

Sunscreens



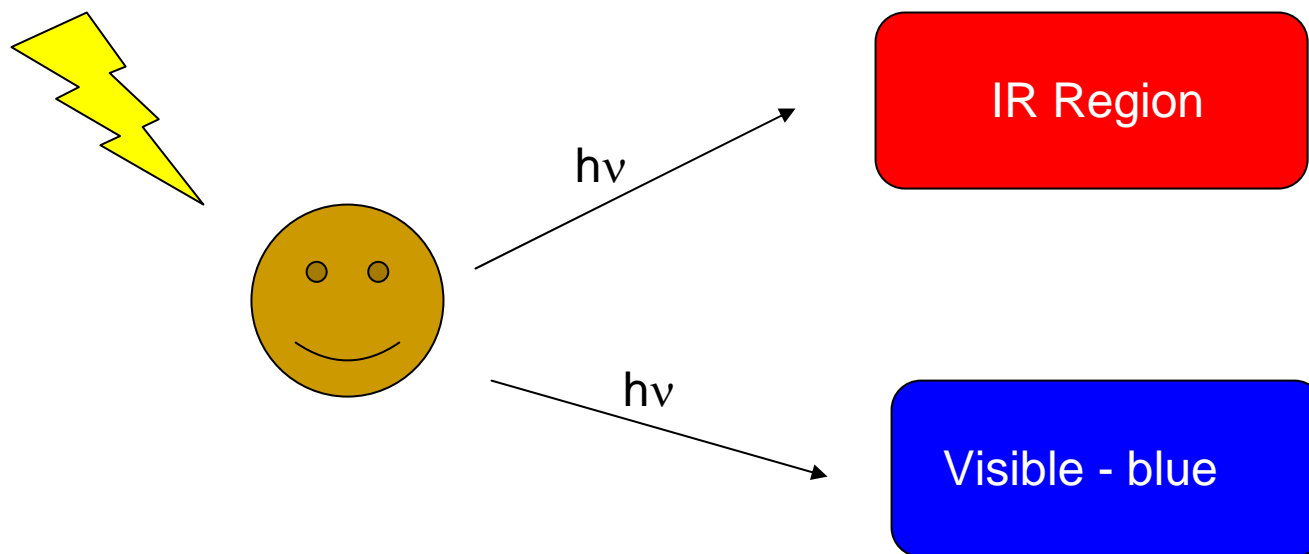
Sunscreens are a special class of personal care products containing active ingredients that can absorb UV radiation to shield skin from the damaging effects of the sun. These products are classified as OTC drugs and are regulated by the FDA in the U.S.

UV Light and its Effect

- UVC (200-290 nm)
 - Most of the light in this range is filtered out by the atmosphere
- UVB (280-320)
 - Termed the burning or erythema region
 - Penetrates the SC and epidermis
 - Damage immediately apparent “sunburn”
- UVA1 and UVA2 (320-360)
 - Penetrates deepest into the skin (dermal layer)
 - More of this type of radiation reaches the earth’s surface
 - UV-induced photo-aging

Chemistry of UV Absorbers

- Aromatic carbonyls
- Amine or methoxy group in either ortho- or para- position on aromatic ring



Sun Protection Factor

- Many sunscreens can repeat quenching reaction multiple times without becoming ineffective
- The SPF represents the ability of a sunscreen to delay sun-induced skin erythema

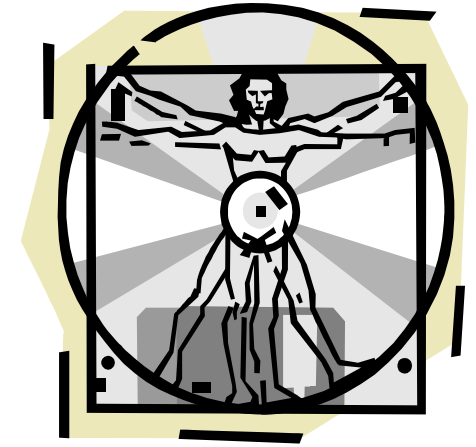
Wish you
were here?



