A Sustainable Alternative to Textile Dyes: Synthesizing and Applying PMMA Nanoparticles To Create Structural Coloration

Mizobuchi, Yumi (School: Iolani School)

Synthetic textile dyes have been one of the largest contributors to global pollution, resulting in wastewater with toxic chemicals and lower levels of dissolved oxygen in bodies of water near textile factories. My solution was to develop structural coloration, which depends solely on the shape of an object and does not contain any hazardous chemical components that might enter wastewater. The goal of this research was to colorize textiles by synthesizing and spray coating nanospheres that create structural color on fabrics. In this research, poly methyl methacrylate (PMMA) nanospheres were synthesized by stirring distilled water, methyl methacrylate, and 2,2-Azobis(2-methylpropionamidine) dihydrochloride) initiator under an inert atmosphere. The optimal method of preparing and spray coating the PMMA involved centrifugation, mixing of 100:1 ratio of PMMA/water solution and carbon black, then spray coating onto fabric in 5 layers. The PMMA particles showed high durability on the fabric. By changing amounts of distilled water, methyl methacrylate, and initiator, resulting colors included red-violet, violet, blue, turquoise, green, and yellow-green. I successfully produced structural coloration by synthesizing and applying nanospheres in a variety of colors to fabrics. Structural coloration is a promising non-polluting alternative to dyes for the future.

Awards Won: