Part I: Understanding “Mild” Cosmetics

Part II: Introduction to Sensitive Skin

CHEM 470
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What is “Mildness?”

• Consumer definition: Product that will not cause irritation

• Cosmetic chemist: Mildness is the ability of a product to perform its primary function without an unacceptable level of negative side effects such as irritation, allergic reaction, or sensitization of the skin or eyes.
Irritation

- Irritant Contact Dermatitis (ICD)
- Symptoms: erythema (redness), burning, itching, and flaking
- Major characteristic: damage to the stratum corneum does not involve associated immunological reaction
Allergic reactions

- Allergic Contact Dermatitis (ACD)
- Similar to ICD but different in cause
- ACD – immunologic response to antigens (potentially infectious agents)
- Contact allergens cause a response in T lymphocytes
- Once an individual has developed an antigen response, he or she is said to be “sensitized”
Product Mildness

- Product mildness can be affected by extraneous factors such as water hardness (Warren, et al). Surfactant exposure is widely recognized to cause contact dermatitis, which is a general term used to describe non-specific skin irritation.
Product Mildness

• Irritation due, in part, to water loss that occurs when the intercellular lipids are disrupted

• Two causes: (1) effect of calcium ions on skin and (2) indirect effect of calcium with surfactants

• Calcium can interfere with the skin’s ability to repair its moisture barrier after exposure to surfactants
Hypoallergenic

• Hypoallergenic – *less likely* to cause an allergic reaction, such as redness, rashes, itching and burning sensation

• 1978 consumer survey: 33% responses – products advantageous for people with allergies or sensitive skin; 20% responses – non-allergenic, 37% responses – no allergic reaction whatsoever, 1% responses – milder than most products; 9% responses - agreed with FDA
Animal Testing

• Draize test: 6 albino rabbits are exposed to a test substance for 24h, the skin is examined and an irritancy score can be assessed.

• Intradermal safety testing: Rabbits are injected with a test product solution and then an Evans blue solution. The diameter of the zone of bluing gives an indication of irritation potential.

• Guinea pig maximaization test – measures the sensitizing potential of ingredients. The albino rabbit eye irritancy test evaluates whether a product will be an eye irritant or not.
Alternatives to Animal Testing

- LDH leakage assay and MTT reduction test – test for cytotoxicity in human fibroblast cultures
- LDH test takes advantage of the fact that lactate dehydrogenase leaks from cells when they are damaged by surfactants. The amount of the LDH that leaks is an indication of the amount of cellular damage.
Alternatives to Animal Testing

• The MTT test allows you to evaluate the mitochondrial dehydrogenase activity. It demonstrates toxic effects on cell metabolism by the rate of color change of the MTT blue compound. It tests mitochondrial integrity and cell viability. These values have been shown to relate to surfactant irritation.
Sensitive skin

- Consumers 40% of the cosmetics market
- Consumers with sensitive skin develop stinging, burning, erythema, and/or desquamation with topical formulations that seem innocuous to the majority of the population
How do you know if you have sensitive skin?
Physiology

• Heightened Neurosensory Input
• Sensitive skin consumers may have altered nerve endings, more neurotransmitter release, unique central information processing, chronic nerve ending trauma, or slower neurotransmitter removal to account for this reaction
Heightened Neurosensory Input

- Effect can be extended to vascular reactivity such as the flushing induce in rosacea patients with certain ingested foods, temperature extremes and physical or emotional stress.
- Thus heightened neurosensory input allows the evaporation of volatile vehicles or the presence of minor cutaneous irritants in cosmetics and skin care products to induce dramatic symptoms.
Enhance Immune Responsiveness

- Heightened antibody response to antigen presentation (allergic contact dermatitis)
- Such patients demonstrate increased positive reactions to patch and prick testing with the height of immune responsiveness occurring around age 30 and progressively decreasing thereafter.
Defective Barrier Function

• Lack of an intact barrier can result in heightened neurosensory input by inadequately protecting nerve endings

• Presents with altered calcium level in the stratum granulosum, increased cytokines, elevated levels of interleukin and growth factor production.
Testing

- 1st group: minimum of 40 subjects
- minimum of 200 subjects to support the claim of hypoallergenic
Non-invasive Testing

• Bioengineering Tests to Measure Skin Response
• Measure preclinical disease without altering the underlying skin condition
Transepidermal water loss (TEWL)

- Transepidermal water loss measurement (TEWL) or evaporimetry
- Assesses barrier dysfunction and recovery following ingredient or finished product application
- Measures skin porosity indirectly predicting the rate of loss of topically applied substances from the skin surface
Profilometry

- Profilometry involves obtaining a silicone rubber cast of the skin surface, transforming the cast into a plastic positive and obtaining a computerized contour tracing of the surface.