Vitamin B_{12} as an efficient catalyst for photochemical functionalizations of olefins

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Vitamin B_{12} is a natural compound involved in enzymatic processes, making it an essential substance for the proper functioning of living organisms. Due to the presence of a central Co ion on the +III oxidation state, it exhibits catalytic properties that are widely used in chemistry. It is used as an environmentally friendly catalyst in reactions such as addition to unsaturated bonds (alkylation and acylation), dehalogenation, dimerization, rearrangement reactions or transformations involving other catalysts (dual catalysis).

The aim of my PhD thesis was to develop photocatalytic olefin functionalization reactions using vitamin B_{12} as a catalyst*, which could provide alternative synthesis methods using environmentally friendly reactants.* In the initial part of my work, I focused on the use of cobalamin as a catalyst for the difunctionalization reaction of unactivated olefins – the intramolecular cyclization of a bromoalkene and the subsequent Giese addition. The conditions developed allow the efficient preparation of pyrrolidine and piperidine derivatives, which are important building blocks of natural and synthetic compounds, after only 15 minutes of reaction. I have also shown that, depending on the reaction conditions used, it is possible to selectively obtain different products from a single substrate.

In the second project, I attempted to elucidate the effect of the micellar environment on the vitamin B_{12}-catalysed, tandem radical addition/1,2-aryl migration reaction. I have shown that the use of aqueous micellar solutions significantly increases the yield of the reaction, which is strongly dependent on the structure of the bromine, the lengthof the aliphatic chain and the presence of functional groups. NMR measurements and theoretical studies showed the most stable localization of reaction components in micellar solution.

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