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REVIEW

Research Progress of DBU in C—C, C–Heteroatom, and Heteroatom–Heteroatom Bond Formations

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ABSTRACT

1,8-Diazabicyclo[5.4.0]undec-7-ene (DBU), a commercially available and easily handled bicyclic amidine base, is recognized as a strong organic base and deprotonating agent with nucleophilic properties, which has become increasingly important in organic synthesis in recent years. The selectivity of this reagent, including chemo-, regio-, and stereo-selectivity, is exceptionally high and highly applicable in modern synthetic organic transformations. This review article offers a succinct update on various types of C—C, C–heteroatom, and heteroatom–heteroatom bond formation reactions. It highlights representative methodologies employing DBU as a catalyst, base, or reactant, covering developments from May 2022 to the present (triennial update). The compilation is systematically organized into categories including C—C, C–heteroatom, heteroatom–heteroatom bond formation, and reactions involving multiple bonds, primarily. Furthermore, various additional reactions, including isomerization, rearrangement, and the formation of heterocyclic rings, facilitated by DBU, have also been recorded.

1 | Introduction

The broad use of amidine and guanidine bases in synthetic chemistry requires a thorough understanding of their chemical properties [1–3]. 1,8-Diazabicyclo[5.4.0]undec-7-ene (DBU), a bicyclic amidine base acknowledged for its efficacy as a strong organic base and deprotonating agent with nucleophilic characteristics (Figure 1), acts not only as a basic additive but also as a Lewis base catalyst to enhance product formation [4–6]. Furthermore, DBU plays an essential role in reactions, leading to the formation of DBU derivatives [7–11]. Neat DBU demonstrates stability over prolonged periods in dry environments; however,

Abbreviations: 9,9′-BF, 9,9′-bifluorenylidene; AAC, azide-alkyne cycloaddition; ACN, acetonitrile; BH, Baylis–Hillman; BOR, Bestmann–Ohira reagent (1-diazo-2-oxopropyl phosphonate); BT, 2,1,3-benzothiadiazole; BTPP, *tert*-butylimino-tri(pyrrolidino)phosphorane; CDC, cross-dehydrogenative coupling; DABCO, 1,4-diazabicyclo[2.2.2]octane; DBU, 1,8-diazabicyclo[5.4.0]undec-7-ene; DDQ, 2,3-dichloro-5,6-dicyano-*p*-benzoquinone; DFO, 1,8-diaza-fluoren-9-one; DIPEA, *N*,*N*-diisopropylethylamine; DTBP, di-*tert*-butyl peroxide; EBXs, ethynylbenziodoxolones; EDA, electron donor–acceptor; HWE, Horner–Wadsworth–Emmons; IMes·HCl, *N*,*N*′-(2,4,6-trimethylphenyl)imidazolium chloride; LBAs, Lewis base adducts; LSF, late-stage functionalization; NaTFA, sodium trifluoroacetate; OPVs, organic photovoltaic solar cells; PIDA, phenyliodine(III) diacetate; *p*-QMs, *para*-quinone methides; SET, single-electron transfer; SGR, Seyferth–Gilbert reagent (dimethyl(diazomethyl)phosphonate); TBHP, *tert*-butyl hydroperoxide; TCF, ThioClickFerrophos.

Dedicated to Prof. Ana M. Lobo.