Managing the potential contamination that hair shedding can present

Research into hair containment reveals that the issue of hair contamination is not just a natural phenomenon of hair shedding but also a direct result of modern hair styling.

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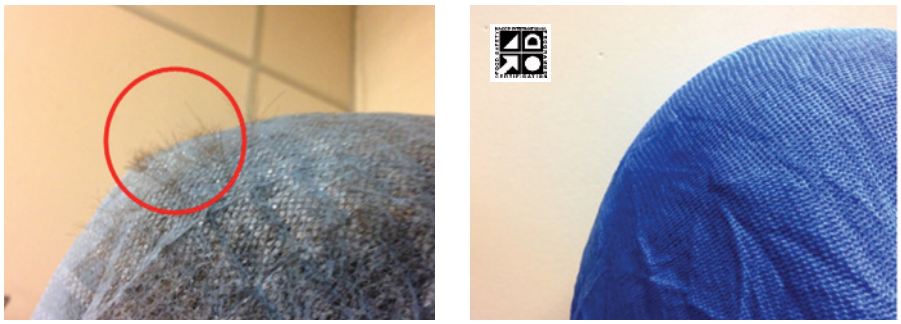


Fig. 1. Left, a 12gsm mob cap which is NOT certified by HACCP International and right, KleenCap, which is certified.

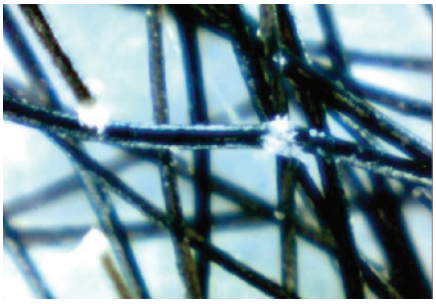
According to Professor Barry Stevens, FTTS, President of the Trichological Society 2014-16:

- In caucasoids an average of 40-130 hair-shafts will be lost to natural cyclical processes per day.
- Higher rates of hair shedding can be attributed to poor diet, reduced iron levels, post natal alopecia, fever or numerous other medical conditions.
- Hair damage is common – due to use of high temperature thermal appliances employed in hairdressing procedures.
- Chemical processes (colouring, permanent waving, relaxing or straightening) are potentially damaging by compromising the protein structure of the hair-shaft.
- Levels of such damage will be individually unique.
- Current conditioners do not repair hair-shaft damage but are useful in providing temporary improvement to lustre, feel, and drag reduction during routine grooming.
- The above processes compromise hair-shaft elasticity and tensile strength leading to such conditions as tricoptilosis (splits) or bubble hair syndrome (blisters) and/or trichorrhexis nodosa (node formation) with possible severance at some point along their axes.

It is the daily on-going shedding/severance of hair-shafts that will be found to contaminate food and therefore needs to be effectively contained.

"If we accept that hair-shaft shedding is a constant occurrence it is possible that 13-43 hairs could be shed from the scalp of each employee during an eight hour period. This equates with 1,300-4,300 hairs per 100 people. These figures can be significantly augmented by thermal injury and severance (following exposure to excessive heat from hairdryers, curling tongs etc) and chemical insult, for example bleaching, colouring, permanent waving, chemical relaxing or chemical straightening. The figures will be further increased by the daily losses of beard, nasal and ear hairs, eyebrows and eyelashes," Professor Barry Stevens adds.

Trichorrhexis Nodosa photo-micrograph (x 50). The high-spots indicate the points of eventual severance (B. J. Stevens).



Why contain hairs?

Whilst daily grooming will remove many of these shed and damaged loose hairs:

- Clearly not all shed and damaged 'loose' hairs are removed by personal grooming.
- Many hair styles are NOT brushed or combed but 'distressed' leaving the shed and damaged loose hairs on the head in addition to those shed during the work activity itself.
- Individual's habits vary greatly with some people showering before sleeping rather than just before work.
- Drying wet hair with high temperature settings on hair dryers and styling with curling tongs damages hair causing it to break off.
- Chemical treatments such as colouring, chemical straightening and perming damage hair causing it to weaken and frequently break off prematurely.
- Many people do not wash hair daily.
- Hair shedding is occurring all the time, including during the work shift itself.

These shed and broken 'loose' hairs will be disturbed and potentially contaminate production during a working shift due to the following reasons:

- The wearer scratching his/her head, the frequency of which can be increased where workers are hot due to either the ambient temperature, higher levels of work activity or discomfort from inappropriate head coverings themselves.
- General movement during the work activity.
- Whether standing or seated the head is usually tilted down towards the work activity increasing the exposure of shed or damaged hair from the crown due to gravity.
- The abrasion of any head covering over hairs that are not lying flat.

It is therefore no surprise that hair is potentially a significant food contaminant.

A microbial threat to food safety?

