



**FORT DODGE®**

# Domoso®

## DIMETHYL SULFOXIDE

### Gel

### 90% Dimethyl Sulfoxide

### For Animal Use Only

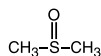
#### CAUTION

Federal law restricts this drug to use by or on the order of a licensed veterinarian.

#### GENERAL

Dimethyl sulfoxide (DMSO), an oxidation product of dimethyl sulfide, is an exceptional solvent possessing a number of commercial uses.

DMSO is the lowest member of the group of alkyl sulfoxides with a general formula of RSOR. Its structural formula is:



It freely mixes with water with the evolution of heat and lowers the freezing point of aqueous solutions. It is soluble in many other compounds including ethanol, acetone, diethyl ether, glycerin, toluene, benzene and chloroform. DMSO is a solvent for many aromatic and unsaturated hydrocarbons as well as inorganic salts and nitrogen-containing compounds. DMSO has a high dielectric constant due to the polarity of the sulfur-oxygen bond. Its basicity is slightly greater than water due to enhanced electron density at the oxygen atom. It forms crystalline salts with strong protic acids and coordinates with Lewis acids. It modifies hydrogen bonding.

DMSO is a hygroscopic stable organic liquid essentially odorless and water white in color. Other physical characteristics include:

Molecular weight	78.13
Melting point	18.45°C
Boiling point	189°C

DOMOSO Gel contains 90% dimethyl sulfoxide, carbomer 934, disodium edetate, NaOH and purified water q.s.

#### PHARMACOLOGY

The original biological applications of DMSO were primarily confined to its use in preserving various tissues and cellular elements including blood (1), blood cells and bone marrow (2), leukocytes (3), lymphocytes (4), platelets (5), spermatozoa (6, 7, 8), corneal grafts (9, 10), skin (11), tissue culture cells (12, 13, 14, 15) and trypanosomes (16), by freezing techniques. DMSO has also been investigated as a radioprotective agent (17, 18).

DMSO has been stated to increase the penetration of low molecular weight allergens such as penicillin G but not large molecular weight allergens such as house dust (19).

The rate of passage of tritiated water in the presence of DMSO on the epidermis of the hairless mouse was measured *in vitro*. DMSO did not appear to promote the passage of water by its presence, but when concentrated solutions (60% to 100%) were used, permanent changes were produced in the rate of passage of water. It was concluded that the concentration of DMSO used seemed more significant than the time of exposure in establishing the effect on the water barrier (20).

When the tails of mice were immersed in a 5% solution of various psychoactive drugs in DMSO, the drugs appeared to exert their usual pharmacological effects, indicating drug penetration as judged by the behavioral effects observed in the experimental subjects. Other solvents, including water, also appeared to permit some drug penetration in this study (21).

Using ten quaternary ammonium salts as test compounds and either water or DMSO as solvents, the oral LD<sub>50</sub> values were determined in rats and mice. Toxicity changes were obtained in some instances by 50% DMSO and more changes were observed in rats than mice although the results in the two species were not always parallel. When toxicity was altered by DMSO it increased in all instances except one (22).

When administered systemically in another study, however, various drugs dissolved in DMSO did not differ significantly in their lethality or cellular penetration as compared to the same drug administered in saline (23).

When evaluated as a solvent for biologic screening tests, low doses of hormones in DMSO stimulated a response similar to that of the hormone in the control vehicle. Higher doses of hormone, however, failed to give the expected response, suggesting a partition coefficient in favor of the solvent (24). DMSO was also shown to carry physostigmine and phenylbutazone through the skin of the rat (25).

The absorption of phenylbutazone dissolved in an aqueous solution of DMSO was impaired when administered orally to the rabbit. Absorption of the same drug was not improved using the subcutaneous route simultaneously with DMSO.

However, phenylbutazone could be detected in the rabbit's blood for several hours when an ointment containing DMSO and 5% phenylbutazone was applied to the skin. When the DMSO content of the ointment was increased, the phenylbutazone levels increased. An increase of phenylbutazone in the muscle tissues underlying the site of application over a control ointment containing phenylbutazone without DMSO could be demonstrated in rats (26).

