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DIMETHYL SULFOXIDE, A NEW DILUENT FOR METHYLENE IODIDE HEAVY LIQUID*

FRANK CUTTITTA, ROBERT MEYROWITZ, AND BETSY LEVIN,
U. S. Geological Survey, Washington 25, D. C.

Dimethyl sulfoxide, $(\text{CH}_3)_2\text{SO}$, which has already been used as a diluent for bromoform (Meyrowitz, Cuttitta, and Hickling, 1959) has been tested and is recommended as a diluent for methylene iodide (diiodomethane). This diluent can be used in place of acetone or ethyl alcohol for the preparation of heavy liquids where constancy of the specific gravity is needed in the separation of minerals or where specific gravity measurements are to be made. Dimethyl sulfoxide-methylene iodide solutions are superior to bromoform-methylene iodide solutions because of the ease with which methylene iodide can be recovered from the former solutions as compared to the latter solutions. The former solutions can be separated by mixing with large volumes of water; the latter solutions can be separated only by fractional distillation. The vapor pressure of dimethyl sulfoxide is very close to that of methylene iodide (Table I). Therefore, the changes in the specific gravity of dimethyl sulfoxide-methylene iodide solutions caused by changes in composition due to differential evaporation are much smaller than they would be if acetone or ethyl alcohol is

TABLE I. SOME PHYSICAL PROPERTIES OF DIMETHYL SULFOXIDE, ACETONE, ETHYL ALCOHOL, AND METHYLENE IODIDE

	Melting point ° C.	Boiling point ° C.	Vapor pressure mm. Hg at 20° C.	Vapor pressure mm. Hg at 30° C.	Specific gravity	Index of refraction	Flash point ° F.	Viscosity 25° F. cp
Dimethyl sulfoxide ¹	18.4	189	0.37	0.79	1.100 (20° C.)	1.48	203	1.98
Acetone	-95 ²	56.5 ²	185 ³	283 ³	0.79 (20° C.) ²	1.36 ²	15 ²	0.32 ²
Ethyl alcohol	-114 ³	78.4 ³	43.9 ³	78.8 ³	0.79 (20° C.) ²	1.36 ²	70 ²	1.1 ²
Methylene iodide	5-6 ²	180 ² (decomposes)	1.01 (20.6° C.) ⁴	1.90 (29.5° C.) ⁴	3.33 (20° C.) ²	1.76 ²	None	0.02 ⁵

¹ Stepan Chemical Co., Technical Bulletin, Dimethyl sulfoxide, December 29, 1954.² Hodgman, 1957.³ National Research Council, 1928.⁴ Gregory and Style, 1936.⁵ Timmermans and Hennaut-Roland, 1932.

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used as the diluent. Table I compares the salient properties of dimethyl sulfoxide, acetone, ethyl alcohol, and methylene iodide.

In order to test the constancy of the dimethyl sulfoxide-methylene iodide solutions during use, a series of solutions, each having a 50-ml. volume, was prepared. The specific gravities of the liquids were 2.92, 2.97, 3.02, 3.13, and 3.19. For each solution in the series, 6 to 12 heavy liquid separations, which included a filtration step, were made on approximately 10 gram portions of mineral mixtures over a period of 19 days. At the conclusion of these separations, the volume of the available liquid was too small for further separation of minerals. The change in the specific gravities of the liquids after use ranged from +1 to -2 in the second decimal place.

<i>Specific gravity before use</i>	<i>Specific gravity after use</i>	Δ <i>Specific gravity</i>	<i>Number of separations</i>
2.92	2.92	0	7
2.97	2.97	0	6
3.02	—*	—	11
3.13	3.14	+0.01	12
3.19	3.17	-0.02	12

* Available liquid insufficient for determination.

The decrease in specific gravity may be due to the entrainment of a small amount of low specific gravity liquid from minerals which had been previously cycled through a conventional bromoform separation.

Mixtures of the two liquids become blood red on standing due to the liberation of free iodine. Dimethyl sulfoxide accelerates the decomposition of the methylene iodide. The intensity of the red color is proportional to the amount of dimethyl sulfoxide present. The red color can be reduced markedly by storing the liquids in contact with copper wire or shavings; the color then ranges from light yellow (sp. gr. = 3.19) to light red (sp. gr. = 2.92) at the end of one month. On further standing the liquids of lower density become blood red.

The combining volumes of dimethyl sulfoxide-methylene iodide solutions are additive and a straight-line mixing curve (volume + volume) can be used to prepare a liquid of desired specific gravity. Acetone, dimethyl sulfoxide, and water are miscible in all proportions. The separated minerals can be washed free of a dimethyl sulfoxide-methylene iodide liquid using acetone. The methylene iodide can be recovered from the washings by mixing the washings with large volumes of water in the manner conventionally used when alcohol or acetone is the diluent. When a dimethyl sulfoxide-methylene iodide solution, prepared for a specific job, is no longer needed, the methylene iodide can be recovered in the same way.

Information supplied by the manufacturers of dimethyl sulfoxide states that toxicity does not seem to be a problem. Toxicological evaluation of preliminary animal studies reveals no sensitivity reactions or harmful effects on lung tissue. However, as these studies are continuing and the final word on this is yet to come, the manufacturer suggests that due care should be exercised in its handling and application.

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STIBIOTANTALITE FROM THE BROWN DERBY
No. 1 PEGMATITE, COLORADO*

E. WM. HEINRICH, *Department of Mineralogy, The University of Michigan, Ann Arbor, Michigan.*

The Brown Derby group of pegmatites and especially the Brown Derby No. 1 pegmatite on the east side of Quartz Creek Valley in Gunnison County, Colorado, are famous for the exceptional development of the variety of pegmatitic minerals that they contain, ever since the discovery in them of lepidolite (Eckel, 1933). Minerals from this dike and its parent granite also have been used extensively for age determinations (e.g., Aldrich *et al.*, 1956). The geology of the dikes and of the district has been thoroughly investigated (Hanley *et al.*, 1950; Staatz and Trites, 1955), and many of the minerals have been studied in detail: microlite (Eckel and Lovering, 1935); tourmalines (Staatz *et al.*, 1955); columbite (Heinrich and Giardini, 1957); garnet (Jaffe, 1951), the micas, especially the lepidolites (Heinrich *et al.*, 1960B); and monazite (Heinrich *et al.*, 1960A). A list of the minerals identified with certainty from the Brown Derby group is given in Table 1.

Stibiotantalite was found by the writer in 1953 in pegmatite blocks on

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