Naftalofos *(BAN, USAN, rINN)*

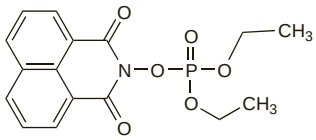
Bay-9002; E-9002; ENT-25567; Naftalofós; Naftalofosum; Naphthalophos; Phthalophos; S-940. Diethyl naphthalimido-oxyphosphonate.

Нафталофос

$C_{16}H_{16}NO_6P$ = 349.3.

CAS — 1491-41-4.

ATC Vet — QP52AB06.



Profile
Naftalofos is an organophosphorus compound (see Organophosphorus Insecticides, p.2047) used as an anthelmintic in veterinary medicine.

Netobimin *(BAN, USAN, rINN)*

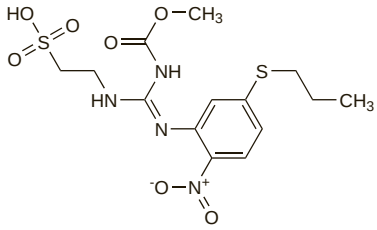
Netobimina; Nétobimine; Netobiminum; Sch-32481. 2-{3-Methoxycarbonyl-2-[2-nitro-5-(propylthio)phenyl]guanidino}ethanesulphonic acid.

Нетобимин

$C_{14}H_{20}N_4O_7S_2$ = 420.5.

CAS — 88255-01-0.

ATC Vet — QP52AC06.



Profile
Netobimin is an anthelmintic used in veterinary medicine.

Niclosamide *(BAN, USAN, rINN)*

Anhydrous Niclosamide; Bay-2353; Niclosamida; Niclosamida Anidra; Niclosamide anhydre; Niclosamidum; Niclosamidum anhydricum; Niklosamid; Niklosamid, vattenfri; Niklosamidi; Niklosamidi, vedetön; Niklozamid; Niklozamid bezwodny; Niklozamidas, bevandenis; Phenasale; Vízmentes niklozamid. 2′,5-Dichloro-4′-nitrosalicylanilide; 5-Chloro-*N*-(2-chloro-4-nitrophenyl)-2-hydroxybenzamide.

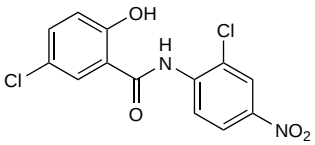
Никлозамид

$C_{13}H_8Cl_2N_2O_4$ = 327.1.

CAS — 50-65-7.

ATC — P02DA01.

ATC Vet — QP52AG03.



Pharmacopoeias. In *Chin.* and *Eur.* (see p.vii).
Int. permits the anhydrous substance or the monohydrate under the title Niclosamide.
Ph. Eur. 6.2 (Niclosamide, Anhydrous). Yellowish-white to yellowish, fine crystals. Practically insoluble in water; slightly soluble in dehydrated alcohol; sparingly soluble in acetone. Store in airtight containers. Protect from light.

Niclosamide Monohydrate *(BANM)*

Niclosamida Mono-hidratada; Niclosamida monohidrato; Niclosamide monohydraté; Niclosamidum monohydricum; Niklosamid monohydrát; Niklosamidimonohydraatti; Niklosamid-monohydrat; Niklozamidas monohidratas; Niklozamid-monohidrát.

Никлозамид Моногидрат

$C_{13}H_8Cl_2N_2O_4,H_2O$ = 345.1.

ATC — P02DA01.

Pharmacopoeias. In *Eur.* (see p.vii).
Int. permits the monohydrate or the anhydrous substance under the title Niclosamide.
Ph. Eur. 6.2 (Niclosamide Monohydrate). Yellowish, fine crystals. Practically insoluble in water; slightly soluble in dehydrated alcohol; sparingly soluble in acetone. Protect from light.

Adverse Effects
Gastrointestinal disturbances may occur occasionally with niclosamide. Lightheadedness and pruritus have been reported less frequently.

Pharmacokinetics
Niclosamide is not significantly absorbed from the gastrointestinal tract.