Sun Protection Factor

- Technical definition
- Level of sun exposure needed to produce a minimal erythema dose (skin reddening) divided by the amount of energy required to produce the same erythema on unprotected skin
- e.g., SPF-10 should mean that a person should be able to stay in the sun 10 times longer without visible erythema

SPF Testing



- Human volunteers
- Untanned
- On the back or upper part of the buttocks
- Quantity of sunscreen per unit of skin surface (sunscreen thickness) is 2 mg/cm^2 of skin
- 30 mL of sunscreen required for an adult to completely cover

Problems

- Only UVB exposure rating
- Not a universally recognized SPF factor for UVA rays
- That thick, really?
- Bank on a mean SPF of between 20 and 50 percent of that expected from product label
- SPF 15 to the face → about fivefold protection
- New rating system
 - Minimal (SPF 2-12), moderate (SPF 12-30), high sunburn protection (SPF 30+)

Water-resistance

- A sunscreen is considered water-resistant if the SPF level is effective after 40 minutes of water immersion. (20 min. cycles)
- Very water resistant: 80 minutes of water immersion
- “Waterproof” will no longer be allowed in labeling
- Lipophilic base, greasy feel, higher SPF formulations



Sunscreen Classifications

- (1) Barrier sunscreens, physical sunscreens, “sunblock” (term no longer used) and (2) Chemical Sunscreens
 - (1) Sensitive skin
 - (1) TiO_2 , ZnO
 - Early formulations (melt, stain, visible)
 - (1) Modern formulations
 - Colloidal suspensions
 - Maximizes safety profile

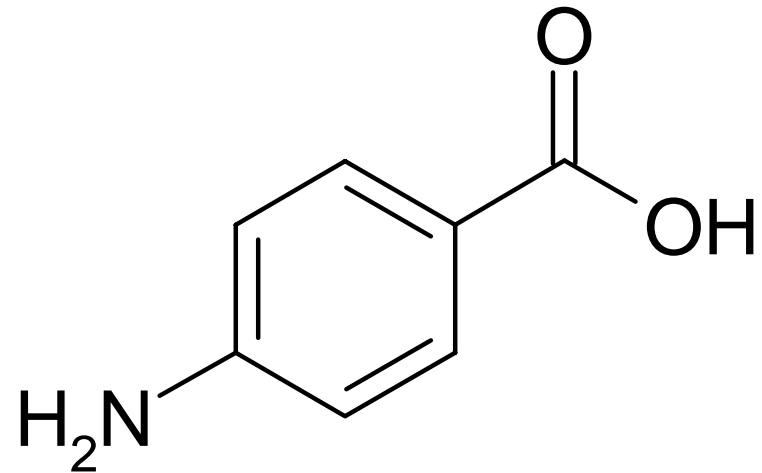


Physical Sunscreens

- Recommended by Dermatologists
- TiO_2
- UVB (280 – 320) and UVA1 (320-340)
- Less effective than ZnO above 340 nm (UVA2 region)
- ZnO
- Particle size $<0.2 \mu\text{m}$ (appears transparent)
- Less photoactive than TiO_2

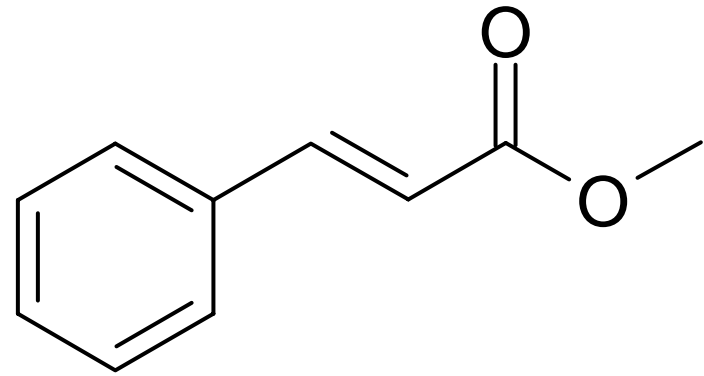
Chemical Sunscreens

- PABA = *Para*-Aminobenzoic acid
- 1950s
- Low water solubility
- Sensitizer, stains cotton and synthetic fabrics
- “PABA-free”
 - “Aminobenzoic acid (PABA)-free”



