



Salicylic acid and its use in cosmetology

Kwas salicylowy i jego wykorzystanie w kosmetologii

ABSTRACT

Salicylic acid is an organic compound with multiple functions in cosmetics.

The article aimed to discuss the wide range of applications of salicylic acid, with particular emphasis on its role in the cosmetic industry. Its effects in cosmetology were described in detail, including its use as a chemical peel in beauty salons as well as its role in the treatment of skin diseases and skin lesions. In addition, the potential side effects accompanying chemoexfoliation procedures were described.

Salicylic acid is widely used in many kinds of cosmetics. It can be used alone or in combination with other ingredients in complex therapies. It is worth noting that it not only acts as an active ingredient, but also has preservative properties.

Keywords: salicylic acid, chemical peel, chemoexfoliation, beta-hydroxy acid, cosmetology

STRESZCZENIE

Kwas salicylowy jest związkem organicznym, który w kosmetyce znajduje wiele zastosowań.

Celem pracy było omówienie szerokiego zakresu zastosowań kwasu salicylowego, ze szczególnym uwzględnieniem jego roli w przemyśle kosmetycznym. Dokładnie opisano jego działanie w kosmetologii, włączając w to zastosowanie jako peelingu chemicznego w gabinetach kosmetycznych, a także jego rolę w terapii chorób skórnych i zmian skórnych. Ponadto, zostały opisane potencjalne działania niepożądane towarzyszące zabiegom chemoeksfoliacji.

Kwas salicylowy jest szeroko stosowany w wielu kosmetykach. Może być używany samodzielnie lub w połączeniu z innymi składnikami w kompleksowych terapiach. Warto podkreślić, że nie tylko pełni rolę substancji aktywnej, ale również ma właściwości konserwujące.

Słowa kluczowe: kwas salicylowy, peeling chemiczny, chemoeksfoliacja, beta-hydroksykwas, kosmetologia

INTRODUCTION

Salicylic acid (SA) is an organic compound that has been used for many years in the chemical industry and in medicine. It is extracted naturally from the bark of white willow, birch leaves, and a variety of species of the savoy tree. It was first isolated in 1828. However, the primary evidence that salicylic acid could be used by humans was discovered in the dental plaque of Neanderthal fossils from the El Sidron cave. Remnants of poplar bark were discovered in these fossils, which may have indicated that poplar bark was chewed to relieve pain caused by periodontal inflammatory lesions.

Salicylic acid is a signalling molecule involved in the physiological processes of many plants. It has been shown to activate plant defence mechanisms in response to biotic and abiotic factors, among which are reactive oxygen species. Salicylic acid activates key antioxidant enzymes, i.e. superoxide dismutase (SOD), ascorbate peroxidase (APX) and glutathione reductase (GR), as well as non-enzymatic antioxidants such as glutathione and acetylsalicylic acid. It also influences the regulation of sulphur uptake, thus affecting the synthesis of cysteine, methionine, heavy metal chelates, coenzymes, and vitamins [1, 2].



In medicine, salicylic acid derivatives are used primarily in the treatment of rheumatic and cardiovascular complaints. One of the best-known drugs containing its derivative, acetylsalicylic acid, is aspirin. Salicylic acid is also used in medicine to treat skin diseases and lesions [3-6].

In cosmetic surgeries, chemical peels, i.e. exfoliating treatments using salicylic acid, are performed. Due to its keratolytic and antibacterial effects, it is particularly recommended for oily, seborrhoeic, acne-prone skin, hyperpigmentation, and in slowing down the processes associated with skin ageing. It is equally effective in the treatment of inflammatory lesions, irritation, or sun damage. In cosmetic products, this acid can act not only as an active ingredient but also as a preservative [3, 7-12].

