SYNLETT Spotlight 12

This feature focuses on a reagent chosen by a postgraduate, highlighting the uses and preparation of the reagent in current research

Scandium Triflate

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Scandium triflate (**1**) is a new type of Lewis acid, differing from typical Lewis acids such as AlCl_3 , BF_3 and TiCl_4 .¹ It is not decomposed or deactivated in the presence of water and will work as a catalyst where other Lewis acids are required in stoichiometric quantities. This is exemplified by its catalytic activity in the aldol reaction of silyl enol ethers with aldehydes and acetals,² Michael reactions,² Friedel-Crafts acylations³ and Diels-Alder reactions⁴ among others. Moreover, many nitrogen containing compounds can be activated by a catalytic amount of $\text{Sc}(\text{OTf})_3$ in both organic and aque-

ous solvents.⁵ Scandium triflate can be recovered almost quantitatively after the desired reaction and can be recycled in subsequent reactions without loss of activity.¹

Preparation: Scandium triflate is commercially available but can also be prepared from the corresponding oxide (Sc_2O_3) and aqueous trifluoromethanesulfonic acid (TfOH).⁴

Abstracts

A) Friedel-Crafts alkyl- and acylation reactions usually require a stoichiometric amount of Lewis acid to facilitate complete reaction. However, a catalytic amount of $\text{Sc}(\text{OTf})_3$ is sufficient to facilitate the same transformation.^{3,6}

B) $\text{Sc}(\text{OTf})_3$ catalysed three-component couplings can be carried out affording amino esters **3** and γ -acyl- δ -lactam derivatives **4** stereoselectively in high yields.⁷ This is a powerful tool for the preparation of libraries of δ -lactam derivatives. Similar four-component couplings have also been carried out.⁷

C) $\text{Sc}(\text{OTf})_3$ is a useful Lewis acid catalyst for acylation of alcohols with acid anhydrides and esterification between alcohols and carboxylic acids.⁸

D) Allylation reactions of carbonyl compounds with tetraallyltin (**6**) occur smoothly under the influence of a catalytic amount of $\text{Sc}(\text{OTf})_3$.⁹ Three component reactions of aldehydes, amines and allyltributyltin (**8**) also proceed smoothly.¹⁰ No direct reaction with aldehyde is observed.

References and Notes

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