
화학과 대학원 세미나

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Stable Organic Radicals Derived from Carbenes and Their Applications

For the past decade, there have been developed numerous organic/main group radicals with the aid of N-heterocyclic carbenes (NHCs) and cyclic (alkyl)(amino) carbenes (CAACs). Novel reactivity and properties of them expand further applications of radical chemistry such as new catalysis, and electronic/magnetic materials. However, current synthetic efforts to obtain highly stable organic radicals are based on aminoxyl (TEMPO) or trityl derivatives. A new structure for highly stable organic radicals is, therefore, a priority in the radical chemistry field. Our group has been exploring diverse NHC/CAAC-based organic radicals, which include unique structural platforms of nitric oxide. As our continuous efforts to access stable organic radicals, we have designed, synthesized, and characterized 1,2-dicarbonyl radical cations derived from NHCs and CAAC. Most notably, air-, water-, chemical-, and thermal stability of the presented radicals are comparable to or higher than the state-of-the-art organic radicals (TEMPO, trityl, and other radicals). We believe our 1,2-dicarbonyl radical cations would serve as a good complement to the well-known stable organic radicals in various fields, which will be presented in detail. In addition, we also demonstrate our other effort to access structurally interesting persistent organic radicals.

이 은 성 교수

서울대학교 화학부