CHEMICAL STRUCTURE

Salicylic acid is the main representative belonging to the beta-hydroxy acids (BHA). It is an active secondary metabolite in plants and in organisms such as bacteria and fungi. It is an important phytohormone for the plant organism, which regulates many metabolic pathways and physiological processes such as growth, stress resistance, and resistance against pathogens. As a chemical compound, it has both a hydroxyl group (-OH) attached to the beta carbon atom and a carboxyl group (-COOH) in its molecule (Figure 1). It belongs to acids, but also to alcohols, so it is able to undergo reactions specific to both groups [3, 6, 9, 10].

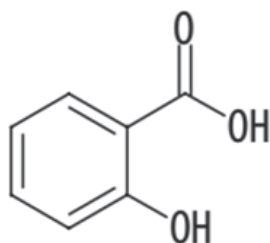


Figure 1: Schematic diagram of the chemical structure of the salicylic acid molecule Source: [2].

The most common method to obtain salicylic acid is chemical synthesis from phenol by the Kolbe-Schmitt reaction discovered in 1859. The substrate of this reaction is sodium phenolate, the main product is sodium salicylate and the final product is salicylic acid. This method enables the production of this acid on an industrial scale [1, 2]. As reported in the literature, salicylic acid has also been synthesised from natural wintergreen oil according to the principles of so-called 'green chemistry' [4].

PHYSICOCHEMICAL PROPERTIES

Salicylic acid finds its natural source in the bark and root of white willow (*Salix alba*). As a plant bioactive substance, it has a number of physicochemical properties, the most relevant of which, from a cosmetology point of view, are listed in Table 1.

Table 1 Physicochemical properties of salicylic acid

Parametr	Wartość
Name according to INCI	Salicylic Acid
Sum formula	C ₇ H ₆ O ₃
Molecular weight	138.13 g/mol
Physical state	Solid, needle-like crystals or powder form
Colour	White, nearly white or colourless
Odour	Odourless
Density	1.443 g/cm ³ (20°C)
Solubility	Salicylic acid is slightly soluble in water and in chloroform, tetrachloromethane and methylene chloride, while it is freely soluble in methanol, ethanol, acetone and diethyl ether
Chemical stability	Stable

Source: [3, 11]

THERAPEUTIC EFFECT

Salicylates have always attracted a lot of attention. They were the subject of much investigation until acetylsalicylic acid, a novel medication based on a salicylic acid derivative, was developed in 1897. Aspirin is mostly used as an analgesic, antipyretic, antithrombotic (including antiplatelet), and anti-inflammatory medication. [12].

In medicine, salicylic acid is most commonly used in the treatment of skin diseases and lesions that require adequate exfoliation and removal of dead epidermal cells. Psoriasis is a good example, in which salicylic acid preparations are used to eliminate scales. Keratolytic products containing salicylic acid are also used in the topical treatment of seborrhoeic dermatitis and dandruff, but also in the treatment of calluses, corns, knuckle nodules, and warts [13-16]. In addition to these properties, salicylic acid also has other actions. It can have anesthetic, anti-inflammatory, photoprotective, antiseptic, antifungal, and antibacterial effects [3].

COSMETIC EFFECTS

Salicylic acid consists of a small, lipophilic molecule, which gives it the ability to penetrate freely and rapidly into the epidermis and dissolve in fat. This acid intervenes in the stratum corneum, liquefying the intercellular cement. It influences the ionic bonds that enter between the dead cells of the epidermis, the so-called corneocytes, from the stratum corneum to the stratum spinosum. The penetration depth of salicylic acid is 0.06 mm, resulting in a superficial effect. In concentrations of up to 10%, this acid shows keratoplastic features, in concentrations higher than 10% keratolytic features, while in concentrations of 20-30% it is used in procedures performed in cosmetic salons and dermatological surgeries. In-home care, products with

salicylic acid in concentrations of 0.5-10% can be used on their own [3, 10, 17-20].