In a number of other studies in experimental animals (21, 25, 27) where DMSO has been chiefly administered orally or by injection, no anti-inflammatory or analgesic activity could be established.

Following experimental hypersensitization to human gamma globulin in the horse, antigen challenge resulted in massive erythema, necrosis and slough. This reaction could be markedly reduced by the hourly application of undiluted DMSO to the reaction site, after challenge (19).

DMSO, by itself, at concentrations of 100%, 66% and 33% has been shown to produce neurolysis following perineural injection in the rat's sciatic nerve (28).

The conflicting reports cited above for the anti-inflammatory and analgesic properties of DMSO are partially dependent upon the experimental models and methods used to measure these parameters. DMSO fails to show analgesic or anti-inflammatory activity in certain of these situations, particularly when used by the systemic route or when administered topically preceded by an irritant substance. In clinical studies in the horse, it was noted that when iodine, liniments or other strong irritants were present on the skin from previous therapy and DMSO applied, a temporary but marked local reaction would occur. This was due to the ability of DMSO to carry these substances into the underlying skin tissues where their irritant actions could be displayed.

Using the isolated guinea pig heart it was found that DMSO did not influence the amplitude of cardiac contractions, heart rate or coronary flow, although high intravenous doses in the rat and cat resulted in a transient lowering of blood pressure (25).

Isolated, innervated guinea pig preparations were also used to study the effects of DMSO on skeletal, smooth and cardiac muscles. The compound depressed diaphragm response to both muscle and nerve stimulation and also caused spontaneous skeletal muscle fasciculations. Actual contraction amplitude was augmented although contraction rate appeared unaffected. Vagal threshold was lowered almost 50% by a bath concentration of 6%

DMSO. The fasciculations and increased tone of skeletal muscle, and lowering of the vagal threshold by DMSO could be due to cholinesterase inhibition (29). The *in vitro* oxygen consumption of liver, brain and hemidiaphragm tissues of rats is not affected by the intravenous administration of 75 mg DMSO/100 g body weight during the 7 subsequent days.

Urease, trypsin and chymotrypsin are inhibited by DMSO dependent upon its concentration. The *in vitro* metabolism of corticosterone by rat liver slices is not affected by the intravenous administration of 100 mg DMSO/100 g body weight during 3 subsequent days (30).

DMSO treatment administered intraperitoneally to rats for 35 days decreased experimentally induced intestinal adhesions by 80% over controls as compared to saline, cortisone acetate or a combination of cortisone and DMSO administered separately (31).

In rabbits the application of 70% DMSO, adjacent to but not on the wound incision site, appeared to increase the development of wound tensile strength over controls (32).

Increasing the concentration of DMSO resulted in an increasing inhibition of fibroblast proliferation, *in vitro*, which was reversible (19).

#### TOXICOLOGY

In a study designed to evaluate the effects of DOMOSO® (dimethyl sulfoxide) Solution at a total daily dose of 100–300 mL administered for a total period of 90 days, no essential or clinically meaningful ophthalmological effects were seen in the horse. There were no significant variations in glucose, sodium, potassium, SGOT or SGPT measurements. There were a few fluctuations in hematologic values but no changes appear to be drug-related or of significance.

Another study was conducted in the dog to determine the effects of DOMOSO Solution at a total daily dose of 20–60 mL administered topically for 21 consecutive days. No clinically meaningful ophthalmological effects were noted. No significant variations were observed in blood measurements, including glucose, BUN, SGOT and plasma electrophoresis. Hematologic values were similar to control animals used in this study.

Long-term topical applications of the drug to guinea pigs resulted in histopathologic changes similar to those observed in allergic contact dermatitis. The observed clinical changes were compatible with either an allergic contact dermatitis or a primary irritant effect (33). DMSO was shown to cause erythema and blistering of human and rat skin resulting in increased permeability of venules and capillaries (34).

