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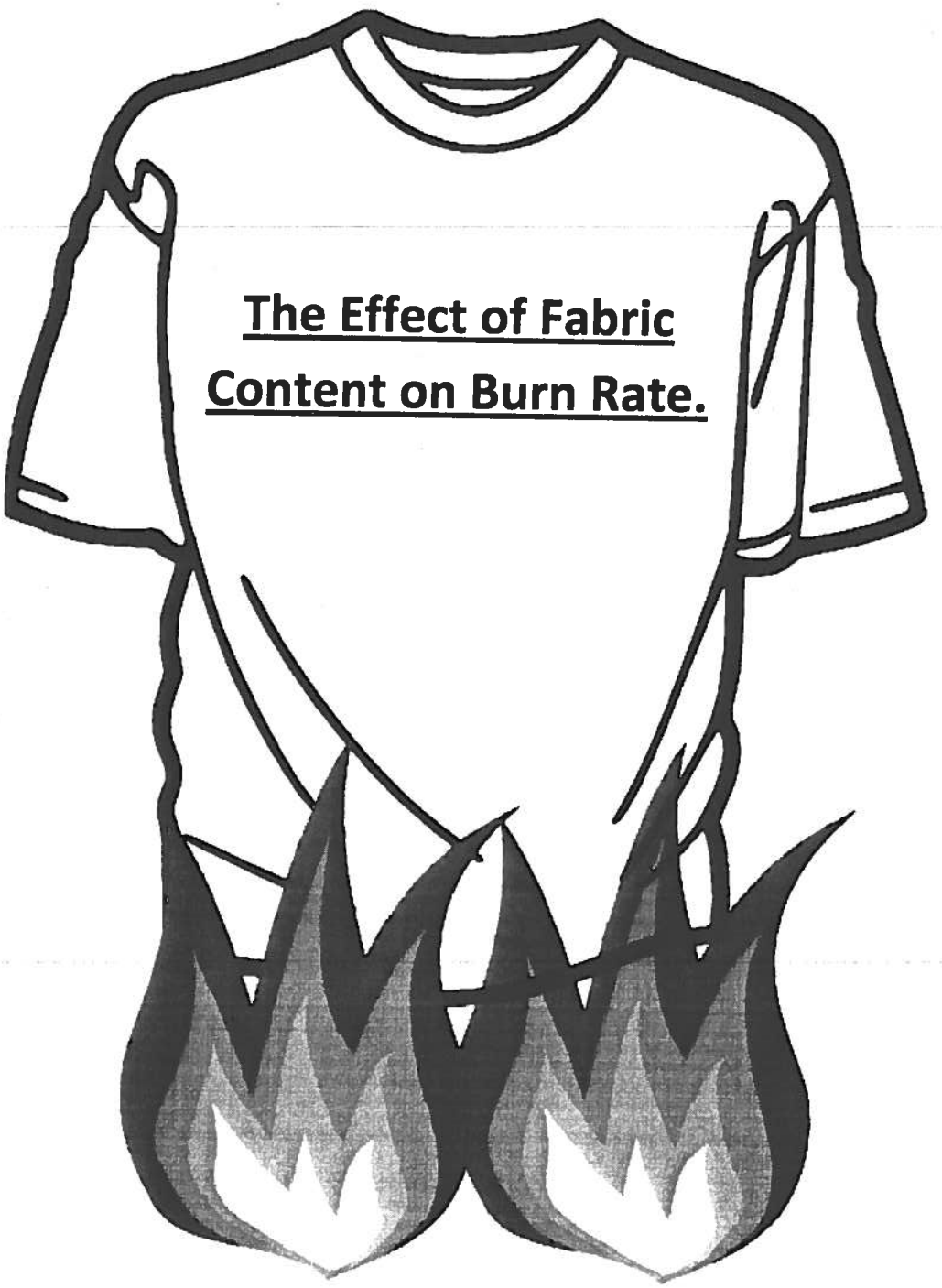
The Effect of Fabric Content on Burn Rate.