Salicylic acid also has an effect on *Cutibacterium acnes* bacteria. It penetrates the sebaceous glands and unblocks the follicle orifices, thus contributing to the reduced formation of non-inflammatory skin lesions and the alleviation of existing lesions. Salicylic acid reduces sebum secretion by sebaceous glands, reduces dilated pores on the skin, and is also responsible for regulating epidermal exfoliation. The exfoliation of the epidermis ensures the regeneration of the skin, as well as its reconstruction through the formation of new cells. The skin becomes oxygenated, nourished, as well as moisturised through increased collagen, which contributes to a shallowing of wrinkles and scars. Salicylic acid also reduces the appearance of hyperpigmentation as a result of reduced melanin production in the skin, which is why it is often used in the treatment of photodamage to the skin, the levelling of freckles and lentiginos [3, 8, 10, 18, 19].

In addition, the use of salicylic acid facilitates the penetration of other active ingredients applied to the skin.

INDICATIONS AND CONTRAINDICATIONS FOR TREATMENT WITH SALICYLIC ACID

Indications for exfoliation with salicylic acid:

- acne vulgaris (also in active form): papulopustular, comedonal and papulopustular;
- rosacea;
- shallow wrinkles and scars (pigmented and atrophic), stretch marks, premature ageing,
- rough skin, inflexible, low firmness;
- melasma, lentiginos, freckles, sun damage, post-sun and post-inflammatory hyperpigmentation;
- enlarged pores, keratosis, seborrhoea;
- various skin types: oily skin, combination skin, impure skin, mature skin, seborrhoeic skin;
- psoriasis [3, 17, 19, 21-23].

Relative contraindications to exfoliation with salicylic acid:

- medications used (anti-inflammatory drugs, antibiotics, diuretics, cardiovascular drugs, steroids, contraceptive drugs);
- supplementation of herbs e.g. chamomile, St. John's wort;
- skin diseases, e.g. atopic dermatitis, rosacea;
- long-term sinusitis;
- frostbite;
- tannorexia;
- atrophy and atrophy of the sebaceous glands;
- use of intoxicants, i.e. drugs, alcohol, smoking;
- permanent exposure of the skin to sunlight;
- other recent treatments that interfere with a chemical peel;
- a season of the year (spring, summer), due to the possibility of sunburn or hyperpigmentation (applies to high concentrations of acid used) [3, 17, 20].

Absolute contraindications to exfoliation with salicylic acid are:

- active viral, bacterial and fungal infections;
- active herpes;
- pregnancy and lactation;
- hypersensitivity and allergy to salicylic acid and salicylates;
- severe redness and irritation of the skin and fresh wounds/cuts/abrasions;
- presence and tendency towards keloids/scar formation;
- taking isotretinoin orally and up to 6 months after treatment;
- use of antidepressants and photosensitisers;
- the presence of HIV virus;
- chemotherapy and liver and kidney disorders;
- phototherapy;
- emotional problems, mental illnesses such as depression;
- the presence of conditions associated with an abnormal healing process, e.g. diabetes and autoimmune diseases [3, 17-20].

TREATMENT PROCEDURE FOR SALICYLIC ACID EXFOLIATION

Before starting the chemoexfoliation procedure, a detailed interview with the client should be carried out and a written consent should be prepared. It is also possible, with the client's consent, to take a photograph of the skin in order to compare the effects. It is also important to remember to prepare the workstation appropriately [3, 18, 23].

The client should also follow certain recommendations before the treatment. They should not sunbathe, depilate, wax or do perms. It is necessary to ensure that the skin is properly moisturised. It is recommended to use UV filters, cosmetics with a similar pH to the skin reaction, and antiviral drugs in case of herpes outbreaks [3, 10].

Once contraindications to the procedure have been ruled out, a make-up removal, cleansing, analysis of the skin, followed by degreasing of sebum and possibly disinfection should be proceed. Next, in some cases, it is advisable to apply a pre-peel to the face, which facilitates even penetration of the acid and may also have a degreasing effect [10, 17, 18].

