GEOLIQUIDS, INC.
4 East Piper Lane, Suite F
Prospect Heights, IL 60070
www.geoliquids.com
mail@geoliquids.com

p 847.215.0938
p **800.827.2411**
f 847.215.9821

April, 2007

MSDS: SODIUM POLYTUNGSTATE

Sodium Polytungstate is a new component in the production of heavy solutions. It brings a number of advantages with it when compared to Zinc-Chloride solutions or highly toxic halogenous hydrocarbons used in Sink or Swim analysis.

FORMULA: $Na_6[H_2W_{12}O_{40}]$ OR $3Na_2WO_4\ 9WO_3\ H_2O$

APPEARANCE: white crystals or light yellow-green, transparent solution

PROPERTIES: well soluble in water, pH-neutral solution, maximum attainable solution density 3,1 g/cm^3 at 25°C

ADVANTAGES:
Non-toxic
Nonflammable
Non-odorous
Working under an extractor unnecessary
Reusable
Density may be regulated with water from density 1,1 – 3,1 g/cm^3
Low viscosity
Easy to handle
The sink or swim material is extremely easy to clean with water
Ecologically friendly

APPLICATIONS: The dense solution is produced by dissolving sodium polytungstate in deionised water. In this association, one is dealing with an extremely water soluble sat. The maximum attainable solution density at room temperature is 3,1 g/cm^3. Further chemo-physical details may be read from both diagrams, which illustrate density as a function of sodium polytungstate (Fig. 1). viscosity as a function of density (Fig. 2). As is demonstrated in Figure 2, viscosity rises insignificantly to a density of 2,5 g/cm^3. Separation is therefore possible even in the fine particles realm. In areas of higher density a laboratory centrifuge should be employed to accelerate separation.

STABILITY: Moreover, the solution may be reused after filtration. The used solution need then only be heated to a temperature of max. 70°C and reduced to achieve the desired density. Complete dehydration is also possible add no problem.

STRUCTURE: It is a 12-fold aggregated iso polytungstate with a molar mass of ›2986,12 g/mol. According to models, polytungstate is built up of octohedrons in which the oxygen ions are to be found on the corners and the tungsten ions in the center of octohedron. When represented as a spherical model, the oxygen ions comprise a dense spherical shell in which the tungstate ions fill the open spaces in the octohedron.

So composed, one may consider this a "true" meta-tungstate, structurally represented as $Na_6[H_2W_{12}O_{40}]$. It is known of true meta-tungstate that both of the oxygen atoms are to be found in the central cavity of the polyanions and are incapable of transcending the spherical casing.

DIRECTIONS:

Solid crystalline sodium polytungstate is anhydrous and has an unlimited shelf life at room temperature.
Please note the following when using aqueous polytungstate solution:

a) Use only distilled or demineralised water
b) Close all vessels properly after use
c) Use only glass, synthetic or stainless-steel vessels
d) Do not bring the solution into contact with reduced materials. In such cases the resultant blue coloring will not have any effect on the pre-set density. A few drops of hydrogen peroxide will remove or prevent the solution from turning blue.
e) The sink or swim material should not contain any water soluble ions. In particular Pb^{2+}, Ag^{+}, Sn^{2+}, and Ba^{2+} ions lead to the formation of insoluble precipitations of Polytungstate. Should soluble ions be present in the material, it should be washed beforehand in hot water.

ANALYSIS:

Solid sodium polytungstate contains a minimus of 86± 1% WO_3. The amount of water bound in sodium polytungstate may deviate marginally.
Typical analysis results (no guarantee):
Al ‹0,0015%; As ‹0,012%; Bi ‹0,0005%; Ca ‹0,008%; Mg ‹0,0015%
Cu ‹0,001%; Fe ‹0,008%; Mn ‹0,001%; Mo ‹0,02%; Ni ‹0,001%
P ‹0,005%; Pb ‹0,0005%; S ‹0,004%; Sb ‹0,001%; Si ‹0,005%;
Sn ‹0,0005%; Ti ‹0,001; V ‹0,001%; K ‹0,006%.