Introduction

My project title is The Effect of Fabric Content on Burn Rate. For my hypothesis I hypothesized that if the fabric was cotton, then the burn rate would be at a faster rate because cotton is made of a single type of natural fiber rather than a blend or synthetic. I conducted this experiment because I was curious to find out from the fabrics I chose (cotton, polyester, flannel, and satin) which was most flammable and would burn the fastest. I hoped to learn which fabric was most flammable and what kind of fabric I should and shouldn't wear to avoid a fire emergency. I was surprised to find that flannel was more flammable than cotton which proved my hypothesis wrong.

Research

Independent Variable:

I have found, through my research, many interesting facts about my independent variable (fabric content). For instance, scientific experimentation has found that cotton, linen, rayon, and lyocel are the most flammable fabrics. This is a due to their light mass from the large amounts of oxygen allowed through the fabrics. It is found however that cotton and linen are most flammable. Due to many burn injuries experienced by civilians from dangerously flammable fabrics, the Flammable Fabrics Act was passed to protect them. The act was passed in 1953 and used to create a national standard for testing different fabrics' flammability. The ratings for flammability are separated into the groups known as dangerously flammable, intermediate flammability, and normal flammability. If a company's product doesn't meet the standard, the manufacturer can be charged with legal consequences and possible criminal prosecution.

Dependent Variable:

I have also found interesting statements regarding my dependent variable, burn rate. Main topics that were identified were based on fire. Fire is the second oldest form of heat energy used by man. It occurs by a chemical process that requires oxygen, fuel, and heat. Without these elements, fire can't be made or continue to burn if already started. In the process, molecules are rearranged and energy is released or absorbed. To be a fire, flames or smoldering must occur during the chemical process. A process called oxidation happens when oxygen atoms are combined with hydrogen and carbon atoms forming water and carbon dioxide. Oxidation turns iron into rust but iron's reaction is very low making its heat energy released is very low. Though, for or wood or paper the oxidation rate would be much faster. Combustion happens if heat can't be released faster than it is made. The heat made from a reaction with fuel and oxygen in the air is combustion. We use the heat in many types of equipment and in our homes. If the amount of oxygen is reduced, no fuel is supplied, or if there is no heat, fire is reduced and is harder to make. Dry objects are proved to burn faster than wet and the same idea applies for light objects burning faster than heavy.

Relationship:

The relationship with the information regarding my independent variable and dependant variable applies mostly to the burning of fabrics. For instance, learning about the most flammable fabrics and factors of fire was very helpful. By knowing what has been proven to burn fastest had given me an idea of what fabrics I should purchase for my experiment. If I wanted to burn them at an equal amount of heat, I would have to maintain a balanced amount of fuel, heat, and oxygen. If research for my dependent variable, burn rate, hadn't been conducted, I wouldn't know to supply such factors. This would mean that my flame or fire wouldn't be consistent had I not known. The processes that I was informed about supported the scientific factors of fire.

E.D.D

Title: The Effect of Fabric Content on Burn Rate.

Hypothesis: If the fabric is cotton, then the burn rate will be at a faster rate because cotton is made of a single type of natural fiber and not a blend or a synthetic

Independent Variable: Fabric Content

Levels of the Independent Variable (LIVS include units): cotton, polyester, flannel, and satin.

Control Group: cotton

Number of Trials: three (3) per each fabric

Dependent Variable: (include units): Burn Rate (seconds)

Constants:

- Environment (kitchen floor)-location
- Timer (stopwatch)-type of time(seconds)
- Measuring Stick (metric ruler)- centimeters
- Materials: Fabrics, Clothespin, Surface, etc. - types of...
- Burner (matches)-type of match
- Scissors (used to cut the fabric)- edge used to cut(sharpness)
- Temperature(room temperature)-environment/location
- Size of cloth sample
- Type of candle-odor, wick, size, and color.