Subsequently, the wings of the nose, the redness of the lips, the eyes and the eyebrows should be protected with a small amount of petroleum jelly applied with a cotton bud. The eye area can also be protected with a cotton swab soaked in water. Clients with contact lenses should remember to remove them before treatment [10, 17].

The application of the acid with a fan brush should start from the forehead and gradually apply to the other parts of the face (left and right cheeks, chin), neck and décolleté. After application of the acid to the skin, a precipitation whitish colour can be observed, which occurs due to the precipitation of acid crystals.

Table 2 Recommendations after chemoexfoliation treatment

What is recommended after treatment?	What should not be done after the procedure?
The use of creams with high UV filters, min. 30 SPF and moisturising creams.	Do not detach/pluck the detached skin flaps.
Use of gentle skin care and cleansing products.	Do not use home peelings, exfoliating products or rub your face with a towel.
A few days or more after the treatment, cosmetic products can be used again.	After the treatment, do not use new products containing active ingredients other than those found in the preparations used so far.
If changes such as swelling, redness, irritation or burning occur on the skin, a hydrocortisone product should be applied to the skin. This product can be used to alleviate lesions and as a prophylactic measure to avoid the appearance of post-inflammatory hyperpigmentation.	Physical activities, saunas and swimming pools are not allowed immediately and up to two days after the treatment. It is also not allowed to use waxing or depilation. Hair colouring and permanent make-up are also not recommended.

Source: [3, 18]

It is recommended to ask the client about feelings during the procedure. Normal sensations include anaesthesia and an unpleasant smell. When undesirable changes begin to appear on the skin or the client starts to complain of discomfort from the acid, the skin should be washed with water.

Salicylic acid does not require neutralisation. Once precipitation has occurred, the residual substance should be removed with water [3, 18].

Afterwards, the skin should be dried, and toned, a suitable mask can be applied, e.g. with a soothing effect, followed by application of a high sunscreen with no less than 30 SPF [10, 17, 18].

After the treatment, the client should be informed about the post-treatment recommendations (Table 2) and the frequency of treatments every 2-3 weeks for 3 months and a booster treatment once a month for 6 months [18].

JESSNER PEEL

Salicylic acid is also used to create compound peels, such as the Jessner peel. This peel is a mixture of salicylic acid (14 g), resorcinol (14 g) and lactic acid (14 g) in 95 % ethanol. Salicylic acid, as the lipophilic component of the mixture, removes intracellular lipids that are connected via covalent bonds to the cells of the stratum corneum. Rezorcinol damages the hydrogen bonds of keratin proteins, while lactic acid causes the detachment of corneocytes and consequently exfoliation of the stratum corneum. It is also possible to use a modified Jessner peel, which is a mixture of salicylic acid (17 g), lactic acid (17 g), and citric acid (8 g) in 95 % ethanol [18].

Indications for Jessner's peel are mainly hyperpigmentation, shallow wrinkles, acne vulgaris, and seborrhoea. Con-

traindications for the procedure are the same as for salicylic acid chemoexfoliation [18, 22].

The given procedure is performed in a similar manner to salicylic acid exfoliation. The only difference is the method of application of the peel. The Jessner peel can be applied to the skin in layers. The maximum amount of Jessner peel that can be applied to the skin is 8 layers. However, it is important to ensure that an adequate interval of 3 to 10 minutes is maintained between the applied layers. The given solution has the ability to penetrate even into the papillary layer of the dermis [18, 19, 22].

SALICYLIC ACID IN COSMETICS

Salicylic acid is not only used in cosmetics as an active ingredient but also as a preservative, due to its bactericidal and fungicidal properties. It preserves the cosmetic during and after production in a microbiologically unaltered state. It lowers the pH of the product to a point in which microorganisms are unable to grow. Salicylic acid as a preservative can be present in cosmetics in a maximum concentration of up to 0.5% [24-26].

