CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31389

Project Title

Biomimetic Water Striders, Year Two: Testing the Load-Bearing Capacity of Different Leg Coatings

Abstract

Objectives/Goals

To determine whether applying different leg coatings to a static water strider models legs could increase the load-bearing capacity in excess of 15X body weight. Based on my research, I believe the silicon dioxide solution based on Patent 3,931,428, will be the best coating for increasing the models weight-bearing capacity in excess of 15X body weight.

Methods/Materials

To mimic the insects water repellent legs, gelatin, food grade silicone, silicone dioxide, and paint brush bristles with Fumed Silicia powder were applied. The fifth model had bare metal legs. Also, the paint brush bristles and Fumed Silicia leg coating is unique. Results were recorded for each model floating on distilled water in three 3-minute trials, as additional weight was added to the model. In order to test the water strider model leg coatings, five control foreleg pieces of stainless steel wire were cut; one leg was left uncoated; and, the other four leg sections were each covered with one of the four coatings. Each control leg length completed the three, 3-minute surface tension time trial results. Also, the leg dimple shadow area and the different coatings contact angle data were gathered.

Results

The silicon dioxide solution based on Patent 3,931,428 increased the weight-bearing capacity of a static water strider model to 21X body weight. However, the self-assembled leg hair coating using paint brush bristles increased the load-bearing capacity to 24X its body weight. The model with bare metal legs carried 10X its body weight.

Conclusions/Discussion

The data did not support my hypothesis that the silicon dioxide solution would be the best coating. While this solution increased the weight-bearing capacity from 15X to 21X body weight, the homemade paint brush bristles and Fumed Silicia powder carried 24X body weight. The data shows studying innovative water repellent coatings that mimic the legs of a water strider insect may further increase the load-bearing capacity of water strider models, and have applications to water strider robots, marine vessels, and dish TV bowls.

Summary Statement

This study was concerned with increasing the load-bearing capacity of static water strider models beyond 15X its body weight by applying different coatings to the legs.

Help Received

Dr. P. J. Utz, M.D. at Stanford University School of Medicine provided access to the analytical balance. Also, Mr. Robert Dubrow and Ms. Zoe Dubrow provided the solution based on Patent 3,931,428 and advice.