

Fabric Flammability Changes Due to Hair Spray Exposure

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Abstract

Hairspray is widely used worldwide in beauty salons and barbershops to create customized hairstyles. However, the chemicals in hairspray are highly flammable, posing significant risks of burn injuries to staff and customers, especially when clothing is exposed to heated tools such as hairdryers or curling irons. Hairsprays typically contain polymer-based adhesives, liquid solvents, and propellant gases. During application, a notable amount of overspray can settle on clothing, depositing a thin adhesive layer on the fabric. This research project aimed to assess how exposure to hairspray alters the flammability of different fabric types, including Silk, Cotton, Wool, Nylon, and Polyester. Fifteen fabric samples were treated with hairspray, while another fifteen samples served as untreated controls. All treated samples were exposed to the same amount of hairspray and left to dry for 24 hours, while the control samples remained untouched. Flame temperatures and total burn times were measured during testing. The findings revealed that the maximum flame temperatures for Polyester increased by 140%, with burn times rising by 74%. For Nylon, flame temperatures rose 178%, and burn times increased 75%. In contrast, the flame temperatures and burn times for Silk, Cotton, and Wool remained unchanged. The results of further analysis using differential scanning calorimetry and Raman Microspectroscopy suggested that the flammability differences between natural and synthetic fibres are linked to fibre polarity and hydrophobicity variations.

Keywords: Hairspray; Flammability; Natural and Synthetic Fabrics; Burn Injury Risk; Public Health

1 Background

1.1 Health Challenges

Clothing fires pose a significant public health challenge worldwide, leading to thousands of injuries and deaths each year due to the ignition, propagation, and smoking of flames in garments. Approximately two million people suffer burn injuries annually, with over 100 000 requiring medical

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treatment [1, 2]. Burn injuries from clothing fires affect both adults and children [3, 4]. While all fabrics will eventually burn when exposed to flames, factors such as fibre content, fabric construction, weight, and finish significantly influence their flammability. Even fabrics made from the same fibre can burn at different rates depending on these factors.

The severity of skin damage from a clothing fire is directly proportional to the amount of heat transferred from the flames to the skin and also proportional to the duration of the fire [5–7]. Contaminants, such as hairspray, can further affect a fabric's flammability. Hairspray is commonly used to shape and hold hairstyles, but its chemicals are flammable, posing a significant fire risk when they come into contact with hot objects like curling irons or blow dryers [8, 9].

1.2 Exposure Factors

Commercial hairsprays typically contain polymer-based adhesives, liquid solvents, and propellant gases. After application, the propellant gases dissipate, and the solvents evaporate, leaving an adhesive residue that helps maintain the hairstyle. However, during the application, a substantial amount of overspray can settle on clothing, depositing a layer of adhesive on both the hairstylist's and the client's garments. Recently, this overspray has gained attention on social media to prevent makeup stains on clothing, a practice that could increase burn risks in the future [10].

1.3 Consumer Awareness

1. Many hair products contain flammable chemicals such as alcohol and solvents. If these products come into contact with clothing, particularly synthetic fabrics, they can dramatically increase the risk of ignition. Awareness of these risks can help individuals avoid accidental fires, particularly in environments with heat sources or open flames (e.g., candles, stoves, hair dryers, or smoking).

2. Knowing how fabrics react to flammable residues can help consumers make safer choices when selecting clothing or using hair products. For example, someone might opt for natural fabrics like cotton or wool when using a flammable product in a high-risk environment. This information empowers people to take proactive steps to prevent potential fire hazards.

3. Certain occupations, such as those in beauty salons, theatre, or fashion, often frequently use flammable hair products. Knowing how these products interact with fabrics can help professionals implement safety measures to protect themselves and their clients.

4. Children's clothing, as well as clothing for vulnerable populations (e.g., the elderly or disabled), is often made with synthetic materials that are easy to care for. These groups may be more at risk in the event of a fire. Educating caregivers and product manufacturers about the dangers of flammable residues on synthetic fabrics can help reduce accidents and ensure safer clothing choices.

5. Knowledge of changes in fabric flammability when exposed to flammable hair products is essential for creating guidelines and safety regulations. Governments and industry bodies can develop fire safety standards for clothing and consumer products, especially those for high-risk situations. This information can lead to clearer labelling and better safety instructions for hair products and clothing.

6. Fire-related injuries can be severe, and understanding how certain fabrics ignite more easily when exposed to flammable residues can improve first aid and emergency response procedures.