Uses and Administration
Niclosamide is an anthelmintic which is active against most tapeworms, including the beef tapeworm (*Taenia saginata*), the pork tapeworm (*T. solium*), the fish tapeworm (*Diphyllobothrium latum*) and the dog tapeworm (*Dipylidium caninum*); it has also been given for infections with the dwarf tapeworm, *Hymenolepis nana*. For discussions of the treatment of tapeworm infections, see Diphyllobothriasis, p.136, Hymenolepiasis, p.136, and Taeniasis, p.139. The activity of niclosamide against these worms appears to be due to inhibition of mitochondrial oxidative phosphorylation; anaerobic ATP production is also affected.

Niclosamide is given as tablets, which must be chewed thoroughly before swallowing and washed down with water.

For infections with pork tapeworm a single 2-g dose is given after a light breakfast. Niclosamide is not active against the larval form (cysticerci) and, although the risk of inducing cysticercosis appears to be theoretical, a laxative is given about 2 hours after the dose to expel the killed worms and minimise the possibility of the migration of ova of *T. solium* into the stomach; an antiemetic may also be given before treatment.

For infections with beef or fish tapeworms the 2-g dose of niclosamide may be divided, with 1 g taken after breakfast and 1 g an hour later.

In dwarf-tapeworm infections an initial dose of 2 g has been given on the first day followed by 1 g daily for 6 days.

Children aged 2 to 6 years are given half the above doses and those under 2 years of age are given one-quarter the above doses.

Unless expulsion of the worm is aided by a laxative, portions are voided in a partially digested form after treatment with niclosamide; the scolex is rarely identifiable.

In schistosomiasis (p.138), niclosamide is used as a molluscicide in water-treatment control programmes.

Preparations
BP 2008: Niclosamide Tablets.

Proprietary Preparations (details are given in Part 3)
Belg.: Yomesan; ***Braz.:*** Atenase†; ***Cz.:*** Yomesan†; ***Denm.:*** Yomesan†; ***Fin.:*** Kontal; ***Fr.:*** Tredemine; ***Ger.:*** Yomesan; ***Gr.:*** Tredemine; Yomesan; ***India:*** Niclosan; ***Israel:*** Yomesan; ***Ital.:*** Yomesan; ***Mex.:*** Overoid; ***Neth.:*** Yomesan; ***S.Afr.:*** Yomesan; ***Swed.:*** Yomesan; ***Thai.:*** Manozide; Niclosan†; Telmitin; Unicide; Yomesan; ***Turk.:*** Yomesan; ***UK:*** Yomesan.

Multi-ingredient: ***Thai.:*** Zenda†.

Nitroscanate *(BAN, USAN, rINN)*

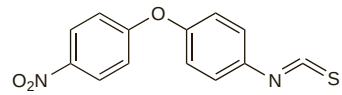
CGA-23654; Nitroscanato; Nitroscanatum; Nitroskanaatti; Nitroskanat. 4-(4-Nitrophenoxy)phenyl isothiocyanate.

Нитросканат

$C_{13}H_8N_2O_3S$ = 272.3.

CAS — 19881-18-6.

ATC Vet — QP52AX01.



Profile
Nitroscanate is an isothiocyanate anthelmintic used in veterinary medicine.

Nitroxinil *(BAN, rINN)*

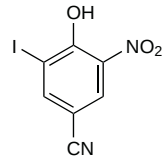
Nitroxinilo; Nitroxinilum; Nitroxynil. 4-Hydroxy-3-iodo-5-nitrobenzonitrile.

Нитроксинил

$C_7H_3IN_2O_3$ = 290.0.

CAS — 1689-89-0 (nitroxinil); 27917-82-4 (nitroxinil eglumine).

ATC Vet — QP52AG08.



Pharmacopoeias. In *BP(Vet).* Also in *Fr.* for veterinary use only.
BP(Vet) 2008 (Nitroxinil). A yellow to yellowish brown powder. Practically insoluble in water; slightly soluble in alcohol; sparingly soluble in ether; it dissolves in solutions of alkali hydroxides. Protect from light.

Profile
Nitroxinil is an anthelmintic used in veterinary medicine for the treatment of fascioliasis and some gastrointestinal roundworms in cattle and sheep.

Oxamniquine *(BAN, USAN, rINN)*

Oxamniquina; Oxamniquinum; UK-4271. 1,2,3,4-Tetrahydro-2-isopropylaminomethyl-7-nitro-6-quinolylmethanol.

