HEAVY LIQUID SEPARATION WITH Na-METATUNGSTATE

compiled by

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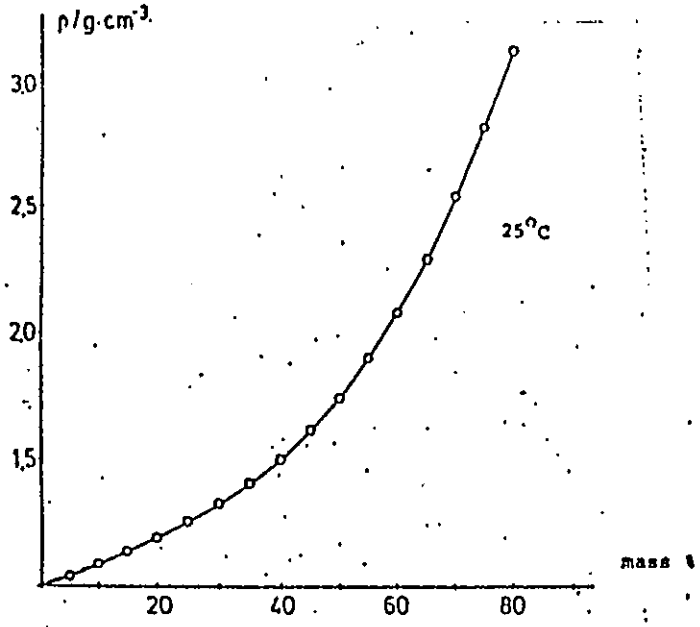
I. INTRODUCTION

Sodium metatungstate [$Na_6(H_2W_{12}O_{40})$] is a new, non-toxic, inorganic, high density liquid which produces neutral (pH 6) solutions with densities up to 3.1 g/ml-1. This compound can be readily used in place of the very toxic heavy liquids now in general use. Na metatungstate requires a minimum of equipment when used in the float/sink method of mineral separation and is readily applicable to other types of mineral analysis such as density gradient centrifugation (see reference).

II. CONTROL OF DENSITY

A. Pure crystalline Na-metatungstate:

The calibration curve/formula listed below should be followed to produce the required density.



$$\text{mass\%} = \frac{\text{gram (substance)}}{\text{gram (substance)} + \text{gram (water)}} \cdot (100)$$

example: Formation of a polytungstate solution with a density of 2.5 g/cm³.
According to the diagram this corresponds to a 70 mass % solution, i.e. 70g polytungstate + 30g water

B. Already dissolved Na-metatungstate:

Start with a dense solution and work towards lighter density solutions. There are several methods for calibration of a solution's density. Two are listed below;

1. Use a density chip of the required density. Add distilled water to the solution until the chip floats in the center of the solution column (or sinks or floats at the surface

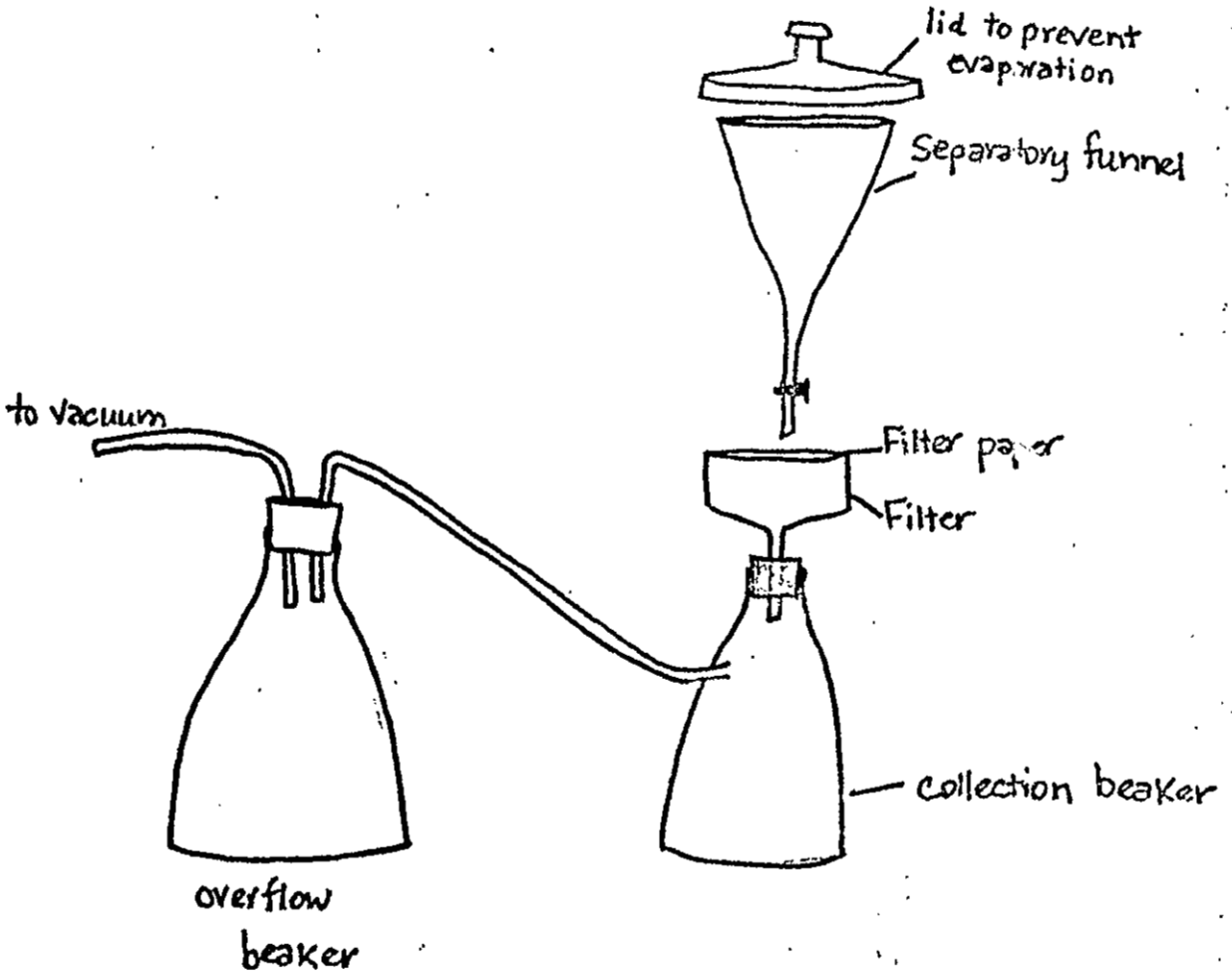
if that is the required effect for crystals of that density.)

2. Use a pure mineral standard crushed to the same grain size as your sample. Follow the procedure outlined above for the required results.

III. EQUIPMENT SET-UP

Needed equipment:
- separatory funnel
- separation filter
- filter paper (coffee filters work great)
- collection beaker
- wash beaker
- vacuum pump or aspirator
- overflow beaker
- tubing

(* it is best if all the beakers etc. are made of plastic; a source for these is included at the end of this paper)


lid to prevent evaporation
Separatory funnel
to vacuum
Filter paper
Filter
collection beaker
overflow beaker

IV. PROCEDURE

Place the sample in the funnel containing the Na-metatungstate. Allow the dense crystals to settle out. Open the funnel to flush out the settled crystals; then close the funnel. The crystals will collect on the filter paper and the metatungstate solution will pass into the collection beaker with the density unchanged via the action of the vacuum. (This can be done with just gravitational filtering but the metatungstate tends to dry rapidly and clog the filter paper). Exchange the collection beaker with the wash beaker and wash the sample with distilled water. The sample is then air dried. The less dense separate still in the funnel is handled the same way.

In this manner the metatungstate retains the set density and is ready for another run. The wash solution can be air dried or dried in a low temperature ($<95^{\circ}C$) oven until it is once again at the desired density.

V. NOTES ON METATUNGSTATE:

1. Metatungstate adheres slightly to glass so it is best to use plastic funnels/beakers/filters.

2. All washings and dissolved solutions should be saved as there is an almost 100% recycling of metatungstate.

3. The liquid density is controlled by the amount of distilled water added (to decrease the density) or the amount of evaporation (to increase the density). The best method to evaporate the water is by placing the solution in a low temperature oven overnight. If the metatungstate

recrystallizes, the quickest method of placing it back in solution is by using a magnetic stirrer on a hot plate set at low. If the beaker has a large enough diameter the redisolving may only take an hour or so with no need for agitation or heat. (NOTE: do not place a glass beaker containing recrystallized metatungstate on a hot plate as the beaker will break due to the greater thermal expansion of metatungstate.)

4. If the metatungstate collects fine particles that are not caught by the filter they can be removed by diluting the solution and centrifuging (or allowing to settle overnight) and decanting off the clear solution.

5. The Na-metatungstate will turn an intense blue when it comes in contact with a reducing agent. This effect does not change it's density properties. If left in contact with the atmosphere, the blue will eventually fade back to clear.

6. When working with Ca-minerals (especially carbonates) there is a reaction of the Na-metatungstate with Ca to produce and insoluble residue of Ca-metatungstate. There will be a thick sludge created and a corresponding loss of volume.

7. The density range is 1.5 to 3.2 g/ml^{-1}. However the viscosity increases rapidly above 2.5.

8. Samples separated with Na-metatungstate contain an anamolous amount of W in geochemical analysis no matter how well they are washed.

SOURCE FOR METATUNGSTATE (1985 PRICES INCLUDED ON ATTACHED SHEET):

METAWO
Falkenrfed 4
D-1000 Berlin 33
West Germany
Telephone: (030) 8 31 19 50 Telex: 0 185 443

SOURCE FOR PLASTIC WARE:

DYNALAB CORP.
Rochester Scientific Div.
P.O. Box 112
Rochester, NY 14692-0112
Telephone: (716) 334-2060
Telex : 97-8386

Refrence:

Plewinsky, B. and R. Kamps; Sodium metatungstate, a new medium for binary and ternary density gradient centrifugation: Makromol. Chem. 185:1429-1439, 1984.

MTW

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New Mexico Institute of
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c/o Professor D.B. Johnson
Socorro, NM 87801

12-21-1984

Dear Professor Johnson:

Thank you for your letter of December 6, 1984.

Sodium metatungstate can at present only be ordered from us, there is no U.S. distributor so far in order to avoid the additional cost of a respective representation. The delivery times are dependant upon the way of shipment, by air mail it should take about 5 to 7 days, by a combination of air and land about 14 days.

The prices of the three qualities at present available are as follows:

technical liquid	$ 48.--)	
technical solid	$ 52.--)	per kilogram
pure solid	$ 65.--)	

The technical product has a slight bluish tinge, is, however, perfectly suited for the mineral separation.

No taxes will be charged, however, the postage would be debited.

While metatungstate is more expensive than TBE (the use of dibromoethane was prohibited in the United States recently because of its cangerogenous toxidity) it has the great advantage of being not inflammable as an inorganid compound, is not toxic , can be easily recovered by simple washing with water and discarding causes no problems (in low concentrations it improves the plant growth).

We would be happy to hear from you again and should you have any specific questions, please, feel free to contact us.

Sincerely yours,