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Routes to Greener Silicone Surfactants

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PURPOSE OF THE ABSTRACT

One way to reduce the energy toll associated with silicone synthesis is to dilute the silicone with natural moieties. More importantly, this (atypical) combination often leads to new materials with interesting properties, including lignin-filled silicone foams [1], or soybean oil/silicone foams [2] that exhibit enhanced stability during combustion. Silicone surfactants are widely used in several industries, owing to the unique properties of silicones as hydrophobes in combination with various hydrophilic materials to control interfaces. For example, the superwetting surfactants that are used as adjuvants to spread pesticides on plant leaves require silicone hydrophobes, as organic analogues are not effective. However, the polyether hydrophiles have their own environmental concerns. We have previously linked silicones to saccharides through boronic acid linkers [3]. We report here an alternative facile strategy to link silicones to saccharides to produce greener silicone surfactants.

The boron-catalyzed Piers-Rubinsztajn reaction was used to form new Si-O bonds to vary both the size and degree of branching of the hydrophobe (Figure 1A). Thiol-ene click chemistry was used to functionalize vinyl-functional silicones with amines, for example, using cysteamine (Figure 1B). The reactions up to this point can be undertaken with little or no organic solvent. Interfacial reactions, by dispersing the silicone in water, were then used to bind the amine to lactones formed by oxidation of the reducing end of sugars, as shown for gluconolactone (Figure 1C). The process is flexible and permits a library of compounds to be prepared. The surfactancy as a function of saccharide size and structure, and silicone size and 3D structures will be reported.

FIGURES

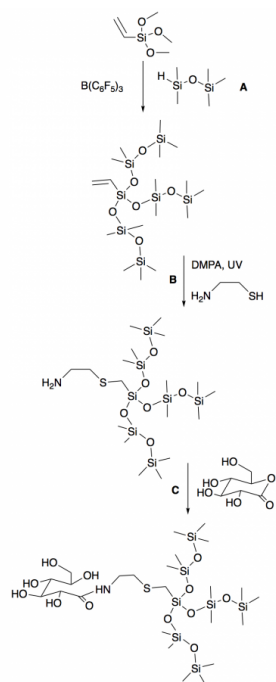


FIGURE 1

Mild routes to aminosilicones, and then amidosilicone sugars.

FIGURE 2

KEYWORDS

Silicone | Saccharides | Surfactants | Thiol-ene

BIBLIOGRAPHY

- [1.] Gale, C. B.; Chin, B.; Tambe, C.; Graiver, D.; Brook, M. A., Silicone structurants for soybean oil: foams, elastomers, and candles 2018, in press.
- [2.] Zhang, J.; Fleury, E.; Chen, Y.; Brook, M. A., Flame retardant lignin-based silicone composites. RSC Advances 2015, 5 (126), 103907-103914.
- [3.] Macphail, B.; Brook, M. A., Controlling silicone-saccharide interfaces: greening silicones. Green Chem. 2017, 19 (18), 4373-4379.