In most cases the local irritation of the skin characterized by erythema, vesicle or blister formation and scurfing abates even with continued treatment. This phenomenon has been described as "accommodation" or "hardening" of the skin, and has been noted with other solvents.

The undiluted compound has low systemic toxicity but a marked local necrotizing and inflammatory effect when it is injected subcutaneously. In rats the subcutaneous injection of 10 g/kg or the intravenous injection of 2.5 g/kg of undiluted DMSO for 2 weeks showed no definite indication of systemic toxicity. The local necrotizing effects produced at these dose levels, however, prevented a longer period of treatment. No significant hematologic or biochemical changes were noted in 3 dogs receiving 0.4 g/kg for 33 days (24).

Four dogs were administered topical DMSO at 1 g/kg body weight, 5 days weekly for 18 months. Serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), prothrombin time, alkaline phosphatase, bilirubin, total protein and albumin globulin (AG) ratio, and blood urea nitrogen (BUN) were determined at the beginning of treatment and at monthly intervals. Significant abnormalities did not occur (41).

Upon injection of DMSO into the rat pleura, there is an accumulation of fluid, initially appearing as a transudate, but later as a protein-rich exudate. Exudate formation is thought to be due to increased vascular permeability, predominantly in venules, brought about by a delayed release of histamine together with activation of a vaso-active slow contracting substance (34).

A compilation of the results for a number of acute toxicity (LD<sub>50</sub>) determinations derived from several published reports (24, 40, 42, 43, 44) in several experimental animal species is as follows:

Species	Rt. of Adminstr.	LD <sub>50</sub> g/kg
Mouse	SQ	— 13.9 — 20.5
Mouse	IV	— 3.82 — 10.73
Mouse	Oral	— 15.0 — 22
Mouse	IP	— 20.06
Rat	IV	— 5.25 — 5.36
Rat	Oral	— 16.0 — 28.3
Rat	IP	— 6.5 — 13.621
Dog	IV	— 2.5
Guinea Pig	IP	— 6.5
Chicken	Oral	— 12.5

Hemolysis resulting in hemoglobinuria and methemoglobinuria was noted in anesthetized cats following single intravenous doses of 200 mg/kg DMSO. The intraperitoneal administration of DMSO or the dilution of DMSO with isotonic saline prior to intravenous administration reduced its hemolytic activity (39).

Tests *in vitro* showed that washed rabbit erythrocytes are hemolyzed in a short time with 40% to 60% DMSO solution. Higher concentrations caused, without hemolysis, an agglutination of the erythrocytes (40).

#### Teratology

The intraperitoneal administration of 5.5 g/kg of DMSO as a single dose to pregnant hamsters induced developmental malformations of their embryos (35). Both dimethyl sulfoxide and diethyl sulfoxide are teratogenic when injected into the chick embryo, the classification of malformations being dependent upon the stage of embryonic development at the time of treatment. The same drugs when administered by various techniques to mice, rats and rabbits in which fertility had been established, did not cause any embryonic malformations (36).

#### Ocular Effects

In a variety of experimental animals including rats, dogs, swine, rabbits and primates, following oral or topical administration of DMSO, certain eye changes have been noted. These consist mainly of a change in the refractive index of the lens described as a "lens within a lens". The lens changes are characterized by a decrease in the normal relucency of the lens cortex, causing the normal central zone of the lens to act as a biconvex lens. When viewing the fundus of affected animals, it is necessary to interpose biconcave lenses in order to see the retinal vessels clearly. The functional effect would be a tendency toward myopia (37).

The lens changes were first observed in dogs receiving 5 g DMSO/kg after 9 weeks of administration. At lower dose levels the change was observed later. In rabbits these changes were seen after 90 days of dermal application, (8 mg 50% DMSO/kg/day and 4 mg 100% DMSO/kg/day and higher). In swine, dermal application of 4.5 g 90% DMSO/kg twice daily caused similar lens changes by 90 days of treatment (38).

The lens changes appear earlier with oral administration, and also bear a relation to the dosage employed; the higher the dose the more rapid their appearance.

The eye changes are slowly reversible but with a definite species difference, the dog being the slowest to exhibit improvement.

