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Dynamics of spider glue adhesion: effect of surface energy and contact area GAURAV AMARPURI, YIZHOU CHEN, TODD BLACKLEDGE, ALI DHINOJWALA, University of Akron — Spider glue is a unique biological adhesive which is humidity responsive such that the adhesion continues to increase upto 100% relative humidity (RH) for some species. This is unlike synthetic adhesives that significantly drop in adhesion with an increase in humidity. However, most of adhesion data reported in literature have used clean hydrophilic glass substrate, unlike the hydrophobic, and charged insect cuticle surface that adheres to spider glue in nature. Previously, we have reported that the spider glue viscosity changes over five orders of magnitude with humidity. Here, we vary the surface energy and surface charge of the substrate to test the change in *Larinioides cornutus* spider glue adhesion with humidity. We find that an increase in both surface energy and surface charge density increases the droplet spreading and there exists an optimum droplet contact area where adhesion is maximized. Moreover, spider glue droplets act as reusable adhesive for low energy hydrophobic surface at the optimum humidity. These results explain why certain prey are caught more efficiently by spiders in their habitat. The mechanism by which spider species tune its glue adhesion for local prey capture can inspire new generation smart adhesives.

Gaurav Amarpuri
University of Akron

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