According to Commission Regulation (EU) 2019/1966 of 27 November 2019, salicylic acid must not be present in cosmetic products for children under 3 years of age left on the skin. In other cosmetic products (with the exception of eye shadows, eyeliners, lipsticks, mascara, body lotions, and roll-on deodorants), salicylic acid and its derivatives may be present in concentrations of up to 2%, and in hair rinse cosmetics in concentrations of up to 3% [27].

SIDE EFFECTS OF SALICYLIC ACID

Complications following treatments with very superficial or superficial acids are very rare. Obstacles following chemoexfoliation treatments include:

- exacerbation of acne lesions and formation of prosacchiae;
- wounds, scabs, scars;
- hyperpigmentation and discolouration;
- activation of the herpes virus;
- hypersensitivity to cold and light;
- allergic reactions;
- contact dermatitis;
- demarcation lines;
- telangiectasias;
- permanent skin damage;
- swelling
- erythema;
- pruritus [3, 10, 17, 20].

SUMMARY

Salicylic acid is a widely used hydroxy acid in cosmetology, as well as in chemistry and medicine. It is employed in a variety of procedures intended to remove skin lesions, including illnesses, because of its advantageous benefits. Salicylic acid is most often applied as a chemical peel in cosmetology for

oily, seborrheic, acne-prone, mature, and photo-aged skin. This acid may be used either on its own or in more intricate peels like Jessner's peel.

Currently, there is a wide range of products on the market that contain salicylic acid. For safety reasons, salicylic acid must be used in specific concentrations in certain product groups. It is also worth noting that salicylic acid in cosmetics acts not only as an active substance, but also as a preservative.