No effects were seen following direct application of aqueous solutions varying from 10% to full strength into the eyes of albino rabbits for a total dosage of DMSO between 0.1 and 0.2 g/kg body weight per day for six months. Rabbits which received daily doses as high as 10 g/kg orally or topically showed lines of discontinuity in their lenses. No cataract was seen after ten weeks of such daily treatment, although discontinuous lens lines could be detected in about two weeks by slit lamp examination. Chemical studies on these lenses revealed reduction in the usual concentrations of urea, glutathione, uric and amino acids (19).

#### INDICATIONS

##### Canine and Equine

DOMOSO (dimethyl sulfoxide) Gel is recommended as a topical application to reduce acute swelling due to trauma.

## ADMINISTRATION AND DOSAGE

DOMOSO Gel is to be administered topically to the skin over the affected area.

Dogs — Liberal application should be administered three to four times daily. Total daily dosage should not exceed 20 g. Total duration of therapy should not exceed 14 days.

Horses — Liberal application should be administered two to three times daily. Total daily dosage should not exceed 100 g. Total duration of therapy should not exceed 30 days.

## SIDE EFFECTS

In general, adverse reactions are local, and while they may prove to be annoying to some patients, they are usually not of a serious nature. Upon topical application, an occasional animal may develop transient erythema, associated with local "burning" or "smarting". Even when erythema or vesiculation occurs, they are self-limiting reversible states, and not necessarily an indication to discontinue medication. Dryness of the skin and an oyster-like breath odor have been reported. These effects are temporary and are not considered to be of serious consequence. Changes in the refractive index of the lens of the eye and nuclear cataracts have been observed in animals, with the use of this drug. This appears to be related to dosage and duration of therapy.

## PRECAUTIONS AND CONTRAINDICATIONS

Contact between DOMOSO Gel and the skin should be avoided. Rubber gloves should be worn while applying this drug. Forceps and swabs may be used to facilitate application. If absorbed through the skin, DOMOSO Gel will cause odorous breath and unpleasant mouth taste. Mild sedation or drowsiness, sensations of warmth, burning, irritation, itching and mild erythematous localized or generalized dermatitis have been reported in some persons following exposure to DOMOSO Gel. Treatment of such side effects is symptomatic. Consult a physician immediately if adverse effects appear.

DOMOSO Gel may mask certain disease signs such as seen in fractures, etc.; this does not obviate the need for specific therapy in such conditions.

Since DOMOSO Gel effectively alters the biologic membrane, it will in some cases facilitate the systemic absorption of other topically applied drugs and may have a potentiating effect on drugs administered systemically.

DOMOSO Gel should be judiciously used when administered in conjunction with other pharmaceutical preparations, especially those affecting the cardiovascular and central nervous systems.

DOMOSO Gel may enhance the absorption of other materials into the skin. The veterinarian should make certain that other medications are not present prior to its application.

Keep DOMOSO Gel out of the reach of children.

DOMOSO Gel is recommended for topical application only. **DO NOT ADMINISTER BY ANY OTHER ROUTE.**

DOMOSO Gel should not be used under occlusive dressings.

DOMOSO Gel is contraindicated in horses and dogs intended for breeding purposes.

DOMOSO Gel is a potent solvent and may have a deleterious effect on fabrics, plastics and other materials. Care should be taken to prevent physical contact with DOMOSO Gel.

DOMOSO Gel should not be administered to horses that are to be slaughtered for food.

CAUTION: HYGROSCOPIC. CLOSE CAP TIGHTLY AFTER USE. AVOID FREEZING. DUE TO THE RAPID PENETRATION ABILITY OF DOMOSO GEL, RUBBER GLOVES SHOULD BE WORN WHEN APPLYING THIS DRUG.

## HOW SUPPLIED

DOMOSO (dimethyl sulfoxide) Gel is supplied in 2.1 Oz (60 g) and 4.2 Oz (120 g) collapsible tubes.

