

carbonate rock cutting a nepheline syenite. The Ontario mineral contains roughly 5 weight per cent of ThO_2 in solid solution.

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A NEW DILUENT FOR BROMOFORM IN HEAVY LIQUID
SEPARATION OF MINERALS*

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Dimethyl sulfoxide, $(\text{CH}_3)_2\text{SO}$, has been tested and is recommended as a diluent for bromoform in place of acetone. Its vapor pressure and flammability is much less than that of acetone. It is a colorless, odorless liquid.

Carbon tetrachloride, CCl_4 , benzene, C_6H_6 , ethyl alcohol, $\text{C}_2\text{H}_5\text{OH}$, and acetone, $(\text{CH}_3)_2\text{CO}$, have been used as diluents in the preparation of heavy liquids for the separation of minerals (Krumbein and Pettijohn, 1938, p. 321). The mixture most commonly used is acetone-bromoform. The disadvantages of acetone as a diluent are its high vapor pressure and its flammability.

The vapor pressures of dimethyl sulfoxide and bromoform are relatively low and of the same order of magnitude (Table 1). Changes in composition of mixtures of these compounds due to differential evaporation are small. These mixtures maintain relatively constant specific gravities during use and in storage as compared to the acetone-bromoform mixtures. A mixture having a specific gravity 2.58 did not change measurably in the second decimal place after 30 mineral separations, including filtering. There is a slight darkening in the color of the mixture after use.

Table 1 compares the salient properties of dimethyl sulfoxide, acetone, and bromoform.

The combining volumes of bromoform-dimethyl sulfoxide mixtures are additive and a straight-line mixing curve (volume+volume) can be

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TABLE 1. SOME PHYSICAL PROPERTIES OF DIMETHYL SULFOXIDE, ACETONE, AND BROMOFORM

	Melting point ° C.	Boiling point ° C.	Vapor pressure mm Hg at 20° C.	Vapor pressure mm Hg at 30° C.	Specific gravity	Index of refrac- tion	Flash point ° F.	Viscosity 25° C., 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	.79 (20° C.) ²	1.36 ²	15 ²	.32 ²
Bromoform	6-7 ²	149.5 ²	5 (22° C.) ⁴	9.4 (25° C.) ³	2.89 ²	1.60 ²	None	1.89 ²

¹ Stepan Chemical Co., Technical Bulletin, Dimethyl sulfoxide, December 29, 1954.

² Hodgman, 1957.

³ National Research Council, 1928.

⁴ Perry, 1950.

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 bromoform-dimethyl sulfoxide liquid using acetone, and the bromoform can be recovered from the washings by the same procedure commonly used for its recovery from bromoform-acetone mixtures, that is, mixing the washings with large volumes of water (Krumbein and Pettijohn, 1938, p. 322).

The price of technical grade dimethyl sulfoxide is similar to that of N.F. grade acetone.

Information supplied by the manufacturer of dimethyl sulfoxide states that "limited tests carried out on rats, guinea pigs, and rabbits indicate that no damage to lung tissue, no allergenicity nor skin irritation is caused by dimethyl sulfoxide." However, "due care should be exercised in its handling and application."

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