

A novel method to eradicate hair contamination in food processing

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Eradicating hair contamination is highly crucial for creating and maintaining a high level of hygiene in the food and clean room industries. To achieve this it is really useful to understand why hair is currently the number one contaminant of food and what preventative measures can be taken to completely avoid this contamination. To address these issues, the University of Bolton and ABurnet have jointly carried out a research project which was partly funded by the Technology Strategy Board (TSB).

Hair shedding issues

All humans shed between 100 and 150 hairs per day. Hair shedding is constant throughout the day irrespective of ethnicity, age and sex. Therefore in an industrial environment, around 3,300-5,000 hairs will be shed per hundred employees in an eight hour shift. If all previously shed hairs are not combed out prior to starting work, the above figure

could easily be doubled or tripled.

In addition, the popularity of modern distressed hair styles that are not combed at all contribute largely to the quantity of shed hair remaining on the head. Hair contamination creates hygiene, social and psychological problems, especially when finding someone else's hair in the food eaten and it is therefore crucial to address these issues.

Hair containment issues

The joint research programme thoroughly investigated how hair contaminates and protrudes the existing head coverings. The findings revealed several key issues.

Hair thickness and its effects when held on and/or within the fabric structure were thoroughly investigated. It is evident that hair at 17- 180 micron thickness is protruding through the gaps in fabrics due to the mechanical force applied to hair when the head covering is moved or dislodged across the head, for example when adjusting the headwear or scratching the head.

Hair is pushed up through the needle gaps in both woven and knitted fabric structures, but more so in the nonwoven materials used in mob/bouffant caps and beard

masks. This is because during the fabric manufacturing process it will not be possible to control either the alignment or spacing of the fibres that results in variation in densities across the fabric.

For these reasons, non-woven materials such as those used in mob caps are totally unsuitable for head coverings and offer very limited protection against hair contamination.

How to contain hair

One of the outcomes of the research programme at the University of Bolton reveals

that for containment, hair must be:

- Folded flat to reduce the incidence of hair being pushed through the inherent gaps within the fabric structure, particularly non-woven structure due to the mechanical force as described above.
- Firmly held in order to contain it. Head coverings designed with a high surface contact area are recommended for the different individual wearer's hair styles. Loose head coverings such as mob caps are in effect only as good as the elasticated edging as shed hairs are simply not withheld.
- Grip any protruding hairs to help limit the passage of hair through the gaps in the fabric.
- Fully contained within the head covering. The elasticated edge of the head covering must be both strong enough to withstand the weight of long hairs and without excessive recoil to provide comfort for people with smaller heads and shorter hair styles. Wearer comfort is important as it will help reduce fidgeting and the linked mechanical forces that help push hair through all fabric structures, particularly non-wovens.

The above findings facilitated ABurnet, with direction from the University of Bolton, to design and develop various fabric structures and ultimately various novel products such as 'KleenCap with HairBarrier' technology and HairTite HygieNets have been produced, tested and characterised.

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Left, hair protruding through a mob cap and, right, hairs withheld in a KleenCap.

Magnification (500x) of the fabric structures with the same human hair showing.



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A user-trial involving 144 tests covering a wide mix of ethnicities, sexes, age groups, hair styles, hair lengths and hair types for each product or a range of different product combinations was carried out at the University of Bolton to evaluate the effectiveness and performance properties of different technical fabric structures and products.

Patents pending

As a result of the University's research and testing, ABurnet has applied for four patents and the production of both the HairTite hairnets and KleenCaps is in progress.

The HairTite hair nets and KleenCaps fully meet all the essential requirements that the University of Bolton stipulated.

HairTite HygieNets feature unique fold and hold patented technology:

- HairTite Standard has 2x hair containment as a 5mm traditional mesh hairnet for the same cost.
- HairTite Hi-Care has 2x hair containment as a 3mm traditional mesh hairnet for the same cost.

KleenCaps feature HairBarrier and optional StayCool technologies:

- 4x hair containment of a mob cap.
- 11x hair containment of a mob cap when worn over HairTite HiCare.
- KleenCap Max with 'StayCool' technology wicks away moisture 23 times higher than that of a mob cap, which ensures employees' comfort in hot or physical work environments and thus reducing the incidence of fidgeting and the associated risk of



hair contamination. The functional properties of the KleenCaps are further enhanced by eliminating the residual hairs which are not removed by the mechanical forces during washing.

The process facilitates KleenCaps to be reusable, maintain hygiene, cost effective and environmentally friendly.

The University of Bolton has developed for ABurnet an advanced formula wash additive – HairGon – that dissolves residual hairs that are present in KleenCaps during washing.

This patent pending product allows for the

safe re-use of head coverings such as KleenCaps and, if adopted by the UK industry, an estimated reduction of 603 tons of landfill each year would be achieved.

A simple wash system with in-built process control validation provides an easy to use quality assured process that reduces the work load compared to the constant re-filling and disposal of mob caps.

Training

As with any head covering, ABurnet recognises that performance of products can only be effective when worn properly.

In response to industry requests, ABurnet has produced training videos, visual wear and best practice posters.

These professional guides such as Buddy-Up and Enclose all your Hair effectively educate and remind staff to follow correct procedures, whilst an on-line app-style tool allows efficient recording of employee compliance.

This can then be presented at the click of a button to report whether or not workforce comply with best practice and find out where the improvements are required.

All these measures enhance the value of best practice and improve productivity and can be used to demonstrate compliance at audits.

ABurnet's HairBarrier technology provides the only independently performance tested products on the market and used in conjunction with the training material and audit tools help reduce hair contamination towards zero – surely the aim of every quality assured food company. ■

Table 1. University of Bolton trial results.

Head covering (s)		University of Bolton findings				Additional hair containment technology		
Under	Outer	Actual avg qty protruding hairs per use	Factored avg qty protruding hairs per use*	Hair containment improvement factor	Short hair protruding over long hair multiplier	HairTite technology	Hair Barrier technology**	Staycool technology
None	12gsm Mob cap	74*	85	0.0	2.3	x	x	x
None	KleenCap standard	35	35	2.4	2.0	x	✓	x
HairTite standard	12gsm Mob cap	21	31	4.0	1.6	✓	x	x
HairTite standard	KleenCap standard	20	20	4.3	1.7	✓	✓	x
HairTite HiCare	12gsm Mob cap	15	15	5.7	1.8	✓✓	x	x
HairTite HiCare	KleenCap standard	15	15	5.7	1.7	✓✓	✓	x
HairTite standard	KleenCap-Max	11	11	7.7	1.6	✓	✓✓	✓
HairTite HiCare	KleenCap-Max	8	8	10.6	1.6	✓✓	✓✓	✓