Hair dyes: plant-based does not mean risk-free

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Hairdressers are exposed to irritating and allergenic substances contained in many products, including those for dyeing or bleaching hair.
Workers who become sensitised to these substances are often forced to give up their occupations, which is a major professional loss.
Replacing these traditional chemical colouring or bleaching products with dyes made solely of active plant ingredients seems like a promising alternative for reducing the burden of these disorders among hairdressing professionals. However, there is still a risk of allergy associated with the handling of these vegetable dyes. Preventive measures in the workplace therefore remain essential.

TRADITIONAL DYEING AND BLEACHING PRODUCTS EXPOSE HAIRDRESSERS TO KNOWN OCCUPATIONAL RISKS

Traditional hair colouring and bleaching activities have long been known to cause skin and respiratory disorders in exposed professionals.

The **occupational skin disorders** suffered by hairdressers are most often eczemas described as «irritant contact dermatitis» (encouraged by repeated hand washing), «allergic contact dermatitis» (delayed hypersensitivity) and, more rarely, contact urticaria. Allergic contact dermatitis is mainly caused by hair dyes containing paraphenylenediamine (PPD) or its derivatives, which are found in the majority of oxidation dyes (known as permanent dyes because they penetrate the hair). More rarely, it is due to the alkaline persulphates found in the bleaching products that are often used prior to the application of a light hair colour. It should be noted that the presence of irritant dermatitis can encourage the secondary onset of contact dermatitis, this time of an allergic nature.

The **occupational respiratory diseases** among hairdressers are mainly rhinitis and allergic asthma (involving immediate hypersensitivity), related to bleaching products and less frequently to PPD. These bleaching products contain alkaline persulphates such as ammonium persulphate. Less volatile powder formulations have been developed but appear to be little used in practice. In 2016, persulphates were the second leading cause of occupational asthma related to chemical exposure in France [1]. In 2019, ANSES recommended restricting their use in hair products in order to protect the health of exposed workers and consumers [2]. Lastly, alkaline irritants such as ammonia contained in hair dyes can also act as respiratory irritants, just like other products found in hairdressing salons.
This can have major professional ramifications for hairdressers affected by an allergy to one of the aforementioned professional products, as these disorders usually lead to them being **declared medically unfit** and therefore needing to **retrain for another occupation**.

For this reason, it is essential to implement measures to protect hairdressing professionals from sensitisation. In this respect, vegetable or «natural» dyes are an attractive alternative to chemical dyes. However, can it be said that natural hair colours, containing no chemicals, are free from risk of respiratory or skin problems for hairdressers?

WHAT DO WE MEAN BY VEGETABLE OR NATURAL HAIR DYE?

Dyes made exclusively from natural active ingredients mainly contain powders from dye plants[1]. Once applied, they cover the hair cuticle rather than penetrate it, unlike the combination of alkalis and synthetic dyes. The best-known, most widely used and long-established plant is red henna, obtained by crushing the leaves and roots ***of Lawsonia inermis*** (syn. Lawsonia alba). It can be used alone or in combination with other plants, depending on the colour sought. ***Indigofera tinctoria*** is a shrub that produces indigo dye (dark blue), and can be used in combination with henna. Plant extracts with lower dyeing potential, but which can add highlights, shine or other benefits to the hair, are also used: ***Cassia obovata*** (known as neutral henna), ayurvedic plants, spices (turmeric), walnut husk, etc.

VEGETABLE OR NATURAL HAIR DYE: ALLERGIES REMAIN POSSIBLE

Professionals buying a dye labelled «plant-based», «vegetable» or «natural», especially if they suffer from occupational asthma or dermatitis, hope that the dye will be safe to handle.
However, it turns out that some plant proteins can induce allergic reactions. Handled in micronised powder form before dilution, they may be inhaled, exposing the user to the risk of respiratory problems. This was shown in certain patients seen at one of the occupational and/or environmental disease centres (CCPPEs) of the National Network for Monitoring and Prevention of Occupational and Environmental Diseases (RNV3PE), as well as in cases published in the scientific literature, reminding us that the use of natural substances does not remove the need for preventive measures.

