Cold Plasma for Hair Loss, Hair-Dye and Hair Removal: A Technical Report

Abstract (Summary)

This report analyzes patents related to the application of cold plasma technology in hair loss treatment, hair dyeing processes, and hair removal methods. The inventions aim to improve existing techniques by addressing limitations such as ineffectiveness on certain hair types, improving hair's absorption capacity for dyes, and enhancing safety in plasma generation devices. The core innovations include novel plasma generation devices, methods for combining plasma with liquid media, and specialized applicators for targeted treatment.

Background and Challenges

Conventional methods for hair loss treatment, such as topical medications and hair transplantation, often have limited efficacy or invasive procedures. Traditional hair dyeing processes can damage hair structure, and hair removal techniques like laser epilation are not universally effective across all hair colors and growth stages. Cold plasma technology offers potential solutions by providing non-thermal, localized treatment options that can stimulate hair growth, enhance dye absorption, and remove hair without the limitations of existing methods.

Technical Fields of Invention

The inventions discussed in this report span several technological areas:

- **Plasma Generation Devices:** Design and optimization of devices for generating cold atmospheric plasma (NAP) (WO2018004300A1, WO2022134279A1, EP3846297B1, EP4048395A1).
- **Hair Loss Treatment:** Methods and devices for stimulating hair growth and treating various forms of alopecia using cold plasma (US11260075B1, WO2018004300A1, EP4048395A1, US10039927B2).
- **Hair Dyeing Enhancement:** Application of cold plasma to improve hair surface properties and increase dye absorption (EP2670903B1).

- **Hair Removal:** Utilizing cold plasma for epilation, particularly addressing limitations of existing laser and photoepilation methods (WO2024020661A1).
- **Medical Device Safety:** Enhancing the safety and isolation of electrodes in plasma generation devices (WO2022134279A1).
- **Cleaning Devices:** Plasma-based cleaning devices for hair removal appliances (WO2013080435A1).
- **Plasma Delivery Systems:** Nozzle designs for targeted cold plasma delivery (US9656095B2).

Inventions Related to Cold Plasma for Hair Loss, Hair-Dye and Hair Removal

Hair Loss Treatment

- **NAP-Medium Compound (US11260075B1):** This invention introduces a method of treating hair loss by applying a non-thermal atmospheric plasma (NAP)-medium compound to the affected area. The novelty lies in the combination of NAP with a liquid medium (e.g., water) to enhance plasma delivery and penetration into hair follicles. The objective is to stimulate hair growth. The technical problem solved is improving the efficacy of plasma treatment by facilitating its interaction with the scalp and hair follicles. (Relevant)
- **Cold Plasma Helmet (US10039927B2):** This invention presents a cold plasma helmet designed for treating large surface areas of the head. The helmet uses dielectric barrier devices (DBDs) to generate cold plasma from a biocompatible gas. The objective is to address conditions like male pattern baldness and scalp disorders. The improvement is the ability to treat the entire scalp evenly, which is difficult to achieve with handheld devices. (Relevant)
- **Plasma Generating Device for Hair Loss (WO2018004300A1):** This invention focuses on a plasma generating device designed to produce a uniform plasma safely for hair loss treatment. The device includes a center electrode and an outer electrode, along with a plasma intensity control section. The objective is to provide a device that can generate and maintain a uniform plasma safely, regardless of the shape of the head or skin surface, and to improve hair growth. (Relevant)

- **Device for Forming Physical Plasma (EP4048395A1):** This invention describes a device for forming physical plasma on the scalp using dielectric barrier discharges. The device features multiple electrode bodies with dielectric spacers that protrude beyond the electrode surfaces. The objective is to create a simple device that can effectively form plasma over large areas of the scalp to stimulate hair growth. The technical problem addressed is creating a device with a simple structure that can effectively form physical plasma over large areas of a human scalp to treat hair loss or stimulate hair growth. (Relevant)

Hair Dyeing Enhancement

- **Dielectric Plasma Treatment for Hair (EP2670903B1):** This invention details a method and apparatus for treating hair to improve its surface properties for subsequent chemical treatments, such as dyeing. The method involves dividing the hair into strands and subjecting them to dielectric plasma treatment using a high-voltage apparatus. The objective is to increase the absorption capacity of the hair for dyes. The technical problem solved is enhancing the uptake of dyes by modifying the hair's surface characteristics. (Relevant)

Hair Removal

- **Epilation Equipment Using Helium Gas (WO2024020661A1):** This invention introduces an epilation equipment that uses an athermic plasma plume of helium gas for hair removal. The equipment comprises an arc flash generator, an applicator handle, and a mechanical valve to modulate helium gas flow. The objective is to overcome the limitations of laser and photoepilation, which are ineffective on certain hair types or hair growth stages. The technical problem solved is achieving hair removal regardless of hair color or growth stage. (Relevant)

Plasma Generation and Safety

- **Plasma Generation Assembly (WO2022134279A1):** This invention focuses on improving the isolation effect of the working electrode in plasma generators to enhance safety. The assembly includes an isolation base, a working electrode, and an isolation cap. The objective is to improve the safety of plasma generators used in devices like hair growth combs. (Relevant)