NDC 0856-0046-50 — 2.1 Oz (60 g) — tube

NDC 0856-0046-51 — 4.2 Oz (120 g) — tube

Store at controlled room temperature 15° to 30°C (59° to 86°F).

## REFERENCES

- Huggins, C.E., PRESERVATION OF BLOOD FOR TRANSFUSIONS BY FREEZING WITH DIMETHYL SULFOXIDE AND A NOVEL WASHING TECHNIQUE. 1963 Surgery 54, 191–194 Jul 1963
- Pyle, H.M. and Boyer, H.F., EFFECTS OF DIMETHYL SULFOXIDE ON BLOOD CELLS AND BONE MARROW. 1961 Vox Sang 6, 199–200 1961
- Rowe, A.W., Kaczmarek, C.S. and Cohen, E., LOW TEMPERATURE PRESERVATION OF LEUKOCYTES IN DIMETHYL SULFOXIDE. Federation of American Societies for Experimental Biology, 47th Annual Meeting. 16–20 Apr 1963. Atlantic City 1963 Fed. Proc. 22, 170 1963 Abstr. No. 60
- Ashwood-Smith, M.J., LOW TEMPERATURE PRESERVATION OF MOUSE LYMPHOCYTES WITH DIMETHYL SULFOXIDE. 1964 Blood 23, 494–501 Apr 1964
- Djerassi, I. and Roy, A., A METHOD FOR PRESERVATION OF VIABLE PLATELETS, COMBINED EFFECTS OF SUGARS AND DIMETHYL SULFOXIDE. 1963 Blood 22, 703–717 1963
- Sawada, Y. and Chang, M.C., MOTILITY AND FERTILIZING CAPACITY OF RABBIT SPERMATOZOA AFTER FREEZING IN A MEDIUM CONTAINING DIMETHYL SULFOXIDE. 1964 Fertil. Steril. 15, 222–229 Mar–Apr 1964
- Zimmerman, S.J., Maude, M.B. and Moldawer, M., FREEZING AND STORAGE OF HUMAN SEMEN IN 50 HEALTHY MEDICAL STUDENTS. A Comparative Study of Glycerol and Dimethyl Sulfoxide as a Preservative. 1964 Fertil. Steril. 15, 505–510 Sep–Oct 1964
- Sherman, J.K., DIMETHYL SULFOXIDE AS A PROTECTIVE AGENT DURING FREEZING AND THAWING OF HUMAN SPERMATOZOA. 1964 Proc. Soc. Exp. Biol. Med. 177, 261–264 1964
- Mueller, F.O., Casey, T.A. and Trevor-Roper, P.D., USE OF DEEP-FROZEN HUMAN CORNEA IN FULL-THICKNESS GRAFTS. 1964 Brit. Med. J. No. 5407, 473–475 22 Aug 1964
- Platts, S. and Reed, H., USE OF DIMETHYL SULFOXIDE FOR PRESERVING CORNEAL TISSUE. 1963 Brit. J. Ophthal. 47, 334–338 1963
- Barlyn, L.W., Berggren, R.B. and Lehr, H.B., FROZEN SKIN AUTOGRAFTS PROTECTED BY DIMETHYL SULFOXIDE. 1964 Surg. Forum 15, 475–476 1964
- Nagington, J. and Greaves, R.I., PRESERVATION OF TISSUE CULTURE CELLS WITH LIQUID NITROGEN. 1962 Nature 194, 993–994 9 Jun 1962
- Porterfield, J.S. and Ashwood-Smith, M.J., PRESERVATION OF CELLS IN TISSUE CULTURE BY GLYCEROL AND DIMETHYL SULFOXIDE. 1962 Nature 193, 548–550 10 Feb 1962
- Lovelock, J.E. and Bishop, M.W., PREVENTION OF FREEZING DAMAGE TO LIVING CELLS BY DIMETHYL SULFOXIDE. 1959 Nature 183, 1394–1395 16 May 1959
- Dougherty, R.M., USE OF DIMETHYL SULFOXIDE FOR PRESERVATION OF TISSUE CULTURE CELLS BY FREEZING. 1962 Nature 193, 550–552 10 Feb 1962
- Walker, P.J. and Ashwood-Smith, M.J., DIMETHYL SULFOXIDE, AN ALTERNATIVE TO GLYCEROL, FOR THE LOW-TEMPERATURE PRESERVATION OF TRYPANOSOMES. 1961 Ann. Trop. Med. Parasit. 55, 93–96 1961
- Ashwood-Smith, M.J., INABILITY OF DIMETHYL SULFOXIDE TO PROTECT MOUSE TESTIS AGAINST THE EFFECT OF X-RADIATION. 1961 Int. J. Radiat. Biol. 3, 101–103 1961
- Ashwood-Smith, M.J., RADIOPROTECTIVE EFFECT OF COMBINATION OF AET OR CYSTEAMINE WITH DIMETHYL SULFOXIDE. 1962 Int. J. Radiat. Biol. 5, 201–202 May 1962
- Leake, C.D., DIMETHYL SULFOXIDE. Science 152, 1646–1649 17 Jun 1966
- Sweeney, T.M., Downes, A.M. and Matoltsy, A.G., THE EFFECT OF DIMETHYL SULFOXIDE ON THE EPIDERMAL WATER BARRIER. 1966 J. Invest. Derm. 46, 300–302 Mar 1966
- Horita, A. and Weber, L.J., SKIN PENETRATING PROPERTY OF DRUGS DISSOLVED IN DIMETHYL SULFOXIDE, (DMSO), AND OTHER VEHICLES. 1964 Life Sci. 3, 1389–1395 Dec 1964

