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SupraSalix™

**Novel Water Soluble
Supramolecular Salicylic Acid**

Broda Technologies Co., Ltd.

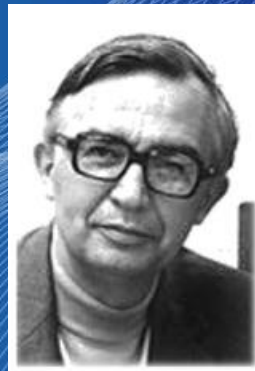
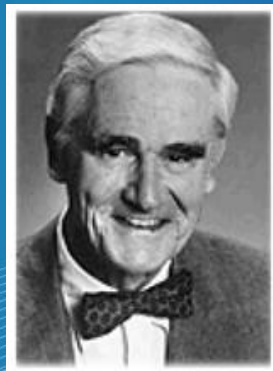
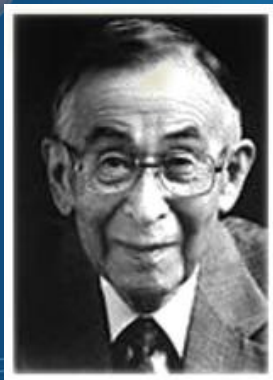
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Introduction to Supramolecular Chemistry

“Supramolecular Chemistry is the Chemistry of the intermolecular bond, covering the structures and functions of the entities formed by the association of two or more chemical species.”

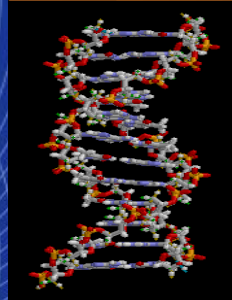
J. – M. Lehn



1987 Nobel Prize in Chemistry: Peterson, C; Cram, D. J. and Lehn, J. -M.

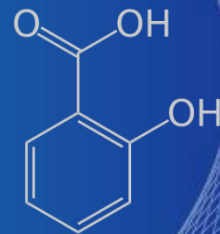
Supramolecular Chemistry — Modern Chemistry

DNA double helix



- 📖 Grown rapidly in the last few decades
- 📖 Expanded the scope of traditional synthetic Chemistry
 - ✂ Synthetic chemistry deals with covalently bonded molecules
 - 📖 Individual behavior
 - ✂ Supramolecular chemistry deals with organized entities of intermolecular complexes
 - 📖 Team behavior
- 📖 Consists of association of two or more molecules held together by non-covalent intermolecular bonds
 - ✂ Such as hydrogen bonds, dipole-dipole interactions, van der Waals forces, cation-pi interactions, pi-pi bonds, CH/pi interactions, or hydrophobic effects, and etc.
 - ✂ Molecular recognition, or self-assembly at molecular level
- 📖 Provides an approach to the formation of Nano scale systems
- 📖 Allows the development of smart, functional materials with applications ranging from biology to materials science

Salicylic Acid



A natural occurring active ingredient

- ✗ Can be found in many plants, such as willow bark.
- ✗ Also known as beta hydroxy acid or BHA
- ✗ Has both cosmetic and medicinal benefits

A key ingredient in many cosmetic products and OTC drug products

- ✗ Well known as keratolytic (exfoliant), anti-inflammatory, analgesic and anti-itching agent
- ✗ Used to treat acne, psoriasis, calluses, corns, warts, dandruff, skin wrinkling, freckles, skin pigmentation, or other skin-related problems

Cosmetic applications

- ✗ Works as an exfoliating agent to penetrate into the pores, dissolve dead skin cells and enhance skin cell turnover.
- ✗ Overall improvement in the appearance of the skin texture with smoothing effect in a reduction of fine lines and wrinkles

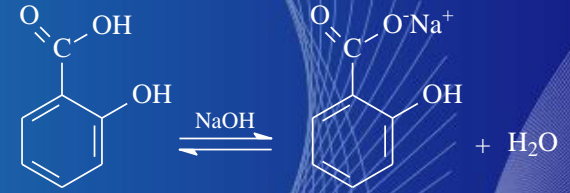
Salicylic Acid Formulation

Challenges

- ✗ Poorly soluble in water
 - 📖 2 g/L at 20 °C
 - 📖 Soluble in ethanol, propanol, acetone, ethers & other organic solvents
- ✗ Tends to recrystallize out during storage
 - 📖 Significantly reduces the bioavailability of active ingredient
- ✗ May cause skin irritation or burning due to low pH (< 3)

Common formulation practice

- ✗ Increase pH with alkaline solution, such as NaOH
 - 📖 Neutralizes free salicylic acid to form water soluble salicylates
- ✗ Stabilizes formulations and avoids possible skin irritation at low pHs
- ✗ Reduces the availability of free salicylic acid and results in a product that is therapeutically less effective

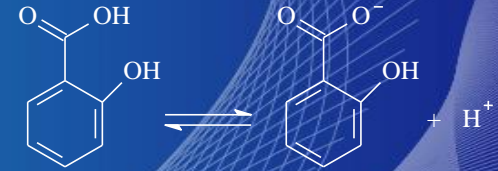


Free Salicylic Acid as a Function of Solution pH

- 📖 Salicylic acid is a lipophilic weak acid with a pK_a of 3
- 📖 Henderson-Hasselbalch equation

$$pH = pK_a + \log_{10} \left(\frac{[A^-]}{[HA]} \right)$$

[HA] is the molar concentration of the unionized weak acid
[A⁻] is the molar concentration of ionized base and
 pK_a is the acid dissociation constant.



