Photochemical and Mechanochemical Rearrangements of *N*-Substituted β-Lactams in the Synthesis of *N*-Heterocyclic Compounds

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This doctoral dissertation focuses on exploiting the unique reactivity of *N*-substituted β-lactams (azetidin-2-ones) as versatile building blocks for the synthesis of complex heterocyclic systems. The primary objective of the research was to develop efficient ring expansion strategies through controlled activation of the amide bond, implemented under photochemical and mechanochemical conditions.

The first part of the dissertation describes the development of a universal method for synthesising optically pure 2,3-dihydro-4-pyridinones. This transformation is based on the UV–C (λ = 254 nm) induced intramolecular aza-Fries rearrangement of *N*-vinylazetidin-2-ones. The research demonstrated that combining continuous-flow chemistry with real-time UV–Vis monitoring enables precise control of the irradiation time. This approach effectively prevents the secondary photodegradation of products and significantly reduces reaction times compared to traditional batch conditions. The method's utility was further demonstrated in the synthesis of advanced benzoindolizidine frameworks.

The second part of the dissertation focuses on the development of a novel *one-pot* mechanochemical protocol for the synthesis of 2,3-dihydroquinolin-4-ones. This sequence combines two chemically incompatible steps: copper(I)-catalyzed Ullmann–Goldberg coupling, followed by an acid-mediated aza-Fries rearrangement using triflic acid (TfOH). The application of liquid-assisted grinding (LAG) with dichloromethane (DCM) was key to the success of this strategy, as it enabled control of the physical state of the mixture and the effective integration of basic and strongly acidic environments. The practical potential of the method is illustrated by the solvent-free synthesis of the antimalarial drug chloroquine on a gram scale.

Completed studies have proven that N-substituted β-lactams serve as excellent synthetic platforms due to their high ring strain energy. Furthermore, modern tools such as flow photochemistry and mechanochemistry can be used to conduct processes with high atom economy and in accordance with the principles of green chemistry.