**ABSTRACT/MOTIVATIONS**

Zinc and silver are very similar in antimicrobial properties. However, when exposed to bacteria, zinc nusts, pulling electrons out from the cell wall of bacteria. The cell wall falls apart, thus killing the bacteria. As for silver, it is known to bind to bacteria which prevents it from performing basic functions [4].

The recent development of antimicrobial textiles, as well as research confirming harmful environmental effects of silver nanomaterials (Ag-NMs) in the textiles [2] has gathered concern on the use of zinc nanomaterials (Zn-NMs) in similar antimicrobial textiles. Various experiments have gathered data that the Ag-NMs decreased within the textile (sock) after wear [3], and it is believed the same will happen for Zn-NMs. If so, very little is known about the transformation of the zinc structure as the textile is worn, and the environmental impact also can be harmful.

For our experiment, we tested the properties of zinc with the use of zinc infused socks in exercise and washing cycles. We looked for zinc in different oxidation states (such as oxides), and if these states can be harmful for the environment if drained into the sewers. Our experimental groups consisted of light exercise (walking) and rigorous exercise (running) groups. Our control groups were an unused sock that is washed and an unused sock that is not washed. The socks were washed in the same washing machine as well as the same load. Each wash was one normal cycle and at the same temperature. The detergent was used and the detergent was unscented [2].

At APS x-ray spectroscopy was used to analyze zinc’s properties after exercise and the washing cycle. We looked for new states that could be potentially harmful for the environment and how much of the zinc would be lost from the sock into the environment. The x-rays gave us a first-hand look at our zinc samples in fabrics of our experimental groups. These gave us a baseline of how zinc can produce a less harmful alternative to silver.

**METHODS**

- 7 pairs of socks: 6 worn, 1 control
- 3 pairs assigned to “exercise” group
- Wore 20 hours, then removed and placed in a Ziploc bag to prevent contamination.
- Transparent Kapton tape was patted on the heel to collect any potential remnants of Zinc left on the skin.
- We placed the socks inside of a sealed container, then inside the washing machine to stimulate a wash cycle — Room temperature distilled water was used.
- The same amount of the same detergent was used.
- The socks were then air dried and the water was filtered [2].
- We then performed X-ray absorption measurements to understand Zn composition [5] and ICP-MS measurements to understand elements present in the wash/rinse water.

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**Non-exercise group:** Theo, Amanda, Rehman

**REFERENCES**