Chemical Sunscreens

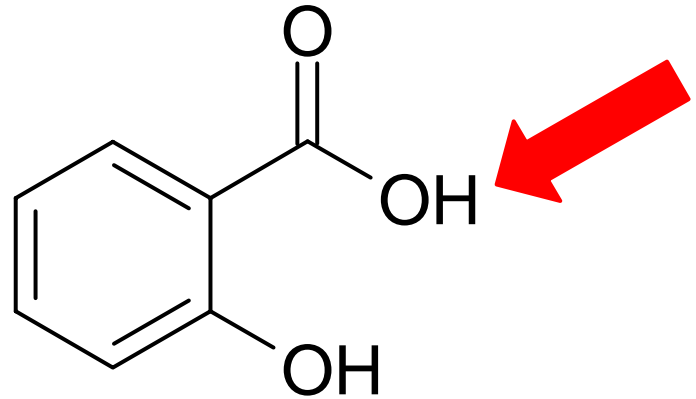
- Cinnamates
- Replaced PABA derivatives
- Max UV absorption 310 nm
- Low water solubility
- Sensitizer



Methyl cinnamate

Chemical Sunscreens

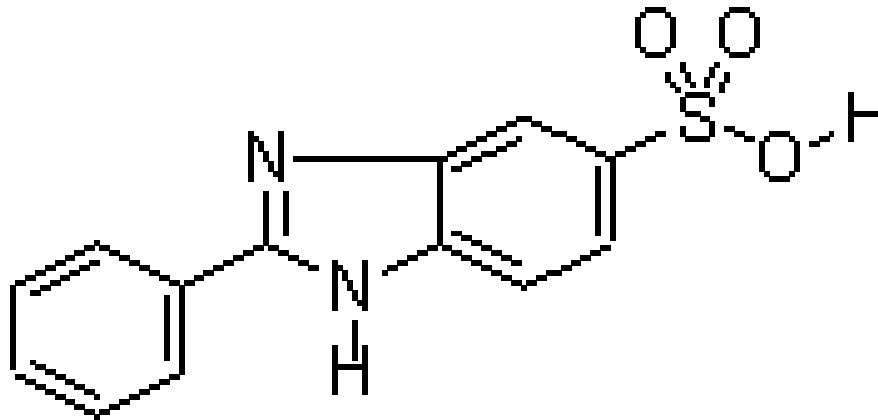
- Salicylates
- UV max 310 nm
- Octyl salicylate
- Stable, nonsensitizing, water-insoluble
- Used in combination with other UV filters



Salicylic acid

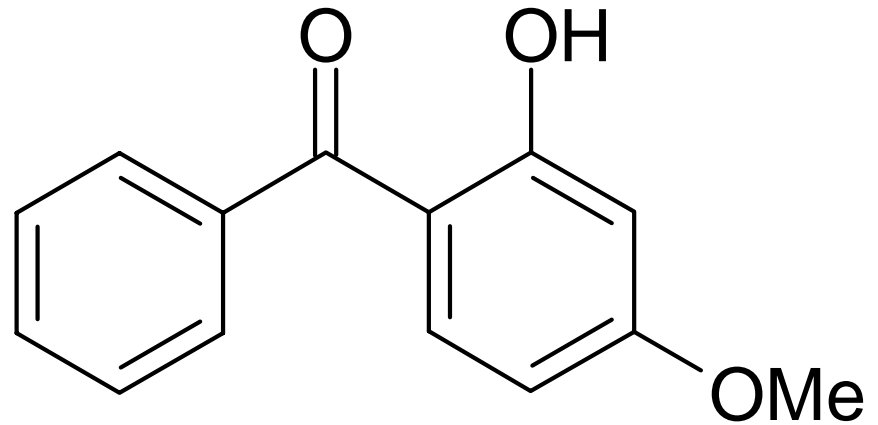
Chemical Sunscreens

- Phenylbenzimidazole Sulfonic Acid
- Water-soluble
- Selective UVB filter and allows almost full UVA transmission



