Demystifying the Soapberry: The Effect of Concentration, Temperature and pH on Soapberry Surfactant and Its Effectiveness in Comparison to Detergent and Bio-Detergent

Prokhorov, Alexandra (School: Presbyterian Ladies' College, Sydney)

The chemicals in man-made cleaning products and the plastics that encase them pollute and harm the environment. This investigation’s goal was to test the effectiveness of a natural plant-based detergent against conventional detergents made from synthetic surfactants that are mostly petroleum-based. A gradient of concentrations (until CMC=0.75%) of powdered Soapberry from the Soap tree (Sapindus) were tested at different temperatures and pH levels and compared against water and a conventional detergent and bio-detergent. Different concentrations were obtained by mixing different amounts of powdered Soapberry with deionized water. Different temperatures were obtained using a thermostatically controlled water bath. Different pH levels were obtained using hydrochloric acid (acid) and sodium hydroxide (base). Effectiveness was determined by surface tension which was calculated using the capillary tube method. Data was analyzed using a One-Way ANOVA and a series of T-tests. Greater effectiveness (lower surface tension) was observed at higher concentration (CMC=0.65%), higher temperature (60°C) and higher pH (12) of soapberry surfactant. The surface tension of Soapberry (0.048N/m at 0.65%) was not statistically significantly different from bio-detergent (0.043N/m at 1.06%) [p=0.429, alpha=0.05]. This study showed that Soapberry is more effective as a detergent at higher concentrations, temperatures and pH levels and is equally as effective as bio-detergent. These results increase its appeal as an alternative cleaning product in domestic and industrial settings, benefiting the environment. Further investigation into their antibacterial and antifungal properties and their effectiveness in soil and oil remediation can further their real-world applications.

Awards Won: