

AD-A014 407

UNUSUAL PROPERTIES OF DIMETHYL SULFOXIDE
(DSMO) IN THE LIGHT OF THE CLINICAL
STUDIES DONE SO FAR

Krzystof Bien

Foreign Technology Division
Wright-Patterson Air Force Base, Ohio

31 July 1975

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

KEEP UP TO DATE

Between the time you ordered this report—which is only one of the hundreds of thousands in the NTIS information collection available to you—and the time you are reading this message, several *new* reports relevant to your interests probably have entered the collection.

Subscribe to the **Weekly Government Abstracts** series that will bring you summaries of new reports *as soon as they are received by NTIS* from the originators of the research. The WGA's are an NTIS weekly newsletter service covering the most recent research findings in 25 areas of industrial, technological, and sociological interest—invaluable information for executives and professionals who must keep up to date.

The executive and professional information service provided by NTIS in the **Weekly Government Abstracts** newsletters will give you thorough and comprehensive coverage of government-conducted or sponsored re-

search activities. And you'll get this important information within two weeks of the time it's released by originating agencies.

WGA newsletters are computer produced and electronically photocomposed to slash the time gap between the release of a report and its availability. You can learn about technical innovations immediately—and use them in the most meaningful and productive ways possible for your organization. Please request NTIS-PR-205/PCW for more information.

The weekly newsletter series will keep you current. But *learn what you have missed in the past* by ordering a computer **NTISearch** of all the research reports in your area of interest, dating as far back as 1964, if you wish. Please request NTIS-PR-186/PCN for more information.

WRITE: Managing Editor
5285 Port Royal Road
Springfield, VA 22161

Keep Up To Date With SRIM

SRIM (Selected Research in Microfiche) provides you with regular, automatic distribution of the complete texts of NTIS research reports *only* in the subject areas you select. SRIM covers almost all Government research reports by subject area and/or the originating Federal or local government agency. You may subscribe by any category or subcategory of our WGA (**Weekly Government Abstracts**) or **Government Reports Announcements and Index** categories, or to the reports issued by a particular agency such as the Department of Defense, Federal Energy Administration, or Environmental Protection Agency. Other options that will give you greater selectivity are available on request.

The cost of SRIM service is only 45¢ domestic (60¢ foreign) for each complete

microfiched report. Your SRIM service begins as soon as your order is received and processed and you will receive biweekly shipments thereafter. If you wish, your service will be backdated to furnish you microfiche of reports issued earlier.

Because of contractual arrangements with several Special Technology Groups, not all NTIS reports are distributed in the SRIM program. You will receive a notice in your microfiche shipments identifying the exceptionally priced reports not available through SRIM.

A deposit account with NTIS is required before this service can be initiated. If you have specific questions concerning this service, please call (703) 451-1558, or write NTIS, attention SRIM Product Manager.

This information product distributed by

NTIS

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161



258154

FOREIGN TECHNOLOGY DIVISION

Ch...

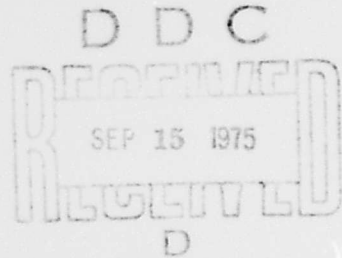
ADA014407



UNUSUAL PROPERTIES OF DIMETHYL SULFOXIDE (DMSO)
IN THE LIGHT OF THE CLINICAL STUDIES DONE SO FAR

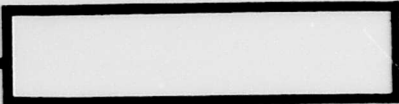
by

Krzystof Bien



Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

Approved for public release;
distribution unlimited.



UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Foreign Technology Division Air Force Systems Command U. S. Air Force	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
	2b. GROUP

3. REPORT TITLE
UNUSUAL PROPERTIES OF DIMETHYL SULFOXIDE (DMSO) IN THE LIGHT OF THE CLINICAL STUDIES DONE SO FAR

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Translation

5. AUTHOR(S) (First name, middle initial, last name)
Krzystof Bien

6. REPORT DATE 1966	7a. TOTAL NO. OF PAGES 6	7b. NO. OF REFS 5
------------------------	-----------------------------	----------------------

8a. CONTRACT OR GRANT NO b. PROJECT NO c. d.	8b. ORIGINATOR'S REPORT NUMBER(S) FTD-ID(RS)I-1809-75
	8c. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
Approved for public release; Distribution unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY Foreign Technology Division Wright-Patterson AFB, Ohio
-------------------------	---

13. ABSTRACT
07

PRICES SUBJECT TO CHANGE

EDITED TRANSLATION

FTD-ID(RS)I-1809-75 31 July 1975

FTD-75-C-002139
UNUSUAL PROPERTIES OF DIMETHYL SULFOXIDE (DSMO)
IN THE LIGHT OF THE CLINICAL STUDIES DONE SO FAR

By: Krzysztof Bien

English pages: 6

Source: Polski Tygod, Lekarski, Vol 21, nr 18, 1966
pp. 688-690.

