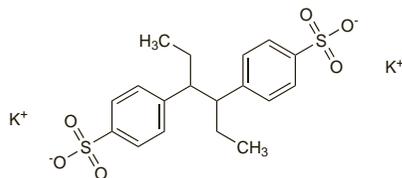


Sigetin

Sygethin. Dipotassium meso-3,4-Bis(p-sulfophenyl)hexane.

Сигетин

$C_{18}H_{20}O_6S_2K_2 = 474.7$.
CAS — 13517-49-2.



Profile

Sigetin is an analogue of hexestrol (p.2109) but is reported to have no oestrogenic activity. It is used in the management of menopausal symptoms in a usual oral daily dose of 100 to 200 mg.

Sigetin is also reported to enhance the action of oxytocin and to improve placental blood flow and has been given intravenously or intramuscularly in the active management of labour and for threatened intra-uterine fetal asphyxia.

Preparations

Proprietary Preparations (details are given in Part 3)

Rus.: Sagenit (Саренит).

Silver

Argent; Argentum; E174; Plata; Silber.

Ag = 107.8682.
CAS — 7440-22-4.
ATC — D08AL30.
ATC Vet — QD08AL30.

Profile

Silver is a pure white, malleable and ductile metal. It possesses antibacterial properties and is used topically either as the metal or as silver salts. It is not absorbed to any great extent and the main problem associated with the metal is argyria, a grey discoloration of the tissues. Silver is also present as the core in some copper-wound plastic intra-uterine contraceptive devices. Silver is used as a colouring agent for some types of confectionery.

Salts or compounds of silver that have been used therapeutically include silver acetate (p.2387), silver allantoate and silver zinc allantoate, silver borate, silver carbonate, silver chloride, silver chromate, silver glycerolate, colloidal silver iodide, silver lactate, silver manganite, silver nitrate (p.2387), silver-nylon polymers, silver protein (p.2387), and sulfadiazine silver (p.337).

Homeopathy. Silver has been used in homeopathic medicines under the following names: Argentum metallicum; Arg. met.

Silver chloride has been used in homeopathic medicines under the following names: Argentum muriaticum; Arg. mur.

Silver cyanide has been used in homeopathic compounds under the following names: Argentum cyanatum; Arg. cy.

Silver iodide has been used in homeopathic medicines under the following names: Argentum iodatum; Arg. iod.

Argyria. Argyria (generalised argyrosis), characterised by a slate, blue-grey discoloration of the skin, sclera, mucosal surfaces, and nails, developed in a patient who had used vasoconstrictor nasal drops containing silver protein for 4 years. The colour changes were most obvious in skin exposed to the sun. Argyria is irreversible and withdrawal of the nasal drops and use of other measures such as use of sun block and chemical peeling had little effect in this patient.¹

1. Tomi NS, *et al.* A silver man. *Lancet* 2004; **363**: 532.

Catheter care. The benefits of silver coated or impregnated catheters in preventing or reducing urinary-tract infection are uncertain, and studies have provided conflicting evidence. Some¹ consider that the benefits are statistically insignificant. However, a meta-analysis² involving 8 studies with a total of 2355 patients concluded, despite some concerns about the quality and heterogeneity of the studies, that there was a benefit, but that silver alloy coated catheters were significantly more effective in preventing urinary-tract infections than were those coated with silver oxide.

1. Reiche T, *et al.* A prospective, controlled, randomized study of the effect of a slow-release silver device on the frequency of urinary tract infection in newly catheterized patients. *BJU Int* 2000; **85**: 54-9.

2. Saint S, *et al.* The efficacy of silver alloy-coated urinary catheters in preventing urinary tract infection: a meta-analysis. *Am J Med* 1998; **105**: 236-41.

Wound healing. Silver is incorporated into topical dressings for wound care although a systematic review¹ of 3 randomised controlled studies found insufficient evidence to support the use of silver-containing dressings or other formulations for the treatment of infected or contaminated wounds. Bacterial resistance to silver can occur, but this risk can be minimised by choosing

dressings that release high levels of silver ions and have a rapid bactericidal action.²

The mechanism of bactericidal action of silver in dressings is that silver atoms are oxidised and slowly released as positively charged silver cations when in contact with fluid. The silver ions bind to and disrupt bacterial cell walls as well as binding to bacterial enzymes and DNA. A nanocrystalline silver coating to the dressing increases the surface area of exposure and facilitates release of silver ions. Silver can also be incorporated as complex silver molecules in various different topical formulations that regulate the speed of delivery.¹ Proposed mechanisms of silver resistance have been plasmid acquisition and gene mutation.²

1. Vermeulen H, *et al.* Topical silver for treating infected wounds. Available in The Cochrane Database of Systematic Reviews; Issue 1. Chichester: John Wiley; 2007 (accessed 24/06/08).

