Collaboration for Cosmetic Innovation
Industry-Academia R&D Showcase

Personal Care & Cosmetic Industry – R&D

Background

- Cosmetic products are not medical, they only colour, oil & 'polish'- i.e. clean, perfume, change appearance, protect, keep in good condition and correct body odours.
- All products must be safe and NOT tested on animals for cosmetic safety or efficacy.
- The industry is fast to market, fashion led, low volume and work on a ''human scale''.
- Personal Care Products are expected to have 30 months shelf lives.
- Moving towards 'greener' products with less impact or damage to 'people and places'
- Seeking academic expertise for collaborative research in the following areas: process control, engineering, biochemistry/skin physiology, nanotechnology, microbiology, biotechnology, material science, mathematics, computer science, etc.

Challenges to Academia

Manufacturing Innovations & Improvements: Math modelling, physics & engineering

Background

Most products start as an idea to meet a marketing brief. The developers prepare their formulas on a 'beaker-scale' in the laboratory. Trial formulas must pass stability testing (including testing in the final packaging), safety, microbiological challenge and efficacy. They must not contradict the cosmetic regulations in the regions where they are to be sold. Formulating is therefore a bit like playing 'snakes and ladders'. Formulas that fail one criteria (i.e. go down a snake) are 'fine-tuned' until they eventually pass (go up a ladder). New product development goes on until all five criteria are passed and the product pleases the marketer who wrote the original brief.
Next, the 'chosen' formulas are scaled-up to pilot scale < 100kg, tested against similar criteria again before being made at the manufacturing scales of < 1-5 tonnes.

Challenges

- Faster reliable methods (including automatic methods) for testing stability, safety, microbiological challenge and efficacy are needed for all the different types of cosmetic products. Sensitive instruments that 'see changes' earlier on in stability trials would be very welcome.
- Scale-up: Linking and relating the different geometries, sheer histories, heat transfer rates etc., between the lab scale / pilot and manufacturing-scale equipment so that optimal settings could be 'automatic' would enable products to be more successfully scaled up and also be transferred more easily between different manufacturing plants.
- Cold process emulsions are available but as complex systems that are often difficult to scale-up. User friendly, predicting software that assists formulators would make these greener formulas more popular.
- New ways to make products and delight the users: Personal care products try to delight the user as well as deliver a function. Up until now this has been achieved using emulsions, dilute surfactant systems, gels, pastes and serums, etc. The industry is open to more novel approaches employing new technologies such as bi-liquid fluids / high shear dispersions. The industry is very interested in unusual textures and delivery systems.

Hair care (Eye lashes/Eye brows): Polymer chemists and others

Background

Hair is very variable however generally, we all like to have healthy hair, which usually means

shiny, tangle free, no static, frizz control, etc. We also use polymers to hold hair in a temporary, semi-permanent or permanent style and use dyes to colour hair.

Challenges

- New methods to straighten/curl (especially ethnic hair) that do not involve formaldehyde or caustic materials would be very welcome. In theory these processes could be catalysed by enzymes. Research is need to show how this could this be put into practice.
- New ways to colour (and maintain hair colour).
- Hair removal/slowing re-growth: materials that would be suitable for alternatives to shaving. For example, it has been proposed (but never perfected) that enzymes isolated from microbes that breakdown keratin might be useful.

Skin

Background

Popular skin care products include those that are nice to use and leave the skin feeling clean and fresh, as well as being clean. Products that help protect skin from UV damage can save lives. Consumers search for products to help address their perceived imperfections. For example, some cultures prefer lighter tone skin while others crave a 'healthy' tan. As we age, our skin undergoes many noticeable changes that cosmetic products are designed to tackle, for example moisturising dry skin. The aging population are looking for products that address changes so they maintain their youthful looking skin for longer. Products can disguise fine lines and pore size. They can contain materials that give some protection from UV light. Cosmetic scientists know the importance of supporting not just the skin but also the healthy skin microflora.

Challenges

- Heat and cold sensations (exothermic/endothermic reactions for skin): Seeking textures and materials that make products feel cool or warm or even tingle.
- Fake tan: Applying DHA (Maillard Browning to skin) is very popular in the UK. Seeking research into the reaction on skin and see how to:
    - Speed up the skin tanning reaction on skin
    - Mask/remove DHA odour during fake tanning
    - Remove stain from 'faked tanned' skin
- Tattoos are very popular and it is likely people will eventually want to remove them. The cosmetic industry would like to understand the process but more importantly make better temporary tattoos, which could later be more easily removed.

Fragrances to enhance products

Challenges

- Long lasting fragrances are achieved by including polycyclic musk (PCM), which the industry needs to replace.
- Alternatives to the allergens that are naturally present in fragrances.
- Smart fragrances with pulsed delivery ''like flashing lights''

Antiperspirant: Odour and perspiration control

Challenge

- This area would benefit from a greater understanding and more choice of effective materials.

Colour in Product

Challenge

- Stable (stabilizer for) natural colours especially pink.

Colour cosmetics

Challenges

- Improving colour stability: Eye-shadow red is notorious for fading quickly. This is especially a problem in products with a little 'tint'. Pink and lavender shades of lipstick also fade fast.

- Materials for long lasting smudge-free mascara (3-4 days), which are only removed with the specific-remover.
- Materials that prevent eye shadow from creasing.
- Self-healing smart polymers for nail varnishes.
- Colour from ''periodousity'' rather than pigments.
- Colour changing cosmetics.

Alternatives to animal testing

Background

This is a major area for cosmetics, which might be moved forward using techniques practiced in stem cell research and tissue culture

Challenge

- 3D Printing of cells: Print artificial skin for efficacy and safety testing.

Sun Protection

Challenges

- UV Protection: In-vitro test SPF which reflect in-vivo test results SPF testing has a bias towards UVB. Design better tests to measure sun protection.
- Develop new UV filters/shields/screens with long lasting broad UV protection.

New preservatives

Challenge

- New preservatives or preservatives linked to packaging.

Water restivity

Challenge

- Thin films technology for helping cosmetics to resist being lost in water and for holding, delivering actives to the skin.

Skin lightening (Popular in Asia)

Challenge

- Skin lightening materials: perhaps by light reflection rather than by chemical bleaching.

Materials which change

Challenge

- Apply smart materials which change in response to the environment to cosmetics.

Modelling and new ways of measuring

Challenge

- Water loss from skin: new ways of measuring.

Packaging

Challenges

- Reducing/removing preservatives: Why not 'lock' the preservative into the containers.
- Packaging which prevents leaching of materials internally into or externally out of the product

Other

Challenges

- Wellbeing: Methods for measuring the effects of product use and fragrances have on behaviour
- Biotechnology: Chitin, Collagen Plant stem cells learning and any benefits for skin
- Stem cells
- Understand product sensory feel using new tribology methods