Unit 21: Chemistry of Hair and Beauty Products

Unit code: K/601/5346
QCF level: 4
Credit value: 14

● Aim
This is a preparation for work unit which is based on knowledge and understanding. This unit is about developing an understanding relating to the chemistry of products used in the hair and beauty sector through theoretical research. It underpins the health and safety aspects of using chemicals and the importance of using appropriate packaging materials.

● Unit abstract
This unit provides the learner with the opportunity to carry out detailed research into the active ingredients used in hair and beauty products and their packaging, in terms of their chemical structures and properties and uses in the hair and beauty industry. This will enable the learner to understand the importance of ingredient selection in relation to the specific requirements of a product.

The effects of product ingredients and UV light on packaging will also be studied and learners will explore properties of different packaging materials in relation to their structure.

Safe working practices in the use and manufacture of products is essential to the industry and by studying this unit, the learner will understand how safe practice is maintained and monitored.

● Learning outcomes
On successful completion of this unit a learner will:

1 Understand the chemistry of active ingredients in hair and beauty products
2 Understand the effects and safe use of active ingredients in hair and beauty products
3 Understand the properties of packaging materials in relation to their structure
4 Understand the properties and effects of ultra-violet radiation on hair and beauty products and their packaging materials.
**Unit content**

1. **Understand the chemistry of active ingredients in hair and beauty products**

   *Chemical compounds:* inorganic and organic chemistry eg hydrocarbons and oxygenated compounds; bonding of carbon atoms; saturated and unsaturated hydrocarbons; alkanes and alkenes; terpenes; alcohols; phenols; aldehydes; esters; lactones; ketenes; isomerism and isoprenes (monoterpenes)

   *Chemical reactions:* oxidation and its effect on the storage of products; oxidation of terpenes, phenols and aldehydes; hydrolysis of esters; ionisation of carboxylic acids; polymerisation of unsaturated compounds

   *Active ingredients:* hydrocarbons; oxygenated compounds; alcohols; phenols; aldehydes; esters; lactones; ketones

   *Effect of functional groups on molecular reactivity:* terpenes; oxygenated alcohols; phenols; aldehydes; esters; lactones; ketones

2. **Understand the effects and safe use of active ingredients in hair and beauty products**

   *Effects of products:* moisturising; volumising; drying; cleansing; smoothing; temporary restructuring of the hair shaft; keratolytic; changing hair structure; changing skin and hair pigment (natural and artificial); nail strengthening

   *Safe working practices:* client contraindications eg skin and hair analysis, client history, testing skin and hair, medical referral, medical authorisation; use and storage of products eg manufacturers’ instructions; risk assessment; use of ingredient data sheets; Cosmetic Products (Safety) Regulations; Lethal Dose 50 (LD50) testing; current and relevant legislation eg Control of Substances Hazardous to Health (COSHH)

   *Organisations responsible for monitoring safety:* Health and Safety Executive (HSE); other organisations eg Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

   *Problems associated with use of oils as active ingredients:* adulterated and synthetic oils (allergic reaction, risk of serious skin irritation, sensitisation)

3. **Understand the properties of packaging materials in relation to their structure**

   *Materials:* metals; glasses; elastomers; thermoplastics; thermosets; ceramics

   *Structure:* crystalline; atomic arrangement; long chain; amorphous; cross-links; giant; bonding (ionic, covalent, hydrogen, van der Waals forces)

   *Effects of tensile and compressive forces:* stress; strain; Hooke’s Law; stiffness; ductile and brittle substances; yield strain; work hardening; effects eg fracture of metals, reorientation of fibres, weakness

   *Effect of shape and temperature:* shape effects (beams, girders, arches, corrugations, tubular structures); heat effects (molecular movement, rupture of bonding, Curie temperature, flow, viscosity)
4 Understand the properties and effects of ultra-violet radiation on hair and beauty products and their packaging materials

*Properties:* photon energy; wavelength; UVA, UVB and UVC; photoelectric effect; energy levels; ionisation

*Effect on chemical composition:* effect on bonds; absorption; opacity; light sensitivity; decomposition

*Effect on packaging:* discolouration of products and packaging; structural changes; transmission and absorption spectrum of glass; effect of colour of glass on UV light transmission
### Learning outcomes and assessment criteria

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| **LO1** Understand the chemistry of active ingredients in hair and beauty products | 1.1  explain the differences between chemical compounds found in hair and beauty products  
1.2  explain the chemical reaction process that occurs in ingredients found in hair and beauty products and their effects on the hair and scalp  
1.3  describe the active ingredients found in different hair and beauty products  
1.4  explain the effect of functional groups on the reactivity of molecules in products |
| **LO2** Understand the effects and safe use of active ingredients in hair and beauty products | 2.1  explain the desired effects of products in relation to their chemical composition  
2.2  explain how to follow safe working practices with regard to contraindications presented by the client  
2.3  explain how to follow safe working practices with regard to the storage, handling and application of hair and beauty products  
2.4  identify the organisations responsible for monitoring the safety, standardisation and Lethal Dose (LD 50) testing of hair and beauty products  
2.5  explain the problems associated with the use of oils as active ingredients |
| **LO3** Understand the properties of packaging materials in relation to their structure | 3.1  explain the chemical properties of packaging materials in relation to their chemical structure  
3.2  explain the effects of tensile and compressive forces on metals, glasses, elastomers, thermoplastics, thermosets and ceramics, fibrous materials  
3.3  explain the effects of shape and temperature on the properties of packaging materials |
| **LO4** Understand the properties and effects of ultra-violet radiation on hair and beauty products and their packaging materials | 4.1  explain the properties and categories of ultra-violet radiation  
4.2  explain how ultra-violet radiation can affect the chemical composition of hair and beauty products  
4.3  explain how the exposure and transmission of ultra-violet radiation can affect packaging materials for hair and beauty products |
Guidance

Links

This unit has particular links with:

- Unit 22: Analysis of Scientific Data and Information
- Unit 23: Chemical Laboratory Techniques
- Unit 24: Laboratory Management.

Essential requirements

Delivery

This unit should be delivered in as practical a way as possible to engage and motivate learners. Tutors should contextualise this unit to the hair and beauty sector, enabling learners to apply chemistry to hair and beauty-related products.

Assessment

It is expected that the learning outcomes will be achieved through a series of assignments comprising reports documenting the results of theoretical research undertaken, including reports on any practical activities undertaken.

Resources

Learners will need access to sources of specialist reference material in order to conduct their research. Examples of material that will be required include: research papers, reports, European cosmetic safety regulations and cosmetic ingredients data sheets.

Learners will also benefit from access to a well-equipped applied science (chemistry) laboratory for testing products and evaluating product ingredients. This would enhance their understanding of the relationship between the properties and uses of a range of cosmetic product ingredients.

Employer engagement and vocational contexts

It would be beneficial for learners to seek work experience in cosmetic manufacturing laboratories. Alternatively, a shorter educational visit programme would give an insight into the day-to-day activities of a cosmetic scientist.

Input by specialists from the cosmetics manufacturing industry may also help learners understand the safety regulations in place to ensure product formulations are safe to use.