# Reactions of electron-deficient alkynes and alkenes with *N*-heterocyles and amines

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Such *N*-heterocycles as indoles, pyrroles and imidazoles are a type of nitrogen containing molecules occurring in numerous natural and biologically active compounds with a wide range of pharmaceutical properties. Amines are ubiquitous in nature. Due to prevalence of amines in therapeutics, as well as in the production of dyes, solvents, agrochemicals, and fine chemicals, the formation of carbon-nitrogen bonds is of tremendous unportance. Hydroamination, the net addition of amino group and hydrogen atom across a carbon-carbon multiple bond, represents a direct approach to access amines from alkene and alkyne precursors. On the other hand, it is well known that ferrocene is a considerable pharmacophore.

We hope that introduction of ferrocenyl group into the biologically active molecules will reveal the enhanced biological activity. We have developed a simple, efficient catalyst-free addition of indoles and pyrroles to ferrocenylnitroethylene Fc-CH=CH-$NO_2$ (Fc=ferrocenyl), with formation of 3-(2-nitro-1-ferrocenyl)-indole and 2-(2-nitro-1-ferrocenyl)-pyrrole. Because of the presence of the nitro group, these products can be readily transformed into a variety of functionalities.

As part of our current studies on the reactions of ferrocenyl-containing electron-deficient alkynes and alkenes [1,2] with *N*-heterocycles and amines, we found that alkyne Fc-C≡C-CN reacts with 1-methylimidazole to give corresponding C(2)-vinylated derivative-3-(1-methyl-imidazole-2-yl)-3-ferrocenyl-2-propenenitrile.

Acetylenic nitrile Fc-C≡C-CN smoothly adds amines-diethylamine, morpholine, pyrrolidine and others, with formation of the corresponding enaminonitriles.

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