2. Chopra I. The increasing use of silver-based products as antimicrobial agents: a useful development or a cause for concern? *J Antimicrob Chemother* 2007; **59**: 587-90.

Preparations

Proprietary Preparations (details are given in Part 3)

Bras.: Ultradrina†; **Fr.:** Micropur†; **Ger.:** Contreet; **Ital.:** Acticoat; Katomed; **UK:** Avance; Contreet.

Multi-ingredient: **Arg.:** Efofid†; Nova-T; **Canad.:** Nova-T; **Chile:** Nova-T†; **Fr.:** Actisorb Ag; Aqualac Ag; Biatain Argent; Micropur Forte DCCNa; Nova-T; Oligorhine; Release Ag; **Ger.:** Actisorb Silver†; Nova-T; **Hong Kong:** Nova-T; **Indon.:** Nova-T; **Irl.:** Actisorb Silver; **Israel:** Neocutan Silver; Nova-T; **Ital.:** Actisorb Plus; Agipiur†; Aqualac Ag; Katoxym; Nova-T; **Silvercel;** Silverdres; Vulnopur; **Malaysia:** Nova-T; **Mex.:** Nova-T; **Neth.:** Nova-T†; **NZ:** Nova-T; **S.Afr.:** Nova-T; **Singapore:** Nova-T; **Spain:** Argentocrom†; **Switz.:** Argent†; Gyrosan†; Nova-T; **Thai:** Nova-T†; **Turk.:** Nova-T; **UK:** Actisorb Silver; Nova-T; **Venez.:** Nova-T.

Silver Acetate

Argentum Acetas; Plata, acetato de.

$C_2H_3AgO_2 = 166.9$.
CAS — 563-63-3.

Profile

Silver acetate has been used similarly to silver nitrate as an antiseptic. It has also been used in antismoking preparations.

Smoking cessation. References.

1. Lancaster T, Stead LF. Silver acetate for smoking cessation. Available in The Cochrane Database of Systematic Reviews; Issue 3. Chichester: John Wiley; 1997 (accessed 12/04/06).

Silver Nitrate

Argent, nitrate d; Argenti nitras; Dusičnan stříbrný; Ezüst-nitrát; Gümüş Nitrat; Hopeanitraatti; Nitrate de Plata; Nitrate de Prata; Plata, nitrate de; Sidabro nitratas; Silvernitrát; Srebra azotan.

$AgNO_3 = 169.9$.
CAS — 7761-88-8.
ATC — D08AL01.

ATC Vet — QD08AL01.

Pharmacopoeias. In *Eur.* (see p.vii), *Int.*, *Jpn*, *US*, and *Viet*.

Ph. Eur. 6.2 (Silver Nitrate). A white or almost white, crystalline powder or transparent colourless crystals. Very soluble in water; soluble in alcohol. Store in nonmetallic containers. Protect from light.

USP 31 (Silver Nitrate). Colourless or white crystals. On exposure to light in the presence of organic matter, it becomes grey or greyish-black. Soluble 1 in 0.4 of water, 1 in 0.1 of boiling water, 1 in 30 of alcohol, and 1 in 6.5 of boiling alcohol; slightly soluble in ether. Its solutions in water have a pH of about 5.5. Store in airtight containers. Protect from light.

Incompatibility. Silver nitrate is incompatible with a range of substances. Although it is unlikely that there will be a need to add any of the interacting substances to silver nitrate solutions considering its current uses, pharmacists should be aware of the potential for incompatibility.

The reported yellow-brown discoloration of samples of silver nitrate bladder irrigation (1 in 10 000) probably arose from the reaction of the silver nitrate with alkali released from the glass bottle which appeared to be soda-glass.¹

1. *PSGB Lab Report P/80/6* 1980.

Adverse Effects

Symptoms of poisoning stem from the corrosive action of silver nitrate and include pain in the mouth, sialorrhoea, abdominal pain, diarrhoea, vomiting, coma, and convulsions.

Short-term mild conjunctivitis is common in infants given silver nitrate eye drops; repeated use or the use of high concentrations produces severe damage and even blindness. Chronic application to the conjunctiva, mucous surfaces, or open wounds leads to argyria (see Silver, above), which though difficult to treat is mainly a cosmetic hazard.

Although silver nitrate is not readily absorbed, absorption of nitrate after reduction of nitrate may cause methaemoglobinemia. There is also a risk of electrolyte disturbances.

Effects on the eyes. Silver nitrate from a stick containing 75% was applied to the eyes of a newborn infant instead of a 1% solution.¹ After 1 hour there was a thick purulent secretion, the eyelids were red and oedematous, and the conjunctiva markedly injected. The corneas had a blue-grey bedewed appearance with

areas of corneal opacification. After treatment by lavage and topical application of antibacterials and homatropine 2% there was a marked improvement and after 1 week topical application of corticosteroids was started. Residual damage was limited to slight corneal opacity.