- Rosen, H., Blumenthal, A., Panasevich, R. and McCallum, J., DIMETHYL SULFOXIDE (DMSO) AS A SOLVENT IN ACUTE TOXICITY DETERMINATIONS. 1965 Proc. Soc. Exp. Biol. Med. 120, 511–514 Nov 1965
- Dixon, R.L., Adamson, R.H., Ben, M. and Rall, D.P., APPARENT LACK OF INTERACTION BETWEEN DIMETHYL SULFOXIDE AND A VARIETY OF DRUGS. 1965 Proc. Soc. Exp. Biol. Med. 118, 756–759 Mar 1965
- Rosenkrantz, H., Hadidian, Z., Seay, H. and Mason, M.M., DIMETHYL SULFOXIDE, ITS STERIOD SOLUBILITY AND ENDOCRINOLOGIC AND PHARMACOLOGIC-TOXICOLOGIC CHARACTERISTICS. 1963 Cancer Chemother. Rep. No. 31, 7–24 Sep 1963
- Haeusler, G. and Jahn, U., UNTERSUCHUNGEN ZUR PHARMAKOLOGIE VON DIMETHYLSULFOXYD (DMSO). 1966 Arch. Int. Pharmacodyn 159, 386–400 Feb 1966
- Pantio, M. and Kaerki, N.T., THE INFLUENCE OF DIMETHYL SULFOXIDE ON THE ABSORPTION OF PHENYLBUTAZONE. Spanish Translation. 1965 Air 8, 133–147 1965
- Preziosi, P. and Scapagnini, U., ACTION OF DIMETHYL SULFOXIDE ON ACUTE INFLAMMATORY REACTIONS. 1966 Curr. Ther. Res. 8, 261–264 May 1966
- Katz, J., Knott, L.W. and Rubinstein, L.J., THE NEUROHISTOLOGICAL CHANGES INDUCED BY PHENOL, DIMETHYL SULFOXIDE, AND HYALURONIDASE ON THE SCIATIC NERVE OF THE RAT. Special Abstract From Fall Pharmacology Meeting April 1966
- Sams, W.M., Carroll, N.V. and Crantz, P.L., EFFECTS OF DIMETHYL SULFOXIDE ON ISOLATED INNERVATED SKELETAL, SMOOTH, AND CARDIAC MUSCLE. 1966 Proc. Soc. Exp. Biol. Med. 122, 103–107 May 1966
- Gerhards, E., Gibian, H. and Raspe, G., STOFFWECHSEL UND STOFFWECHSELWIRKUNGEN VON DIMETHYLSULFOXID. 1965 Arzneimittelforschung 15 1295–1297 Nov 1965
- Mayer, J.H., Anido, H., Almond, C.H. and Seaber, A., DIMETHYL SULFOXIDE IN PREVENTION OF INTESTINAL ADHESIONS. 1965 Arch. Surg., Chicago, 91, 920–923 Dec 1965
- Huu, N. and Albert, H.M., EFFECT OF DMSO ON WOUND HEALING TENSILE STRENGTH MEASUREMENTS IN RABBITS. 1966 Amer. Surg. 32, 421–424 Jun 1966