SUPPLY FORM:

Sodium polytungstate is usually supplied as an instantly usable aqueous solution with a density of 2.82± 0,02 g/cm³ or a density of ›3.0 g/cm³ in 1 kg, 5 kg, 10 kg and 25 kg units. In special cases, sodium polytungstate may be supplied in crystaline form in1 kg, 5 kg, 10 kg and 25 kg units.

TOXICOLOGY:

Generally all tungsten compounds are considered non-toxic (cf. "Metal Toxicity in Mammals - 2", Chemical Toxicity of Metals and Metalloids by B. Venugopal and T.D. Luckey, Department of Biochemistry, University of Missouri, Columbia 1978, as well as Handbook on the Toxicology of Metals, Chapter 39, by L. Fridberg, G.F. Nordberg and V.B. Vouk, ElsevierlNorth Holland Biochemical Press (1979)).
Further, tungsten is not mentioned in the phannacological textbook by Bader, in which the whole spectrum of toxic heavy metals is listed. Sodium metatungstate/sodium polytungstate was considered a new substance within the parameters of the new Chemicals Act (ChemG) and as such thoroughly analysed according to the given legal provisions (in accordance with the declaration and registration duties and the detailed test certificate provided for by the ChemPriifV [Test Certificate Decree]).
Sodium polytungstate was considered non-toxic in terms of the Chemicals Act.
Sodium polytungstate provided the following test results:
LD50 oral, Rat = 1715 mg/kg; LD50 dermal, Rat = › 2000 mg/kg.
Sodium polytungstate will not lead to skin irritation or skin sensibility.
Crystallised sodium polytungstate should not come into eye contact (eye irritation).

WASTE MANAGEMENT: The Sodium Polytungstate material can be reused over and over again by filtering out unwanted minerals leaving the clear Sodium Polytungstatematerial. Once the material does get used up from multiuse etc. you will need to contact a waste disposal company in your area to get rid of it. They will consult with you to dispose of the unwanted material.

VISCOSITY: Density approx. 2.45 g/cm^3, approx. 8 mPa.s *
Density approx. 2.89 g/cm^3, approx. 26 mPa.s **

*1 mPA is the viscosity of pure water. Therefore 8 mPa.s means that S/P is 8 times higher than pure water.

** The viscosity of the S/P at this density means that S/P is 26 times higher than the viscosity of pure water.

POLY-GEE BRAND SODIUM POLYTUNGSTATE:

The mixing of powder material:

Combine the POLY-GEE Brand Sodium Polytungstate powder and very pure distilled water in a pyrex beaker. Heat the water and powder combined, to more than 20ºC to dissolve the powder. Heat slowly so as not to burn the POLY-GEE material. Using the guidelines below for dilution, there might be a bit of variance in the density. If there is a variance, either boil off a bit of water (to increase the density), or add water (to decrease the density). The liquid will remain in liquid form. Keep in a plastic container. A bit of material may settle out over time. You need not be concerned about this.

For a Density of 2.45. Amounts of POLY-GEE material and distilled water:

1lb. Poly-Gee (454 grams)	+ 160 grams of water	= Density approx. 2.45 g/cm3
5 lbs. Poly-Gee (2270 grams)	+ 800 grams of water	= Density approx. 2.45 g/cm3
10 lbs. Poly-Gee (4540 grams)	+ 1600 grams of water	= Density approx. 2.45 g/cm3

For a Density of 2.89. Amounts of POLY-GEE material and distilled water:

1 lb. Poly-Gee (454 grams)	+ 101 grams of water	= Density approx. 2.89 g/cm3
5 lbs. Poly-Gee (2270 grams)	+ 505 grams of water	= Density approx. 2.89 g/cm3
10 lbs. Poly-Gee (4540 grams)	+ 1010 grams of water	= Density approx. 2.89 g/cm3

Do not boil the S/P Solution, maximum temperature is 158° F (70°C)

Figure 1:

The density of aqueous sodium polytungstate solution as a function of the mass portion at 25ºC.

