Iron-Mediated Synthesis of Pyrroles from Cyclopropanes

**Significance:** The synthesis of highly substituted pyrroles \( \text{3} \) from cyclopropanes \( \text{1} \) and amines \( \text{2} \) via an iron-mediated sequential ring opening–cyclization–dehydrogenation reaction is reported. The conditions were optimized using different solvents, reaction times, and iron catalysts. The scope was studied and cyclopropanes \( \text{1} \) bearing methyl and aryl substituents at \( R_1 \) were tested with the latter giving better yields. EWG- and EDG-substituted aryl amines as well as \( R_2 = \text{OEt} \) were well tolerated. Also, a methyl group in the cyclopropane \( (R_4 = \text{Me}) \) was suitable, furnishing 1,2,3,5-substituted pyrrole \( \text{3} \) in good yield. A series of aromatic and aliphatic amines were screened as well: aliphatic amines furnished pyrroles \( \text{3} \) in low yields, while aromatic amines gave better results, although the yields decrease according to the position of the phenyl substituent. A reaction mechanism involving a radical process was suggested based on radical trapping experiments.

**Comment:** Cyclopropane derivatives can be used as precursors to synthesize a variety of useful heterocyclic motifs (C. A. Carson, M. A. Kerr Chem. Soc. Rev. 2009, 38, 3051; J. R. Green, V. Snieckus Synlett 2014, 25, 2258). The present work reports an efficient synthesis of tri- and tetra-substituted pyrroles in moderate to good yields from readily available cyclopropanes and amines. The reaction shows a broad substrate scope; both EWG and EDG-substituted aryl amines as well as \( R_2 = \text{OEt} \) were well tolerated. Also, a methyl group in the cyclopropane \( (R_4 = \text{Me}) \) was suitable, furnishing 1,2,3,5-substituted pyrrole \( \text{3} \) in good yield. A series of aromatic and aliphatic amines were screened as well: aliphatic amines furnished pyrroles \( \text{3} \) in low yields, while aromatic amines gave better results, although the yields decrease according to the position of the phenyl substituent. A reaction mechanism involving a radical process was suggested based on radical trapping experiments.

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