Gold catalyzed synthesis of tetrahydrocarbazole derivatives through an intermolecular cycloaddition of vinyl indoles and N-allenamides

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In the last decades intramolecular gold-catalyzed transformations have been broadly studied giving access to a series of relevant scaffolds. Among unsaturated substrates allenes offered a complete versatility participating in [2+2], [4+2] and [4+3] cyclizations. In contrast, the development of an intermolecular version of these transformations remains less explored. In this context significant [2+2] and [4+2] cycloadditions have been recently reported,\textsuperscript{1} including examples of enantioselective versions.\textsuperscript{2}

Due to our interest in the preparation of functionalized carbazoles derivatives\textsuperscript{4} and considering the recent employment of N-allenamides in intermolecular cycloaddition reactions,\textsuperscript{1,2} we decided to study the viability of gold-catalyzed cycloaddition between allenes and vinyl indoles, which might offer a simple and selective access to these relevant structures. Thus, it was found that an appropriate choice of the substituent at N-1 of the indole and of reaction conditions enabled the selective preparation of isomeric tetrahydrocarbazoles 3, 3’ and of unexpected compound 4, arose from an unusual multicomponent cascade sequence.

With optimized reaction conditions in hand, it was possible to evaluate the scope of these transformations varying both the vinyl indole and the N-allenamide moieties. A mechanism for the formation of the products through a formal [4+2] cycloaddition reaction has been proposed and supported by experimental evidences.