Materials List (includes amount or number of)**:**

- Fabrics (cotton, polyester, flannel, and satin; four different types, three of each)
- Timer (stopwatch; one)
- Burner (matches; twelve but extras may be useful)
- Platform (burning area; one)
- Metric Ruler (centimeters; one)
- Scissors (for cutting fabrics; one)
- Paper, Pencil, and a black sharpie (to record data and mark fabrics; one to two)

- ❖ Clothespins (To hold/hang fabrics; around ten)
- ❖ Bowl of water(big enough to extinguish flame; one)
- ❖ Fire Extinguisher(Just in case; one)

Step By Step Procedures

1) Gather all materials such as fabrics (cotton, polyester, flannel, and satin), stopwatch, matches, etc.
2) Find a supervisor
3) Fill a plastic bowl large enough to put out your burning fabric.
4) Craft a burning surface consisting of two parallel P.V.C pipes of the same length (44cm) on opposite sides of the floral foam block (28cm). A wire should connect to each pole through holes drilled at the top and bottom of each pipe. Attach a clothespin to the wire to hold each fabric sample upon experimentation.
5) Cut all fabric samples into **6cmx 11cm** rectangles. (cotton, polyester, flannel, and satin)
6) Organize samples by fabric type.
7) Start by labeling your cotton samples with a sharpie marking 1, 2, and 3.
8) Then label your polyester samples with the sharpie marking 1, 2, and 3.
9) Next label your flannel samples with the sharpie marking 1, 2, and 3.
10) Last label your satin samples with the sharpie marking 1, 2, and 3.
11) Attach the first cotton sample(labeled trial 1) to the wire with the clothespin.
12) Light your candle with a match.
13) Place the flame of the candle directly underneath the fabric sample and start the stopwatch.(your supervisor may time you)

14) Measure the time from ignition until the flame is out for in seconds with the stopwatch.

15) Extinguish any remaining embers and ensure safety by dipping sample remains in a bowl of water.

16) Collect data from the sample and record burn rate as indicated as time from ignition to when the flame is out.

17) Do the same for the next two trials of cotton

18) Now attach the first polyester sample (labeled trial 1) to the wire with a clothespin.

19) You may keep the candle flame burning but if you don't, you may need to relight it before burning the next fabric.

20) Place the flame of the candle directly underneath the fabric sample and start the stopwatch.(your supervisor may time you)

21) Measure the time from ignition until the flame is out for in seconds with the stopwatch.

22) Extinguish any remaining embers and ensure safety by dipping sample in a bowl of water.

23) Collect data from the sample and record burn rate as indicated as time from ignition to when the flame is out.

24) Do the same for the next two trials of polyester.

25) Attach the first flannel sample (labeled trial 1) to the wire with a clothespin.

26) Place the flame of the candle directly underneath the fabric sample and start the stopwatch.(your supervisor may time you)

27) Measure the time from ignition until the flame is out for in seconds with the stopwatch.

28) Extinguish any remaining embers and ensure safety by dipping sample in a bowl of water

29) Collect data from the sample and record burn rate as indicated as time from ignition to when the flame is out.

30) Do the same for the next two trials of flannel.

31) Attach the first satin sample (labeled trial 1) to the wire with a clothespin

32) Place the flame of the candle directly underneath the fabric sample and start the stopwatch.(your supervisor may time you)

33) Measure the time from ignition until the flame is out for in seconds with the stopwatch.

34) Extinguish any remaining embers and ensure safety by dipping sample in a bowl of water.

35) Collect data from the sample and record burn rate as indicated as time from ignition to when the flame is out.