1. Hornblase A. Silver nitrate ocular damage in newborns. *JAMA* 1975; **231**: 245.

Uses and Administration

Silver nitrate possesses antiseptic properties and is used in many countries as a 1% solution for the prophylaxis of gonococcal ophthalmia neonatorum (see Neonatal Conjunctivitis, p.180). However, as it can cause irritation, other drugs are often used.

In stick form it has been used as a caustic to destroy warts (p.1584) and other small skin growths. Compresses soaked in a 0.5% solution of silver nitrate have been applied to severe burns to reduce infection. Solutions have also been used as topical antiseptics and astringents in other conditions. Instillation of silver nitrate solution has been investigated for pleurodesis in the management of malignant effusions.

Silver nitrate has been used in cosmetics to dye eyebrows and eye lashes.

Homeopathy. Silver nitrate has been used in homeopathic medicines under the following names: Argent. Nit; Argentii nitras; Argentum nitricum; Arg. nit.

References.

- van Hasselt P, Guddé H. Randomized controlled trial on the treatment of otitis externa with one per cent silver nitrate gel. *J Laryngol Otol* 2004; **118**: 93-6.
- Dalela D, *et al.* Silver nitrate sclerotherapy for 'clinically significant' chyluria: a prospective evaluation of duration of therapy. *Urol Int* 2004; **72**: 335-40.
- da Silveira Paschoalini M, *et al.* Prospective randomized trial of silver nitrate vs talc slurry in pleurodesis for symptomatic malignant pleural effusions. *Chest* 2005; **128**: 684-9.
- Alidaee MR, *et al.* Silver nitrate cautery in aphthous stomatitis: a randomized controlled trial. *Br J Dermatol* 2005; **153**: 521-5.

Preparations

BP 2008: Sterile Silver Nitrate Solution;

USP 31: Silver Nitrate Ophthalmic Solution; Toughened Silver Nitrate.

Proprietary Preparations (details are given in Part 3)

Denm.: Helvedstensis†; **Lapis. Ger.:** Mova Nitrat; **Pol.:** Mova Nitrat; **Port.:** Argenpal†; **Spain:** Argenpal.

Multi-ingredient: **Austral.:** Super Banish†; **Spain:** Argentofenol†; **UK:** Avoca.

Silver Protein

Albumosesilber; Argent, protéinate d; Argentoproteinum; Argentum proteicum; Argentum Proteinicum; Hopeaproteini; Plata, proteína de; Protargolum; Proteinato de Plata; Proteinato de Prata; Silverprotein; Srebra proteinicum; Strong Protargin; Strong Protein Silver; Strong Silver Protein.

CAS — 9007-35-6 (colloidal silver); 9015-51-4 (silver protein).

NOTE. Synonyms for mild silver protein include: Argentoproteinum Mite; Argentum Vitellinum; Mild Protargin; Mild Silver Protein; Silver Nucleinate; Silver Vitellin; Vitelinato de Plata and Vitelinato de Prata.

Pharmacopoeias. In *It.*, *Jpn*, and *Viet*.

Eur. (see p.vii) includes Silver, Colloidal, for External Use.

Ph. Eur. 6.2 (Silver, Colloidal, for External Use; Argentum Colloidal ad Usum Externum). It is colloidal metallic silver, containing protein. It contains 70.0 to 80.0% of Ag, calculated with reference to the dried substance. Green or bluish-black, metallic, hygroscopic, shiny flakes or powder. Freely soluble or soluble in water; practically insoluble in alcohol and in dichloromethane. Store in airtight containers.

Profile

Silver protein solutions have antibacterial properties, due to the presence of low concentrations of ionised silver, and have been used as eye drops and for application to mucous membranes. The mild form of silver protein is considered to be less irritating, but less active.

Colloidal silver, which is also a preparation of silver in combination with protein, has also been used topically for its antibacterial activity.

Homeopathy. Silver protein has been used in homeopathic medicines under the following names: Argentum colloidal.

Adverse effects. Irreversible neurotoxicity associated with the daily ingestion of a home-made colloidal silver drink for 4 months developed in an elderly patient.¹ He presented with myoclonic status epilepticus, then entered into a prolonged coma, and eventually died of pneumonia some months later. On admission, high levels of silver were found in the plasma, erythrocytes, and CSF, and at autopsy there was evidence of selective silver accumulation in the brain. As of October 2007, four reports of silver toxicity in patients ingesting home-made products, likewise prepared using a colloidal silver generator, had also been received by the Australian Adverse Drug Reactions Advisory Committee (ADRAC);² one patient also applied it topically after shaving. All patients had high plasma-silver concentrations and