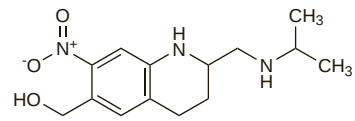
Оксамнихин

$C_{14}H_{21}N_3O_3$ = 279.3.

CAS — 21738-42-1.

ATC — P02BA02.

ATC Vet — QP52AA02.



Pharmacopoeias. In *Fr.* and *Int.*

Adverse Effects
Oxamniquine causes severe pain at the injection site when given intramuscularly and is no longer given by this route.

It is generally well tolerated after oral doses, although dizziness with or without drowsiness occurs in at least a third of patients, beginning up to 3 hours after a dose and usually lasting for up to 6 hours. Headache and gastrointestinal effects such as nausea, vomiting, and diarrhoea are also common.

Allergic-type reactions including urticaria, pruritic skin rashes, and fever may occur. Liver enzyme values have been raised transiently in some patients. Epileptiform convulsions have been reported, especially in patients with a history of convulsive disorders. Hallucinations and excitement have occurred rarely.

A reddish discoloration of urine, probably due to a metabolite of oxamniquine, has been reported.

Effects on body temperature. A review[1] in 1987 noted that although a modest post-treatment rise in temperature had been reported occasionally, fever was not a common adverse effect of oxamniquine, except in Egypt where it appeared to be characteristic. The cause was not known. Increased immune complexes and excretion of antigens occurred in only half the cases, there

was no evidence that Egyptian patients metabolised the drug differently to produce a pyrogenic metabolite, and the effect had not been seen in other areas where a similar high-dose regimen was used.[1]

1. Foster R. A review of clinical experience with oxamniquine. *Trans R Soc Trop Med Hyg* 1987; **81:** 55–9.

Effects on the nervous system. In 37 patients with *Schistosoma mansoni* infection treated successfully with oxamniquine,[1] dizziness and drowsiness were most common, but the most significant adverse effect was the development of EEG abnormalities in 6 of 34 patients whose pre-treatment EEG was normal. Of the 3 patients with pre-existing EEG abnormalities, 1 suffered a tonic-clonic seizure during therapy as previously reported,[2] 1 did not suffer seizures, and the third received phenytoin prophylaxis during oxamniquine therapy. It was considered prudent to give antiepileptics before starting oxamniquine in patients with a history of seizure disorder. After completion of this study, a patient with no history of seizures suffered a tonic-clonic seizure 2 hours after each of the second and third doses of oxamniquine.

The main neuropsychiatric adverse effects seen in 180 Brazilian patients with *Schistosoma mansoni* infection treated with single oral doses of oxamniquine were: drowsiness (50.6%), dizziness (41.1%), headache (16.1%), temporary amnesia (2.2%), behavioural disturbances (1.7%), chills (1.1%), and seizures (1.1%).[3] An EEG was performed before and after treatment in 20 patients; there were alterations in 3 but they were not associated with neuropsychiatric changes.

1. Krajden S, *et al*. Safety and toxicity of oxamniquine in the treatment of Schistosoma mansoni infections, with particular reference to electroencephalographic abnormalities. *Am J Trop Med Hyg* 1983; **32:** 1344–6.
2. Keystone JS. Seizures and electroencephalograph changes associated with oxamniquine therapy. *Am J Trop Med Hyg* 1978; **27:** 360–2.
3. de Carvalho SA, *et al*. Neurotoxicidade do oxamniquine no tratamento da infeção humana pelo Schistosoma mansoni. *Rev Inst Med Trop Sao Paulo* 1985; **27:** 132–42.

Precautions

Oxamniquine should be used with caution in patients with epilepsy or a history of convulsive disorders. Patients should be warned that oxamniquine can cause dizziness or drowsiness and if affected they should not drive or operate machinery.

Pharmacokinetics

Oxamniquine is readily absorbed after oral doses. Peak plasma concentrations are achieved 1 to 3 hours after a dose and the plasma half-life is 1 to 2.5 hours.

It is extensively metabolised to inactive metabolites, principally the 6-carboxy derivative, which are excreted in the urine. About 70% of a dose of oxamniquine is excreted as the 6-carboxy metabolite within 12 hours of a dose; traces of the 2-carboxy metabolite have also been detected in the urine.