Chemical Sunscreens

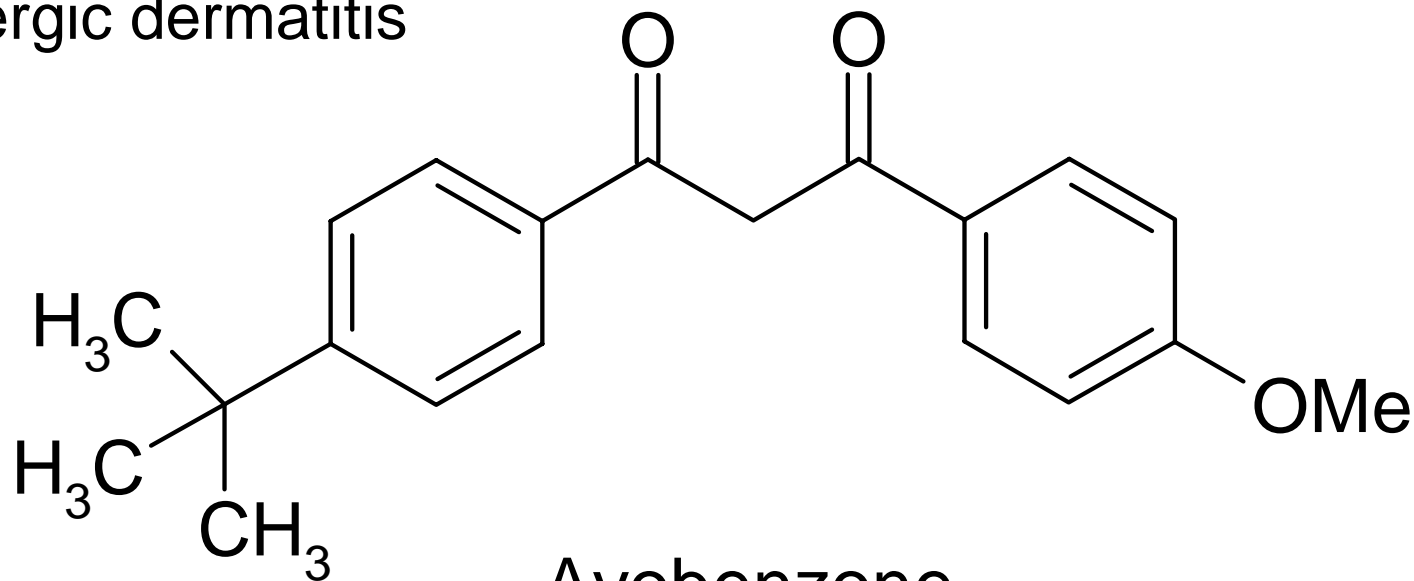
- Benzophenones
- UVA (320-350 nm)
- Oxybenzone has max at 326 nm
- 20%-30% of sunscreens contain oxybenzone
- ***Can be absorbed through the skin***
- Low acute toxicity – chronic toxicity?
 - ***Not suitable for children***



Oxybenzone

Chemical Sunscreens

- Parsol 1789 = avobenzene = butyl methoxydibenzoylmethane
- Max 355 nm
- Great UVA protection
- Photoallergic dermatitis



Avobenzene

Adverse Effects of Sunscreens

- Local cutaneous manifestations
- Allergic and irritant reactions
- TiO_2 and ZnO – no reports of sensitivity
- Additives of sunscreens (fragrances, oils, preservatives)
- Majority of reactions are irritant reactions
- Vehicles for sunscreens can exacerbate acne as can acute UV exposure

Vehicle for Delivery of Active Ingredients

- Lotions and creams
 - Normal to oily or combination skin types – lotions
 - Dry skin – creams
- Oils
 - Spread easily, but greasy feel
- Gels and Sticks
 - Water-based gels for athletes, alcohol-based gels can run into eye area causing a sting
 - Sticks are best for athletes and heavy exposure areas: lips, ears, nose

Protective Effects from Other Sources

- Parsol 1789 inactive upon exposure to pigments used in makeup foundations
- Leave-in hair products may provide some protection
- Separate use of sunscreen and insect repellent (repellent may interfere with sunscreen effectiveness)

Protective Effects from Other Sources

- Clothing
- UPF – Ultraviolet Protection Factor
- Washing appears to strengthen
- New detergents contain UV-absorbing agents
- Tinosorb, a stilbene disulfonic acid triazine backbone that results in a reduction of UV transmission through the clothes
- Broad-brimmed hat (SPF 5)

Protective Effects from Other Sources

- Window shields
- Llummar UV shields by CPFilms
- 99.9% of UVA radiation from 320-380 nm
- Car, boat, house



Summary

- Many sunscreens on the market
- Daily use first line of defense

I wish I
was here!