- **Discharge Device for Hair Care (EP3846297B1):** This invention relates to a discharge device designed to increase the production of acidic components for improved hair and skin health. The device includes a discharge electrode, a counter electrode with a dome-shaped electrode, and protruding electrodes. The objective is to enhance the effectiveness of hair care devices by increasing the production of beneficial acidic components. (Relevant)

Cleaning Device

- **Cleaning Device for Hair Removal Appliances (WO2013080435A1):** This invention describes a cleaning device equipped with a plasma-generating device for cleaning hair removal appliances. The objective is to suppress seizure of the sliding parts of the hair removing device more easily, avoiding the need for lubricant replenishment. (Relevant)

Plasma Delivery Systems

- **Cold Plasma Application Device (US9656095B2):** This invention describes a cold plasma application device comprising a cold plasma generation device having a cold plasma outlet port; and a nozzle having a proximal aperture, a distal aperture and a solid wall located at the distal aperture, the proximal aperture configured to be coupled to the cold plasma outlet port to receive cold plasma from the cold plasma generation device, the distal aperture being non-perpendicular to a longitudinal axis of the nozzle, wherein cold plasma is directed by the distal aperture to a treatment area, and wherein the solid wall precludes cold plasma from contacting a non-treatment area. (not Relevant)

Applicability and Uses

- **Hair Loss Treatment:** The NAP-medium compound (US11260075B1) can be applied topically to the scalp to stimulate hair growth. The cold plasma helmet (US10039927B2) is designed for treating large areas of the scalp, making it suitable for conditions like male pattern baldness. The plasma generating device (WO2018004300A1) can be used in cosmetic and medical treatments, particularly for hair loss. The device for forming physical plasma (EP4048395A1) can be used in hair loss

therapy to widen vessels, stimulate microcirculation, and increase oxygen concentration to promote hair growth. (Relevant)

- **Hair Dyeing:** The dielectric plasma treatment (EP2670903B1) can be used to pretreat hair before dyeing, increasing the absorption of the dye and potentially reducing the need for harsh chemicals. (Relevant)
- **Hair Removal:** The helium-based epilation equipment (WO2024020661A1) offers a method for permanent body hair removal, effective regardless of hair color or growth stage. (Relevant)
- **Safety and General Hair Care:** The plasma generation assembly (WO2022134279A1) can be incorporated into hair dryers and hair growth combs to improve scalp health. The discharge device (EP3846297B1) can be used in hair care devices to increase acidic components for improved hair and skin health. (Relevant)
- **Cleaning:** The cleaning device (WO2013080435A1) can be used for cleaning hair removal devices. (Relevant)
- **Targeted Treatment:** The cold plasma application device (US9656095B2) can be used in medical treatments, including dermatology. (not Relevant)

Conclusion

The patents analyzed demonstrate the diverse applications of cold plasma technology in hair care. These inventions address limitations of existing methods for hair loss treatment, hair dyeing, and hair removal. The innovations include novel plasma generation devices, methods for enhancing plasma delivery, and specialized applicators for targeted treatment. These advancements hold promise for improving the efficacy and safety of hair care practices.

Citations

- US11260075B1 (Relevant)
- US10039927B2 (Relevant)
- WO2018004300A1 (Relevant)
- EP4048395A1 (Relevant)
- EP2670903B1 (Relevant)
- WO2024020661A1 (Relevant)

- WO2022134279A1 (Relevant)
- EP3846297B1 (Relevant)
- WO2013080435A1 (Relevant)
- US9656095B2 (not Relevant)

Contexts: WO2024020661A1 :: HAIR REMOVAL EQUIPMENT\n US11260075B1 :: Non-thermal atmospheric plasma to treat hair loss\n EP2670903B1 :: METHOD FOR TREATING HUMAN OR ANIMAL HAIR AND APPARATUS FOR CARRYING OUT THE METHOD\n WO2018004300A1 :: PLASMA GENERATING DEVICE, AND METHOD FOR TREATING HAIR LOSS USING SAME\n WO2022134279A1 :: PLASMA GENERATION ASSEMBLY, HAIR GROWTH COMB, AND CHARGING BASE\n EP3846297B1 :: DISCHARGE DEVICE AND HAIR CARE DEVICE\n EP4048395A1 :: DEVICE FOR FORMING PHYSICAL PLASMA ON A SURFACE OF AN OBJECT\n WO2013080435A1 :: CLEANING DEVICE\n US9656095B2 :: Harmonic cold plasma devices and associated methods\n US10039927B2 :: Cold plasma treatment devices and associated methods\n , WO2024020661A1 :: HAIR REMOVAL EQUIPMENT\n US11260075B1 :: Non-thermal atmospheric plasma to treat hair loss\n EP2670903B1 :: METHOD FOR TREATING HUMAN OR ANIMAL HAIR AND APPARATUS FOR CARRYING OUT THE METHOD\n WO2018004300A1 :: PLASMA GENERATING DEVICE, AND METHOD FOR TREATING HAIR LOSS USING SAME\n WO2022134279A1 :: PLASMA GENERATION ASSEMBLY, HAIR GROWTH COMB, AND CHARGING BASE\n EP3846297B1 :: DISCHARGE DEVICE AND HAIR CARE DEVICE\n EP4048395A1 :: DEVICE FOR FORMING PHYSICAL PLASMA ON A SURFACE OF AN OBJECT\n WO2013080435A1 :: CLEANING DEVICE\n US10039927B2 :: Cold plasma treatment devices and associated methods\n