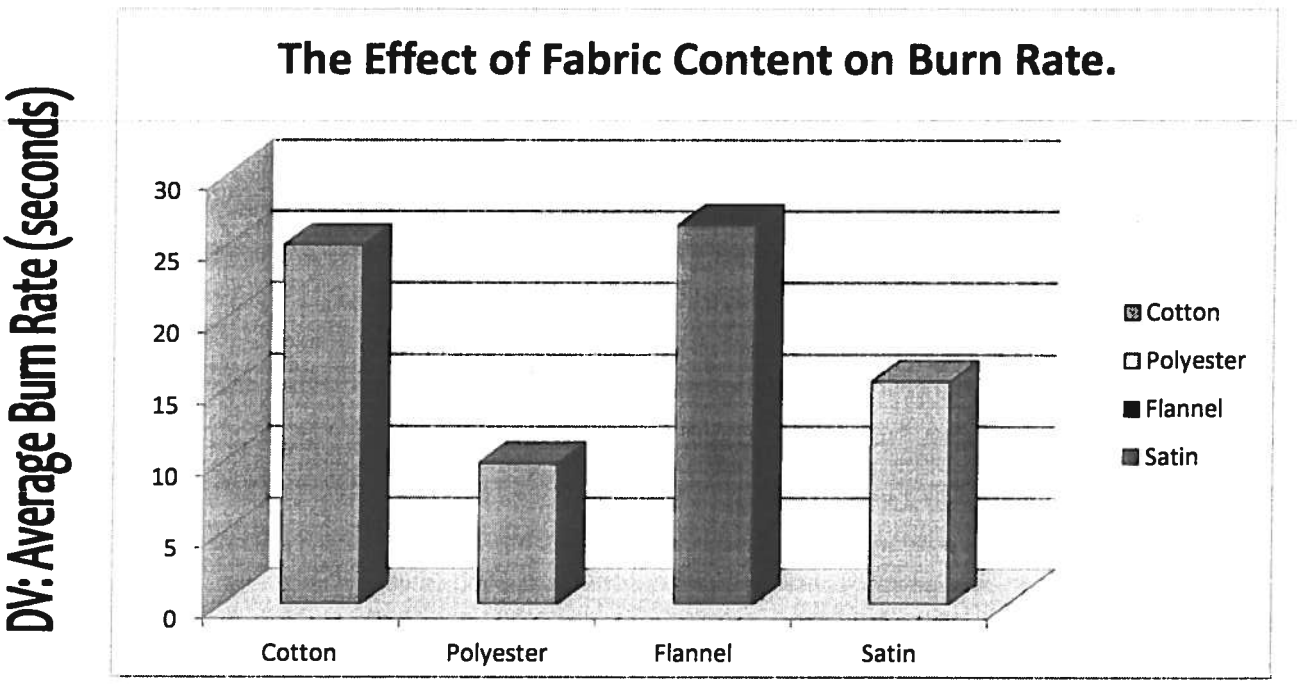
36) Do the same for the next two trials of satin.

37) Throw away your burnt samples remains along with the clothespins.

38) Clean up your mess and take caution of hot items.(don't forget to extinguish the candle)

Data Table:

IV: Fabric Content	DV: Burn Rate (Seconds)			
IV levels:	Trial 1	Trial 2	Trial 3	Avg
Control Group Cotton	24.2	30.2	21.0	25.1
Polyester	8.9	9.5	11.2	9.9
Flannel	24.3	26.8	28.4	26.5
Satin	9.2	18.2	19.6	15.6



Analysis: The results of the burn rate for the cotton and flannel closely resembled each other because they are both natural fibers. The burn rates of the polyester and satin fabrics resembled each other because they are synthetic fibers.

Conclusion:

After experimenting with different fabrics' burn rates, my questions have been answered. Originally, I hypothesized "If the fabric is cotton, then the burn rate will be at a faster rate because cotton is made of a single type of natural fiber and not a blend or synthetic." My hypothesis was rejected because the flannel sample burned slightly faster than the cotton sample. Therefore flannel burned the most efficiently. Cotton also ignited and burned completely but took slightly longer. The polyester and satin melted and spread more than it burned. Using other types and weights of fabric could have changed the results. Also, dipping the fabrics in fabric softener or using fire retardant materials could have affected the burn rate. I thought the polyester and satin would go up in flames like the cotton and flannel but, instead, they just melted. I think that other synthetic fabrics would also melt instead of flame up and burn. I think blends of natural and synthetic fibers would both flame up and burn in addition to melting. To improve the experiment, the clothespins should have been replaced by metal clips so they would not ignite. I could have also used more types of fabrics. A flicker would have probably been easier to use than a candle. In order to avoid the flame from going out and continue burning, the polyester and satin would need to remain under a constant flame.

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