Uses and Administration

Oxamniquine is an anthelmintic used in the treatment of schistosomiasis caused by *Schistosoma mansoni*, but not by other *Schistosoma* spp. It causes worms to shift from the mesenteric veins to the liver where the male worms are retained; the female worms return to the mesentery, but can no longer release eggs. Resistance may occur.

Oxamniquine is given orally, preferably after food. Dosage depends on the geographical origin of the infection and total doses range from 15 mg/kg as a single dose to 60 mg/kg given over 2 to 3 days. A single dose should not exceed 20 mg/kg.

Schistosomiasis. Oxamniquine is an alternative to praziquantel for the treatment of schistosomiasis (p.138) due to *Schistosoma mansoni*, although resistance has occurred, particularly in South America,[1] and it is somewhat less effective than praziquantel.[2]

The dose ranges between a single dose of 15 mg/kg and 60 mg/kg given over 2 or 3 days.[1,3] Doses in the low range have been used effectively in South America, the Caribbean, and West Africa while patients in Egypt, South Africa, and Zimbabwe require doses at the top end of the range; intermediate doses may be effective in other parts of Africa.[3]

After the appropriate therapeutic dose of oxamniquine, cure rates of at least 60%, and often more than 90%, can be expected. Egg excretion in those not cured will be reduced by over 80%, and usually by over 90%, one year after treatment.[3]

1. WHO. The control of schistosomiasis: second report of the WHO expert committee. *WHO Tech Rep Ser 830* 1993. Available at: http://libdoc.who.int/trs/WHO_TRS_830.pdf (accessed 16/07/08)
2. Ferrari ML, *et al*. Efficacy of oxamniquine and praziquantel in the treatment of Schistosoma mansoni infection: a controlled trial. *Bull WHO* 2003; **81:** 190–6.
3. WHO. The control of schistosomiasis: report of a WHO expert committee. *WHO Tech Rep Ser 728* 1985. Available at: http://libdoc.who.int/trs/WHO_TRS_728.pdf (accessed 16/07/08)

Preparations

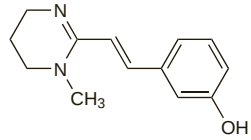
Proprietary Preparations (details are given in Part 3)
Braz.: Mansil; ***Gr.:*** Vansil†.

Oxantel Embonate *(BANM, rINNM)*

CP-14445-16; Embonato de oxantel; Oxantel, Embonate d'; Oxantel Pamoate *(USAN)*; Oxanteli Embonas. (*E*)-3-[2-(1,4,5,6-Tetrahydro-1-methylpyrimidin-2-yl)vinyl]phenol 4,4′-methylenebis(3-hydroxy-2-naphthoate).

Оксантела Эмбонат

$C_{13}H_{16}N_2O,C_{23}H_{16}O_6$ = 604.6.
CAS — 36531-26-7 (oxantel); 68813-55-8 (oxantel embonate); 42408-84-4 (oxantel embonate).
ATC — P02CC02.



(oxantel)

Profile

Oxantel is an analogue of pyrantel that has been used as the embonate in the treatment of trichuriasis. It is used with pyrantel for various intestinal nematode infections.

Preparations

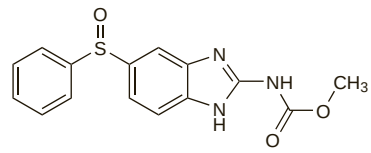
Proprietary Preparations (details are given in Part 3)
Multi-ingredient: ***Indon.:*** Quantrel; ***Philipp.:*** Quantrel; ***Venez.:*** Dualid; Quantrel.

Oxfendazole *(BAN, USAN, rINN)*

Oksfendatsoli; Oxfendazol; Oxfendazolum; RS-8858. Methyl 5-phenylsulphinyl-1*H*-benzimidazol-2-ylcarbamate.

Оксфендазол

$C_{15}H_{13}N_3O_3S$ = 315.3.
CAS — 53716-50-0.
ATC Vet — QP52AC02.



Pharmacopoeias. In *Eur.* (see p.vii) and *US* for veterinary use only.
Ph. Eur. 6.2 (Oxfendazole for Veterinary Use; Oxfendazole BP(Vet) 2008). A white or almost white powder. It shows polymorphism. Practically insoluble in water; slightly soluble in alcohol and in dichloromethane. Protect from light.
USP 31 (Oxfendazole). A white or almost white powder. Practically insoluble in water; slightly soluble in alcohol and in dichloromethane. Protect from light.

