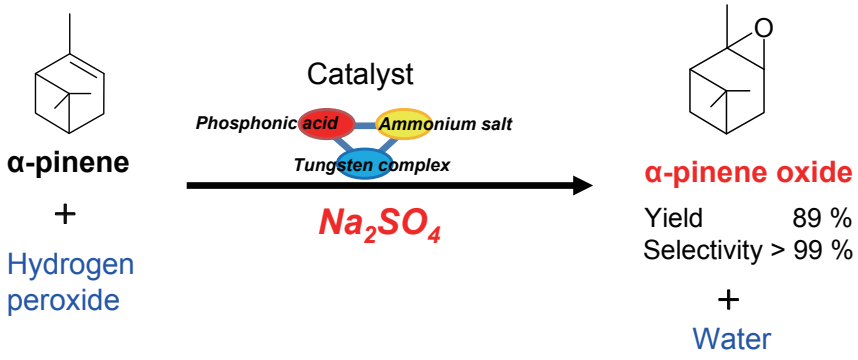

Epoxidation of α-pinene using hydrogen peroxide

Technology for production of targeted functional molecules in the body
Control of gene expression by light and heat energy

Development of optical control methods of cellular functions is important for various biological applications. In particular, heat shock promoter-mediated gene expression systems by laser light are attractive targets for controlling cellular functions. However, previous approaches have considerable technical limitations because they utilize ultraviolet, short-wavelength visible, and infrared laser light which have poor penetration into biological tissue. Biological tissue is relatively transparent to light inside the diagnostic window between wavelengths of 650 and 1100 nm. Here we present a new optical biotechnological method utilizing carbon nanohorn (CNH), to transform energy from diagnostic window laser light to heat in order to control expression of various genes. Using CNH, we demonstrated that laser irradiation within the diagnostic window resulted in effective heat generation and thus caused heat shock promoter-mediated in vivo gene expression. This study provides an important step forward in the development of light-controlled gene expression technologies.

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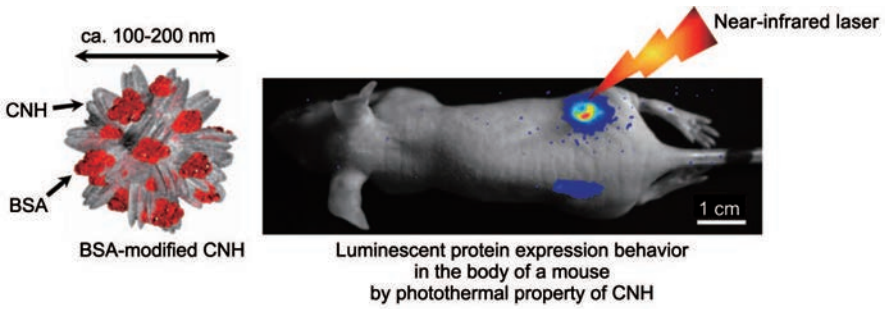

Control of gene expression by photothermal property of CNH