- Wright, E.T. and Winer, L.H., TOPICAL APPLICATION OF DIMETHYL SULFOXIDE (DMSO) TO SKIN OF GUINEA PIGS, A Histopathological Study. 1966 J. Invest. Derm. 46, 409–414 Apr 1966
- Willoughby, D.A., Walters, M.N. and Spector, W.G., AN ANALYSIS OF THE IRRITANT ACTION OF DIMETHYL SULFOXIDE. 1966 J. Path. Bact. 91, 195–205 Jan 1966
- Marin-Padilla, M., MESODERMAL ALTERATIONS INDUCED BY DIMETHYL SULFOXIDE. 1966 Proc. Soc. Exp. Biol. Med. 122, 717–720 Jul 1966
- Caujolle, F., Caujolle, D., Cros, S., Calvert, M. and Tollon, Y., TERATOGENESE POUVOIR TERATOGENE DU DIMETHYLSULFOXIDE ET DU DIETHYLSULFOXYDE. TERATOGENESIS-TESTS OF THE TERATOGENY OF DIMETHYL SULFOXIDE AND OF DIETHYL SULFOXIDE. 1965 C.R. Acad. Sci. Paris, 260, 327–330 4 Jan 1965
- Rubin, L.F. and Mattis, P.A., DIMETHYL SULFOXIDE, LENS CHANGES IN DOGS DURING ORAL ADMINISTRATION. 1966 Science 153, 83–84 1 Jul 1966
- Unpublished data 1966
- DiStefano, V. and Klahn, J.J., OBSERVATIONS ON THE PHARMACOLOGY AND HEMOLYTIC ACTIVITY OF DIMETHYL SULFOXIDE. 1965 Toxic. Appl. Pharmacol. 7, 660–666 Sep 1965
- Sommer, S. and Tauberger, G., TOXIKOLOGISCHE UNTERSUCHUNGEN MIT DIMETHYLSULFOXYD. TOXICOLOGIC INVESTIGATIONS WITH DIMETHYL SULFOXIDE. 1964 Arzneimittelforschung 14, 1050–1053 1964
- Jacob, S.W., Herschler, R.J. and Rosenbaum, E.E., DIMETHYL SULFOXIDE (DMSO) LABORATORY AND CLINICAL EVALUATION. 1965 J. Amer. Vet. Med. Assoc. 147, 1350–1359 1965
- Brown, V.K., Robinson, J. and Stevenson, D.E., A NOTE ON THE TOXICITY AND SOLVENT PROPERTIES OF DIMETHYL SULFOXIDE. 1963 J. Pharm. Pharmacol. 15, 688–692 Oct 1963
- Willson, J.E., Brown, D.E. and Timmens, E.K., A TOXICOLOGIC STUDY OF DIMETHYL SULFOXIDE. 1965 Toxic. Appl. Pharmacol. 7, 104–112 Jan 1965
- Caujolle, F., Caujolle, D., Bouyssou, H. and Calvert, M.M., PHARMACODYNAMIE-TOXICITE ET APTITUDES PHARMACOLOGIQUES DU DIMETHYLSULFOXYDE. PHARMACODYNAMICS-TOXICITY AND PHARMACOLOGICAL PROPERTIES OF DIMETHYL SULFOXIDE. 1964 C.R. Acad. Sci. Paris, 258, 2224–2226 17 Feb 1964

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