Two cases of occupational allergic asthma recorded by the RNV3PE provide an illustration of this:
- A 31-year-old hairdresser with an allergic predisposition to common respiratory allergens such as pollen, cat hair and dust, who had been working in a salon using only vegetable dyes for 10 years, quickly developed rhinitis and sneezing during her working hours, which she had tolerated. However, once she began experiencing respiratory discomfort, coughing, shortness of breath and a feeling of tightness in the chest, she sought medical advice. All the symptoms showed a clear occupational pattern: discomfort when diluting the powders that recurred each time she was re-exposed and improved when she stopped working, and with a reduction in symptoms when she rinsed her hair after returning home, suggesting that it contained powder residues. The allergy assessment revealed sensitisation to the following plant ingredients (highly positive in prick tests): ***L. inermis*** (red henna), ***C. obovata*** (neutral henna),
I. tinctoria (indigo) and ***acacia***, whereas the prick test for latex found in certain gloves was negative. Occupational asthma was declared and professional retraining proved necessary.

- A 40-year-old colourist suffered respiratory problems as soon as she started work in a salon using 100% natural dyes. In her case, allergy tests indicated sensitisation to red henna (***L. inermis***). Professional retraining was also recommended.

Several cases of occupational rhinitis and asthma due to the inhalation of red henna powder [3], caused by an immediate allergy mechanism, have been published in the scientific literature [4]. In most cases, sensitisation occurred during preparation of the dye, through exposure of the respiratory tract to the micronised plant powder mixed with water. Neutral henna may also be involved, as in the case of a 30-year-old hairdresser who developed occupational rhinitis and asthma, via an immediate allergy mechanism, one year after hair dyes containing a mixture of red henna (***L. inermis***) and neutral henna (***C. obovata***) were introduced into her workplace [5]. Two cases of occupational asthma, rhinitis and contact urticaria in young hairdressers (aged 22 and 28 years) sensitised to ***I. tinctoria*** proteins, leading to changes of occupation, were recently published [6].

LESSONS TO BE LEARNED

Overall, the rhinitis and asthma associated with the vegetable dyes, documented by the CCPPEs and the scientific literature, are a reminder that the use of these products of natural origin does not dispense hairdressing professionals from implementing preventive measures, especially given the major occupational consequences. Ceasing exposure to the allergens concerned, which is necessary to cure or improve asthma, means redeployment to another job in the same company, or even a change of occupation.

Nevertheless, sensitisation phenomena and respiratory symptoms seem to occur less frequently with natural dyes than with the handling of chemical dyes. However, this should still be qualified by the fact that the use of these products is still less widespread. Plant-based alter-

[1] Une plante tinctoriale est une plante dont certaines parties peuvent servir à préparer des colorants et des teintures.

natives therefore appear to be a promising way of reducing the risk of this type of complaint among hairdressing professionals. They are a possible alternative in the event of sensitisation to traditional dyes, for avoiding medical unfitness for work and loss of employment, but on condition that the same preventive measures are observed as those recommended for handling traditional dyeing or bleaching products, i.e.:

- using the least volatile products (compact powder, paste, granules);
- preparing powder mixtures under a local extraction system and adequately ventilating the salon;
- wearing an FFP mask when handling powders;
- and lastly, cleaning work surfaces with sponges or damp cloths to reduce dust dispersion.

Despite this apparent better tolerance, the use of these vegetable dyes calls for vigilance and information for hairdressers, occupational physicians and pulmonologists, since rhinitis and asthma could become more common if their use were to develop. It should also be noted that certain natural dye preparations also contain synthetic chemical compounds with their own toxicity risks.

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REGULATIONS

Hair dyes are governed by Regulation (EC) No 1223/2009 on cosmetic products. This lists the colouring ingredients that may be used in hair dye formulas, subject to certain conditions and restrictions. Assessment of the health risks, including requirements for testing the potential genotoxicity and carcinogenicity of these substances, is carried out by the Scientific Committee on Consumer Safety (SCCS) mandated by the European Commission. Concentrations of substances with respiratory and skin sensitising potential in hair dyes intended for hairdressing professionals or the general public are restricted. In addition, appropriate warnings must appear on the labelling of products containing them, in accordance with the Regulation on classification, labelling and packaging of substances and mixtures (known as the CLP Regulation).

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