

# Formic acid as a hydrogen source in olefin metathesis and transfer hydrogenation reactions sequence

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The results of my research allowed to understand the nature of TH reaction of olefins catalyzed by alkylidene ruthenium complexes with formic acid as a hydrogen donor. The TH reactions with neutral and activated olefins underwent effectively under proposed conditions and led to desired products in moderate and high yields. The results of experiments with linear, carbo- and heterocyclic alkenes confirmed a broad scope of the reaction and indicated for a high application potential in organic synthesis.

The developed methodology is a very attractive alternative for the classic catalytic hydrogenation, inter alia due to a high functional group tolerance. The methodology allows for selective reduction of various unsaturated ketones and alkenes substrates bearing nitro, sulfonyl or sulfoxide group. In comparison to the reaction applying hydrogen gas in presence of palladium catalyst, the reduction under developed conditions undergoes without undesired hydrogenolysis of aryl halides or a cleavage of benzyl ethers.

Considering that TH reaction may be promoted by olefin metathesis catalysts, tandem conditions were proposed involving olefin metathesis and transfer hydrogenation. The application of 1,6-dienes and 1,8-dienes in RCM/TH tandem sequence led to five- and seven-membered cyclic compound in high yields. More demanding CM/TH tandem sequence with a challenging cross-metathesis partner—methyl acrylate—allowed to obtain desired products in high yields. The developed methodology was applied in formal synthesis of known drugs: bencyclane and pentoxiverine.

Additionally, a plausible mechanism of the reaction was proposed based on analysis of the control experiments involving deuterium-labeled formic acid and special model substrates.