Reactions of Epoxides, Thiiranes, Aziridines and Azirines with Cyanoform

Significance: Vinyl azide 1 can be prepared on a gram scale, is safe to handle at room temperature, and can be stored in the solid state at –25 °C. Oxazolidines, thiazolidines, and imidazolidines are useful pharmacophores (S. Sasho et al. Chem. Pharm. Bull. 2009, 57, 288; M. Takagi, T. Nishibe, K. Ishimitsu WO 2003000668, 2003) and have been prepared by other methods (L. G. Chanu, O. M. Singh, S. H. Jang, S. G. Lee Bull. Korean Chem. Soc. 2010, 31, 859; A. Samzadeh-Kermani Monatsch. Chem. 2016, 147, 761). However, previous preparations are limited by lack of commercial availability of reagents. The present method increases the scope of accessible derivatives of these heterocycles; electrophiles can be prepared using well-known procedures such as epoxidation or aziridination.

Comment: The regio- and stereochemical outcome of the reaction is consistent with the conventional acid-catalyzed epoxide ring-opening process. Under similar conditions, the reaction of cyanoform (2) or tricyanomethanide salts with other electrophiles (alkyl halides, ketones, Michael acceptors) results in C-alkylation (K. Rakus, S. P. Verevkin, H.-D. Beckhaus, C. Rüchardt Chem. Ber. 1994, 127, 2225; K. Banert et al. Angew. Chem. Int. Ed. 2017, 56, 9582). The observed N-alkylation reported here suggests a ketenimine intermediate in this transformation. The proposed mechanism is supported by 15N-labelling of the electrophile (azirine) or nucleophile (1) to confirm the regiochemistry of the nucleophile addition as shown.

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