According to Professor Barry Stevens, "Whilst it is known that the scalp can be a haven for bacteria (especially the relatively

harmless Malassez Furfur (Pityrosporum Ovale). I am unable to eliminate hair-shafts as disease carriers (i.e. Staphylococcus aureus). However, hand contact with the scalp during food production is probably more likely to act as a carrier. therefore complete head hair covering is recommended. I cannot ignore the potential for contamination via beard hair as this can be an involuntary target of touch by infrequently washed hands. Covering the beard with net is therefore a wise precaution."

Research into different head coverings undertaken by the University of Bolton, England, found marked differences in performance as detailed in Table 1.

Professor Barry Stevens also make the following observation: "Food production personnel can effectively prevent scalp hair contamination through the wearing of HairTite HygieNets and KleenCap-Max, with HairBarrier products such as Neck Shield – which can be worn in multiple ways to cover beard, face and nasal hair as desired, or Beard Shield, or KleenCap-Max Neck Guard (covering scalp and beard hair) if new each day or cleansed with HairGon after a single day's wear to remove any residual hair-shafts caught in the material. However eyebrow, eyelid, ear and facial hair cannot be ignored – their prevention being more problematic."

HACCP International, the product certification body, recently evaluated a selection of hair coverings, from both products widely used in industry and those new to the market. Their results reveal some startling conclusions. The mob cap, widely used in industry, failed the HACCP International evaluation as a method of hair containment.

The results of HACCP International's findings are interesting because they sit beside research undertaken by University of Bolton, England and endorsements from the President of the Trichological Society 2014-16, Professor Barry Stevens, FTTS and the experience of industry.

According to Professor Subhash Anand MBE, Professor of Technical Textiles, Institute for Materials Research and Innovation, University of Bolton, England, "Non-woven materials, such as those used in mob and bouffant caps should not be used as a hair barrier fabric. Due to the non-woven manufacturing methods of spinning the fibres, it is impossible to control the alignment and spacing of the fibres leading to variable fabric structure with inherent gaps and different densities, allowing hairs to protrude through. Due to the fabric's rigidity, it will neither hold the head of hair nor grip strands of hair that protrude through the fabric. It is a totally unsuitable material."

Fig. 2 demonstrates the variable spacing and non-alignment of the spun fibres – present in all weights of non-woven fabrics such as those used in mob caps, bouffant caps and beard covers ■

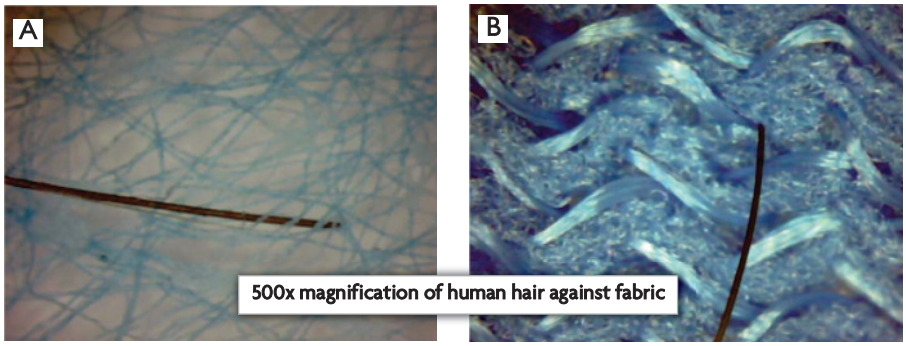


Fig. 2. Left (A) a 12gsm mob cap. Inherent gaps in material easily allow hair to protrude. Right (B) KleenCap breathable hair barrier fabric restricts hair penetration. StayCool technology transports moisture through the fabric to evaporate into the atmosphere to help keep workers cool. Antimicrobial inhibits the multiplication of bacteria and fungi such as Gram positive staphylococcus.

Table 1. Research into different head coverings undertaken by the University of Bolton, England.

	University of Bolton findings				Additional hair containment technology			Optional anti-microbial technology	
Head covering(s)	Actual av. quantity protruding hairs per use	Factored av. quantity protruding hairs per use	Hair containment improvement factor	Short hair protruding over long hair multiplier	HairTite	HairBarrier	StayCool	HairTite	KleenCap
Under covering = None									
12gsm mob cap	74*	85	0.0	2.3	✗	✗	✗	✗	✗
KleenCap Standard	35	35	2.4	2.0	✗	✓	✗	✗	✗
Under covering = HairTite Standard									
12gsm mob cap	21	21	4.0	1.6	✓	✗	✗	✓	✗
KleenCap Standard	20	20	4.3	1.7	✓	✓	✗	✓	✗
Under covering = HairTite HiCare									
12gsm mob cap	15	15	5.7	1.8	✓✓	✗	✗	✓	✗
KleenCap Standard	15	15	5.7	1.7	✓✓	✓	✗	✓	✗
Under covering = HairTite Standard									
KleenCap Max	11	11	7.7	1.6	✓	✓✓	✓	✓	✓
Under covering = HairTite HiCare									
KleenCap Max	8	8	10.6	1.6	✓✓	✓✓	✓	✓	✓

* Where mob caps ballooned away from the head, protruding hairs could not be accurately counted. The University therefore factored the figure to account for the percentage of the head zones where the mob cap ballooned away from the head.