REFERENCES / LITERATURA

1. Bano K, Kumar B, Alyemeni MN, Ahmad P. Exogenously-Sourced Salicylic Acid Imparts Resilience towards Arsenic Stress by Modulating Photosynthesis, Antioxidant Potential and Arsenic Sequestration in Brassica napus Plants. *Antioxidants*. 2022;11(10):2010. <https://doi.org/10.3390/antiox11102010>
2. Singh S. Salicylic acid elicitation improves antioxidant activity of spinach leaves by increasing phenolic content and enzyme levels. *Food Chemistry Advances*. 2023;2:100156. <https://doi.org/10.1016/j.focha.2022.100156>
3. Stasiorowska S, Rodak I. Chemoeksfoliacja w gabinecie kosmetycznym. *Kosmetologia Estetyczna*. 2020;9(2):199-210.
4. Özokan G, Sağır T, Emekli Alturfan E. Synthesis of Natural Salicylic Acid as a Cosmetic Ingredient Using Green Chemistry Methods. *Experimed*. 2022;12(1):12-17. <https://doi.org/10.26650/experimed.2022.1068934>
5. Maruri-Lopez I, Aviles-Baltazar N, Buchala A, Serrano M. Intra and Extracellular Journey of the Phytohormone Salicylic Acid. *Frontiers in Plant Science*. 2019;10:423. <https://doi.org/10.3389/fpls.2019.00423>
6. Mishra AK, Baek KH. Salicylic Acid Biosynthesis and Metabolism: A Divergent Pathway for Plants and Bacteria. *Biomolecules*. 2021;11(5):705. <https://doi.org/10.3390/biom11050705>
7. Randjelović P, Veljković S, Stojiljković N, et al. The Beneficial Biological Properties of Salicylic Acid. *Acta Facultatis Medicae Naissensis*. 2015;32(4):259-264. <https://doi.org/10.1515/afmnai-2015-0026>
8. Zhao Q, Dai C, Fan S, et al. Synergistic efficacy of salicylic acid with a penetration enhancer on human skin monitored by OCT and diffuse reflectance spectroscopy. *Scientific Reports*. 2016;6: 34954. <https://doi.org/10.1038/srep34954>
9. Marzec A. *Chemia kosmetyków: surowce, półprodukty, preparatyka wyrobów*. Toruń: TNOiK Dom Organizatora; 2009.
10. Kołodziejczak A. Peelingi chemiczne. In: Kołodziejczak A. *Kosmetologia T. 2*. Warszawa: Wyd. PZWL; 2019:514-524.
11. Karta charakterystyki substancji chemicznej, Zgodna z Rozporządzeniem (WE) nr 1907/2006 (REACH), Załącznik II oraz Rozporządzeniem (WE) nr 1272/2008 (CLP) – Polska, Avantor Performance Materials; 2014:1-7.
12. Szalek E. Działanie plejotropowe kwasu acetylosalicylowego. *Farmacja Współczesna*. 2015;8:52-58.
13. Nowicka D. Łuszczycyca – pielęgnacja i postępowanie w gabinecie kosmetycznym. *Kosmetologia Estetyczna*. 2018;7(5):529-532.
14. Brzezińska-Wcisło L, Wcisło-Dziadecka D, Lis-Święty A, et al. Łupież i łojotokowe zapalenie owłosionej skóry głowy – patogenesa, obraz kliniczny oraz aspekty terapeutyczne. *Post Dermatol Alergol*. 2007;24(2):59-64.
15. Rubas K, Nockowski P. Dermatozy wywołane przewlekłym działaniem czynników mechanicznych. *Kosmetologia Estetyczna*. 2018;7(1):43-49.
16. Mądry E, Gibas M, Adamczak-Ratajczak A, et al. HPV – wirus o wielu twarzach. *Family Medicine & Primary Care Review*. 2009;11(3):702-704.
17. Ząbczyńska M, Jurzak M. *Zastosowanie hydroksykwasów w kosmetologii*. Kraków: Oficyna Wydawnicza AFM; 2012.
18. Grimes PE. *Aesthetics and Cosmetic Surgery for Darker Skin Types*. Philadelphia: Lippincott Williams Wilkins; 2015:23-29.
19. Noszczyk M. *Kosmetologia pielęgnacyjna i lekarska*. Warszawa: Wyd. PZWL; 2013.
20. Kapuścińska A, Nowak I. Zastosowanie kwasów organicznych w terapii trądziku i przebarwień skóry. *Postępy Higieny i Medycyny Doświadczalnej*. 2015;69:374-383. <https://doi.org/10.5604/17322693.1145825>
21. Goliszewska A, Gromek M, Padlewska K, et al. *Kosmetologia pielęgnacyjna*. Warszawa: WSZKiPZ; 2014.
22. Kaniewska M. *Kosmetologia podstawy*. Warszawa: WSiP; 2011.
23. Adamski Z, Kaszuba A. *Dermatologia dla kosmetologów*. Wrocław: Edra Urban & Partner; 2010.
24. Cira A, Jurzak M, Drąg J. *Substancje w preparatach do pielęgnacji cery trądzikowej*. Kraków: Oficyna Wydawnicza AFM; 2013.
25. Zasada M. Substancje biologicznie czynne stosowane w rozjaśnianiu hiperpigmentacji skóry. *Kosmetologia Estetyczna*. 2016;5(5):467-473.
26. Miranowska-Dzierżawska K. Substancje konserwujące stosowane w przemyśle kosmetycznym. *Bezpieczeństwo Pracy: nauka i praktyka*. 2017;11:16-20.
27. Rozporządzenie Komisji (UE) 2019/1966 z dnia 27 listopada 2019 r. w sprawie zmiany i sprostowania załączników II, III i V do rozporządzenia Parlamentu Europejskiego i Rady (WE) nr 1223/2009 dotyczącego produktów kosmetycznych. Dziennik Urzędowy Unii Europejskiej.

received / otrzymano: 11.02.2023 | corrected / poprawiono: 22.02.2023 | accepted / zaakceptowano: 01.03.2023