Country of origin: Poland

Translated by: SCITRAN

F33657-72-D-0853

Requester: PDTI

Approved for public release; Distribution
unlimited.

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP.AFB, OHIO.

FTD -ID(RS)I-1809-75

Date 31 Jul 19 75

Krzystof Bien

Unusual properties of dimethyl sulfoxide (DMSO) in the
light of the clinical studies done so far

(From the Warsaw Dermatological Hospital; Division III
Dermatological; Ward Head: Dozent Jerzy Schanek, M.D.)

Dimethyl sulfoxide is a chemical compound that has been used for a couple of years in industry. It is a very strong solvent, used in the manufacture of synthetic fibers, an agent which reacts in a chemical synthesis or can be used as an agent for extracting and accelerating chemical reactions. The compound was synthesized in 1867. It is a byproduct of the paper mill industry. Chemically, it is a derivative of lignin and belongs to the group of alkyl sulfoxides. The compound is a colorless, transparent, hygroscopic organic liquid which mixes with water, lipids, and organic solvents. When mixing with water, heat in the amount of 60 cal/g at 20° is released. The compound damages fabrics made of artificial fibers. It particularly rapidly damages fibers of artificial silk, polyurethane, and acryl.

The attention of medicine was turned to DMSO when a notice was made of its great value as an agent increasing the life force of frozen cells and tissues, and greatly facilitating the passage of various substances (e.g., antibiotics and fungicidal agents) through the cell membranes of plants and animals, including hominids.

The interest in the compound grew immensely when the papers by Jacob and other workers were published. They reported that DMSO is an active therapeutic agent in man. According to Jacob et al., DMSO penetrates undamaged skin with great ease, and it enhances and accelerates the absorption of various substances. Moreover, DMSO acts as a local anesthetic, counters inflammation, acts bacteriostatically, diuretically, as a tranquilizer, and increases the effect of other substances.

Other authors confirmed the rapid absorption of DMSO through undamaged skin and the effect of DMSO on various substances consisting of an increase in, and sometimes an acceleration of, their absorption when the substances are used together with DMSO. The effect of DMSO on absorption depends on the type, and sometimes also on the concentration of the substance with which it is used, and is dependent on the concentration of DMSO.

Many various substances were studied in this respect, and various concentrations of DMSO were used. For example, fluocynol acetate was in some cases absorbed five times better when it was put on the skin in a 10-25% alcohol solution of DMSO and when it was not covered with a tight bandage. A 2% iodine solution in a 100% DMSO was absorbed completely from the surface of the skin after two hours (the skin in the meantime lost its coloration). 20% aluminum chloride, used without DMSO in arm pits reduced sweating by 54%, but when used in a 50% DMSO solution it reduced sweating by 73%. However, the agent did not have any effect when 20% DMSO was used or a 10% solution of aluminum chloride in 50% DMSO.

According to Kligman, DMSO acts as a weak anesthetic. The author also did not notice any strengthening effect of DMSO on a 2% solution of procaine and lidocaine chlorohydrate used locally and containing a 10-90% DMSO solution, even though he found that the absorption of those agents became accelerated. The fungicidal and antibacteria effect of DMSO also turned out to be weak. The compound is a weak bacteriocidal agent, much weaker than alcohol (according to Klingman).

Rosenbaum and Jacob showed the therapeutic value of DMSO in diseases of the motor organs. The authors observed 548 persons with various diseases of muscles and bones. According to the authors, DMSO used locally in acute injuries of the muscular-skeletal system very rapidly eased pain, and the swellings and skin irritation were relieved.

In an acute sub-shoulder inflammation of bursa synovialis DMSO used locally "dramatically" reduced pain and muscular tension.

According to the authors, on the first day DMSO must be used every 3-4 hours, and then 1-2 times a day up to complete recovery.

In a chronic subshoulder inflammation of bursa synovialis DMSO acted beneficially (already after 20-30 minutes) mainly in the cases of pain with a limitation of movement. In the bone-joint inflammation pertaining to ankles, hands, and knees great improvement was obtained. When the hip joint was affected, the improvement was not as remarkable.

In a rheumatoid inflammation of joints no great improvement was obtained. Relatively best results were obtained when the systemic changes were small, limited to one or two joints.

The authors (Jacob et al.) conclude that the period of therapy with DMSO depends on the length of the disease. The longer the problem lasts, the longer DMSO must be used to obtain a beneficial therapeutic effect. They also conclude that DMSO is a useful agent, helpful in treating patients with the acute form of rheumatism receiving gold preparations, chlorokine, butazolidine or cortisone. Similar results were obtained when treating joint inflammation in gout. In those cases the improvement usually consisted of a rapid decrease of pain and swelling.