Profile

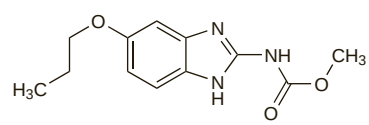
Oxfendazole is a benzimidazole carbamate anthelmintic structurally related to mebendazole (p.148). It is used in veterinary medicine.

Oxibendazole *(BAN, USAN, rINN)*

Oxibendazol; Oxibendazolum; SKF-30310. Methyl 5-propoxy-1*H*-benzimidazol-2-ylcarbamate.

Оксибендазол

$C_{12}H_{15}N_3O_3$ = 249.3.
CAS — 20559-55-1.
ATC Vet — QP52AC07.



Profile

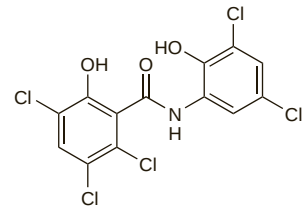
Oxibendazole is a benzimidazole carbamate anthelmintic structurally related to mebendazole (p.148). It is used in veterinary medicine.

Oxyclozanide *(BAN, rINN)*

ICI-46683; Oxiclozanida; Oxyclozanidum. 3,3′,5,5′,6-Pentachloro-2′-hydroxysalicylanilide.

Оксиклозанид

$C_{13}H_6Cl_5NO_3$ = 401.5.
CAS — 2277-92-1.
ATC Vet — QP52AG06.



Pharmacopoeias. In *BP(Vet)*.
BP(Vet) 2008 (Oxyclozanide). A pale cream or cream-coloured powder. Very slightly soluble in water; soluble in alcohol; freely soluble in acetone; slightly soluble in chloroform.

Profile

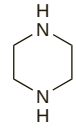
Oxyclozanide is an anthelmintic used in veterinary medicine for the control of fascioliasis in cattle and sheep.

Piperazine

Piperatsiini; Piperazin; Piperazina; Piperazinum.

Пиперазин

$C_4H_{10}N_2$ = 86.14.
CAS — 110-85-0.
ATC — P02CB01.
ATC Vet — QP52AH01.



Pharmacopoeias. In *US*.
USP 31 (Piperazine). White to off-white lumps or flakes having an ammoniacal odour. Soluble in water and in alcohol; insoluble in ether. Store in airtight containers. Protect from light.

Piperazine Adipate

Piperatsiiniadipaatti; Piperaz. Adip.; Piperazina, adipato de; Piperazinadipat; Piperazin-adipát; Pipérazine, adipate de; Piperazini adipas; Piperazino adipatas; Piperazinum Adipicum.

Пиперазина Адипат

$C_4H_{10}N_2,C_6H_{10}O_4$ = 232.3.
CAS — 142-88-1.
ATC — P02CB01.

Pharmacopoeias. In *Eur.* (see p.vii), *Int.*, *Jpn*, and *Viet*.
Ph. Eur. 6.2 (Piperazine Adipate). A white or almost white, crystalline powder. Soluble in water; practically insoluble in alcohol.

Piperazine Citrate

Hydrous Tripiperazine Dicitrate; Piperatsiinisitraatti; Piperazina, citrato de; Piperazincitrat; Piperazin-citrát; Piperazin-citrát hydrát; Pipérazine, citrate de; Piperazini citras; Piperazini Citras Hydricus; Piperazino citratas.

Пиперазина Цитрат

$(C_4H_{10}N_2)_3,2C_6H_8O_7,xH_2O$ = 642.7 (anhydrous substance).
CAS — 144-29-6 (anhydrous piperazine citrate); 41372-10-5 (piperazine citrate hydrate).
ATC — P02CB01.

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Int.*, *US*, and *Viet*.
Ph. Eur. 6.2 (Piperazine Citrate). A white or almost white granular powder. It contains a variable amount of water. Freely soluble in water; practically insoluble in alcohol.
USP 31 (Piperazine Citrate). A white, crystalline powder having not more than a slight odour. Soluble in water; insoluble in alcohol and in ether. pH of a 10% solution in water is about 5.