Percentage of Free Salicylic Acid as a Function of pH

pH Value	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Free Salicylic Acid (mole %)	96.9%	90.9%	75.8%	50.0%	23.8%	9.1%	3.1%	1.0%

Review for the Delivery of Salicylic Acid

Chitosan

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📖 A number of strategies have been developed

- ✂ Solvent with buffered solution
- ✂ Esterification of salicylic acid with polymeric polyols
- ✂ Forms acid additive with amine-containing polymers to form cationic charged materials
- ✂ Encapsulation of salicylic acid particles

📖 Provides partial solutions for the delivery of salicylic acid

📖 Limitations in formulation freedom, and

📖 Reduced therapeutically efficacy

📖 Unmet needs for the delivery of salicylic acid

AHAs vs. BHA

Both work as exfoliator to reduce fine lines and wrinkles, stimulate collagen growth, and firm your skin

📖 **AHAs exfoliate on the surface of skin**

✂️ For sun-damaged and dry skin

📖 **AHAs are water soluble**

✂️ Easy to formulate

📖 **BHA exfoliates and penetrates into clogged pores**

✂️ For oily, acne-prone skin and for treating blackheads and whiteheads

📖 **BHA is water insoluble**

✂️ Difficulty to formulate

In addition

📖 **BHA has anti-inflammatory and antibacterial action**

✂️ Excellent for acne or sensitive, reddened skin

📖 **BHA is good for rosacea**

✂️ Less redness and a smoother skin

What is SupraSalix?

📖 Water soluble supramolecular Salicylic acid, unbuffered,

- ✂ Advanced supramolecular recognition and self-assembly technology
 - 📖 Consists of a water soluble block copolymer and at least one water insoluble associative gelling adjuvants
- ✂ Delivers salicylic acid in water without use of alcohol or any other solvents
 - 📖 Alcohol-free or solvent-free formulations
- ✂ Forms clear & transparent solution or hydrogel in water
- ✂ Stable without recrystallization or discoloration in water
- ✂ Clinically proven non-irritating at 2% Salicylic acid concentration for leave-on product at low pHs (2 ~ 3)
 - 📖 Enhanced efficacy at low pHs (< 3)
- ✂ Suitable for various cosmetic, personal care, and pharmaceutical applications and is very effective in reducing blemishes, soothing inflammation, and accelerating skin's clarifying process

SupraSalix Product Line

SupraSalix-S

- ✗ Forms a clear and transparent solution in water
- ✗ Without use of alcohol or any other solvents
- ✗ Stable without recrystallization or discoloration
- ✗ Unbuffered at pH < 3

SupraSalix-G

- ✗ Forms a clear and transparent hydrogel
- ✗ Without use of alcohol or any other solvents
- ✗ Stable without recrystallization or discoloration
- ✗ Unbuffered (pH < 3)
- ✗ Passed ICH 6 month stability & real shelf life for 3 over years

WOW!
Gels at pH < 3 ?
Who else can do it?



Benefits of SupraSalix

Added consumer benefits

- ✂ Soft & smooth skin right after first application
- ✂ Reduces fine lines and wrinkles
- ✂ Reduces redness & builds collagen
- ✂ Controls oil , unclogs and makes pore less visible
- ✂ Enhances skin cell turnover; creates radiant, and even skin tone
- ✂ Long last all day wear
- ✂ Clinically proven non-irritating at low pHs
- ✂ Solvent-free formulation

Formulation and processing benefits

- ✂ Water soluble supramolecular Salicylic acid for easy formulation and processing
- ✂ Clear & transparent solution or hydrogel
- ✂ Stable without recrystallization or discoloration
- ✂ Freedom of formulation
 - 📖 Either unbuffered or buffered formulation
 - 📖 Either aqueous solution or hydrogel


Potential Applications

📖 Salicylic acid is a multi-functional active ingredients



- ✂ Anti-aging cream, lotion or gel (0.5 ~ 2.0% salicylic acid)
 - 📖 Sheds off dead skin cells and enhance skin cell turnover
 - 📖 Reduces fine lines and wrinkles
 - 📖 Improves overall appearance of the skin texture
- ✂ Skin toner (up to 2% salicylic acid)
 - 📖 Balance skin pH, moisturizing, oil control, & makes pores less visible
- ✂ Shampoo (up to 3% salicylic acid)
 - 📖 Anti-dandruff, anti-itching, clear pores, and oil control
- ✂ Cleanser & soap bar (up to 3% salicylic acid)
 - 📖 Antibacterial and skin care
- ✂ Shaving cream or gel (up to 3% salicylic acid)
 - 📖 Anti-inflammatory, anti-itching, helps to prevent acne bumps and smooth skin
- ✂ And etc.

Use of SupraSalix

Manufacture

-  Existing production equipment
-  Simple production scale up

Regulations

-  2% salicylic acid for leave-on products
-  3% salicylic acid for rinse-off products

Intellectual property

-  Granted US patent
-  Free to enter the market

Clinical Study

Human Repeat Insult Patch Test (RIPT)

📖 RIPT in US

- ✂ 2% salicylic acid
- ✂ Clear & transparent hydrogel
- ✂ pH=2.6
- ✂ 50 subjects

📖 Tests show there are no identifiable signs or symptoms of primary irritation or sensitization noted

📖 Close Human Skin Patch Test in China

- ✂ 2% salicylic acid
- ✂ Clear & transparent hydrogel
- ✂ pH=2.8
- ✂ 30 subjects

📖 Tests show there are no identifiable signs or symptoms of primary irritation or sensitization noted

Thanks

Contact

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