In four cases (out of five) of scleroderma, the use of DMSO resulted in extending the range of movement, and the pathologically affected skin areas underwent softening. This usually lasted for two weeks.

In Dupuytren's contracture 15-30 ml of DMSO was used daily for 2-3 weeks. The softening of palm fascia was obtained, pathological centers were reduced, and the extent of movement in the fingers affected pathologically was increased. The authors obtained improvement in the above-mentioned pathological states in 437 persons (out of 548). In no case did they note any noticeable toxic effects of DMSO. This is also confirmed by laboratory studies, For example, the average lethal dose in mice is 21.400 mg/kg when given orally, and 3.820 mg/kg when given intravenously.

Klingman made clinical studies on healthy volunteers in 1965 and concluded that DMSO is easily tolerated and has little toxic effect. The most frequent side effects after a local application of DMSO were: erythema, rashes, itching, and burning. The symptoms usually appear rapidly - after 15-30 minutes - and just as rapidly go away - after about 20 minutes. The symptoms are caused by the release of histamine in tissues by DMSO. Klingman observed a generalized flaking inflammation of the skin upon a daily use of a 90% DMSO solution in the skin area ranging from the chin to the pelvic girdle. The changes disappeared after some time despite the continuous use of the agent on a one-a-day basis. In two persons (out of 20) to whom a 90% solution of DMSO was applied twice a day to the same skin area, toxic symptoms developed. In one person they included a generalized erythemic-flaking rash and acute abdominal pains (on the 12th day of the use of DMSO); the second patient complained of a similar rash, slight nausea, shivers, and chest pains (on the 13th day). In the first patient the symptoms receded when DMSO was discontinued, and in the second they receded in spite of the continuous use of DMSO.

One of the side effects of the local use included an unpleasant odor in the exhaled air, similar to that of garlic.

In several hundred persons Klingman studied the sensitizing properties of DMSO and found that the compound is not a strong sensitizing agent.

In several hundred persons treated from a couple of weeks to a couple of months, laboratory studies did not detect any deviations from the norm. No characteristic changes were observed in the histological picture of the skin upon locally applying DMSO without a tight bandage. The last observations, however, are extremely rare.

When 90% DMSO or its higher concentrations were used on undamaged skin, applying a tight bandage, then within 15 minutes up to an hour there appeared characteristic papule-bubble exanthema which would disappear within a couple of hours. In those cases one could also observe very characteristic histological changes - mainly in epidermis - which showed the loss of permeability by cellular

membranes; swelling appeared caused by the replacement of the cellular cytoplasm with the hygroscopic DMSO, and leading to the death of cells. The regeneration of epidermis was, however, rapid, despite the use of DMSO.

On the basis of his own studies, Kligman thinks that the skin reactions appearing under the influence of DMSO do not discredit this agent. However, so far the author is one of the few workers who studied DMSO clinically.

Taking this into account as well as the short time given to the clinical appraisal of DMSO, one must consider very carefully the possibilities of using the compound as a drug.

Despite these notes of caution, it seems that DMSO is noteworthy due to its undeniable therapeutic effect in certain diseases of the motor system. We might suppose that its outstanding ability of penetrating cellular membranes, which is mentioned by many authors, and its effect on the absorption of, e.g., various therapeutic agents, may contribute to a development in the future of new therapeutic methods in various pathological states. Perhaps it will replace certain agents used today against pain and inflammation, and make it possible to introduce to undamaged skin those agents that today can only be injected.

These properties of DMSO may be extremely valuable in dermatology. Here we might mention the possibility of using DMSO in pathologies of the connective tissue, or as an agent facilitating the absorption and enhancing the power of treatments for local use, especially in skin pathologies in which general treatment is normally of little use.

One can hope that further clinical and laboratory studies will enable us to obtain more accurate data about the therapeutic value of this apparently promising compound.

Received: November 20, 1965; Address: Stoleczny Szpital Dermatologiczny, Drugi Oddzial Dermatologiczny, 15 Leszno St., Warsaw.

REFERENCES

1. Kligman A. M.: Dimethyl Sulfoxide — Cz. 1. J.A.M.A., 1955, 193, 799.
2. Kligman A. M.: Dimethyl Sulfoxide — Cz. 2. J.A.M.A., 1955, 193, 923.
3. Rosenbaum E. E., H. S. G. et al. & Jacob S. W.: DMSO in musculoskeletal disorders. J.A.M.A., 1955, 192, 279.
4. Swartzman R. E. & Fritsch M.: Influence of Dimethyl Sulfoxide (DMSO). Acta Derm. 1954, 7, 12.
5. Jacob S. W., Biscardi R., Glick R. J.: Dimethylsulfoxide, A New Concept in Pharmacotherapy. Curr. Ther. Res. 1954, 6, 54.