University of Wisconsin-Stout
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Impact of Personal Care Products on Tensile Strength and Structure of Hair

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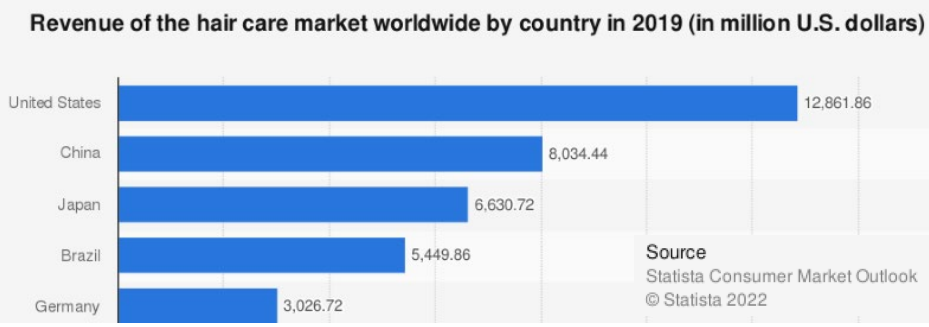
Introduction

There is currently a lot of debate over hair products and the components within them. While sulfates and parabens have become controversial in recent years, there hasn't been as much discussion regarding other individual components of shampoo despite the very limited public knowledge regarding how other common chemical components impact hair. This limited knowledge on how other chemical components in shampoo impact the hair means that people cannot make fully informed decisions on the product that they use.

The purpose of this research is to explore and evaluate the impacts of a few common chemical components of shampoo: citric acid, hydrogen peroxide, and sodium chloride. These impacts will be quantified through measuring changes in tensile strength (stress), and how much the hair can stretch before breaking (strain) of hair samples exposed to a concentrated solution of each chemical treatment and comparing the values of each treatment group to those of the control group.

Why is this important?

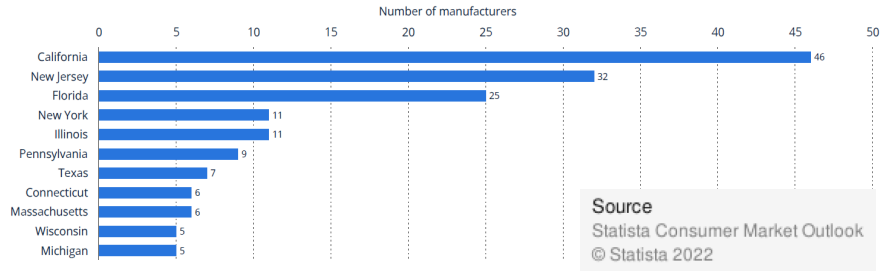
- Better understanding of the products that we use
  - Understanding what is in our products is important in making informed decisions for our health and wellbeing
- Customer advocacy
  - Having available knowledge on the potential negative impacts that certain chemicals may have makes it easier for consumers to avoid products that are damaging
- How much money is spent on hair care products?
  - According to 2019 statistics on statista.com:
    - The United States spends more money on hair care products than any other polled country



- A market of this size employs thousands of employees across the world for things such as:
  - Product development and research
  - Product Manufacturing
  - Product distribution

Number of contract manufacturers of hair care products in the United States as of November 2022, by state

Hair care contract manufacturers U.S. 2022, by state

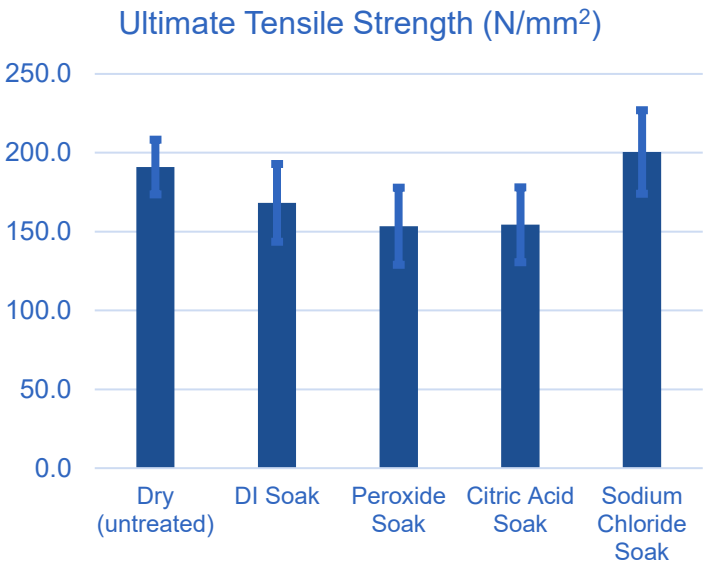


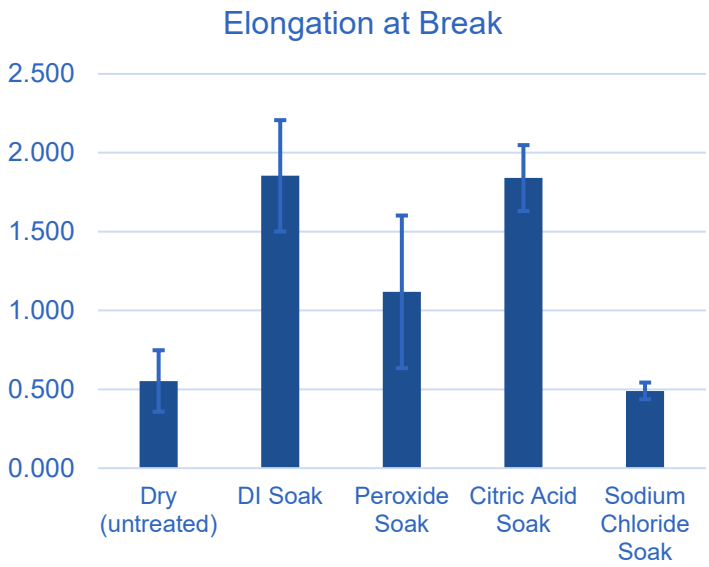
- Wisconsin companies that manufacture or package shampoo and conditioner:
  - ChemRite CoPac, Inc. in Lannon, WI
  - Kleen Test in Washington, WI
  - MaxPax LLC in Elkhorn, WI
  - Menasha Packaging / Rand Diversified in Neenah, WI
  - Northern Labs, Inc. in Manitowoc, WI

Methods

Saturated solutions were prepared of each chemical treatment group. Each solution was split into two vials, ten clean dry hairs were added to each vial, and the hairs were allowed to sit in these solutions for multiple days. After being in the solutions for multiple days, the hairs were carefully removed from the vials, rinsed with deionized water, and allowed to dry in a desiccator for multiple days until fully dry. Once fully dry the hairs were ready to be tested.

Results





Discussion

Based on the results of this study, it appears that there are measurable changes in hair strength and elasticity after some of the chemical interactions tested. Samples exposed to hydrogen peroxide and citric acid showed the greatest decrease in tensile strength while sodium chloride appeared to have a strengthening effect. Samples soaked in deionized water showed a marked increase in elasticity and elongation at break while exposure to sodium chloride decreased the observed elongation at break when compared to the dry untreated control

Conclusion

Further research needs to be done to elucidate the significance and repeatability of the observed effects. Further investigating the mechanism in which these chemicals impact the hair, such as the chemical reactions that may occur, how deep the chemicals penetrate the hair, along with how the chemicals alter the break patterns observed in the hair.

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