Exploring the Feasibility of Turning Shoes into Shingles

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Background

What do you do with your shoes once you decide you no longer want them? For most people, the answer is throwing them away. The decomposition of these shoes can last 80 years (The Shoe Industry, n.d.). Many consumers are not aware that recycling shoes is an option. Shoe soles and tires are both made of rubber compounds, making them similar in the formation and degradation processes (Schroeder, 1994). Traditional shingles have a short life expectancy, which is why manufactures are exploring the viability of new materials. Post-consumer tires can be ground into a powder, mixed with a binder, and poured into a shingle mold (Roof.info, n.d.). Considering the similar composition, it would stand to reason that shoes could also be made into shingles. All of this information leads us to a question: is it possible to turn post-consumer shoes into shingles in a residential setting?

Methods

For all three brands of shoes, we cut the fabric upper away from the sole, leaving the sole intact for further testing.

Freeze Test

Materials: Shoe 1 (New Balance), Shoe 2 (Vans), Shoe 3 (Puma), one aluminum pan, water

Step 1. Place all shoes (soles down) in aluminum pan
Step 2. Add water to mostly cover shoe soles
Step 3. Let freeze until frozen solid
Step 4. Let ice thaw completely
Step 5. Repeat steps 3 & 4. Check conditions for the next three days

Weather Test

Materials: Shoe 1 (New Balance), Shoe 2 (Vans), Shoe 3 (Puma), one aluminum pan

Step 1. Place all shoes (soles up) in aluminum pan
Step 2. Place outside on elevated ground in direct sunlight
Step 3. Check conditions for the next three days

Burn Test

Materials: Shoes from previous freeze and weather test, two aluminum pans, 1 small Fresnel lens

Step 1. Place all frozen test (left) shoes in aluminum pan from frozen test
Step 2. Place all weather test (right) shoes in pan from weather test
Step 3. Place both pans in direct sunlight
Step 4. Use Fresnel lens to burn each sole
Step 5. Observe the difference in reactions to each sole

Freeze Test

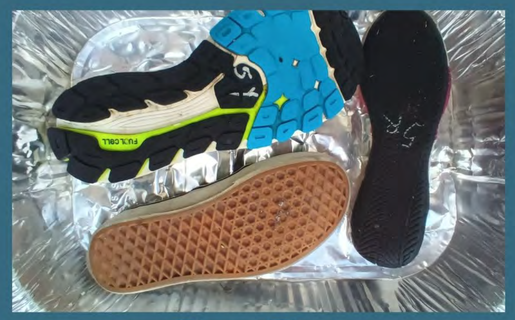
Day 1

Day 3

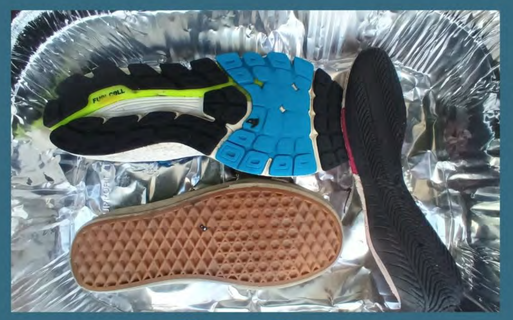
Weather Test

Day 1

Day 3



Burn Test



Burn Test

Results

After freezing and thawing these shoes for three days, there did not appear to be physical changes in any of the shoes. Additionally, upon three days of testing these shoes outside there also appeared to be no changes to the shoes. The burn test resulted in each shoe showing a physical change. The frozen shoes seemed to withstand burning longer than the shoes that were stored outside. The black soles heated and caught flame quicker than the tan soles. This is most likely due to the dark color's natural tendency to absorb heat quicker. The shoes that had more grooves also took a longer time to burn. The more grooves and texture on the soles prevented the sunlight from being able to concentrate the heat as effectively. The shoe that took the longest to burn were the Pumas (Left Shoe 3). Vans (Shoe 2) took the second longest time to burn, followed by New Balance (Shoe 1), each having their frozen (left) shoe withstanding physical change longer than the weathered (right) shoe.

Conclusion

The lack of physical changes following the freeze and weathering experiments shows promising evidence that the shoe soles could be a viable material for a residential shingle. The results of the Fresnel lens experiment lead us to believe that a textured shingle would be more successful than a smooth one. On average, the shoe soles took about one minute to begin burning. In the same amount of time, a Fresnel lens can reach up to 1112 degrees Fahrenheit. The fact that our shoes experienced a physical change does not necessarily discredit our theory because that is a very specific set of conditions unlikely to occur in nature. The shoes that had previously frozen withstanding burning longer warrants further investigation. Another factor to consider would be whether the rubber might let off harmful chemicals as the shoes degrade, such as benzene and chlorine toxic gas (Zhang, 2018, 3).

Future Research

In the future, one might want to use a broader range of shoes to include other well known brands such as Nike, or lesser known shoes like Flower Mountain. Another idea would be to make the experiment last for a longer duration, such as a year, to see if the results vary. We were unable to actually melt the soles, so researchers interested in this topic could experiment with different temperatures to find the melting point. We focused on the weathering feasibility of turning discarded shoes into shingles, but future researchers could also experiment with the capability of actually forming a shingle from the shoe waste.

References

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