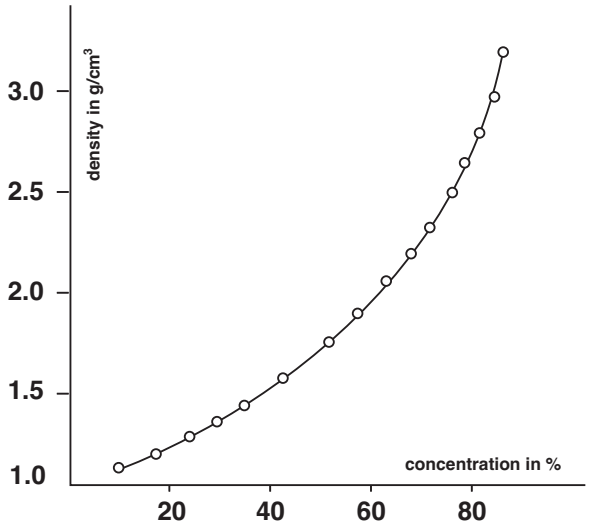


Figure 2:

The viscosity of aqueous sodium polytungstate solutions as a function of density at 25ºC.

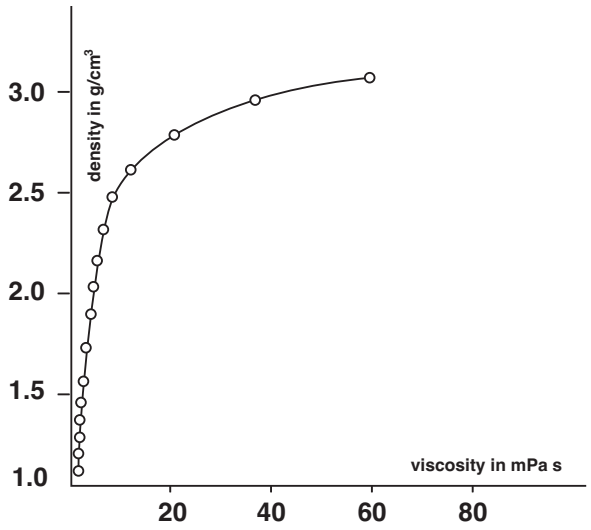
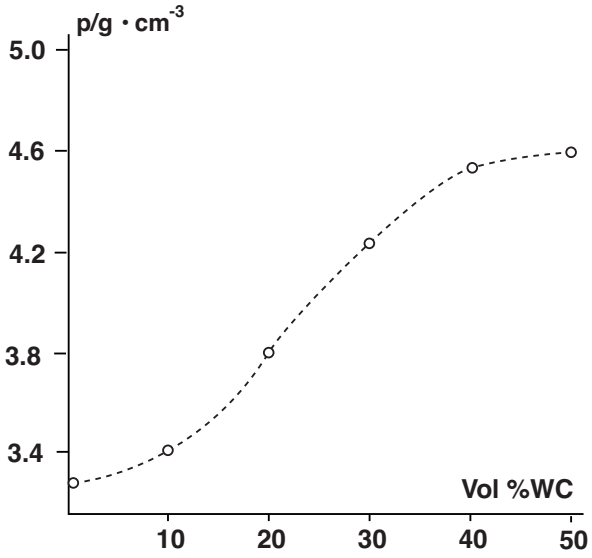


Figure 3:

The viscosity of a heterogenous mixture of aqueous sodium polytungstate solutions and tungsten carbide as a function of the solid material volume portion starting from a saturated aqueous sodium polytungstate solution.



1. INDENTIFICATION OF THE SUBSTANCE/PREPARATION:

Sodium metatungstate, Sodium polytungstate and
aqueous solution of Sodium metatungstate, Sodium polytungstate

2. COMPOSITION/INFORMATION ON INGREDIENTS:

CAS name: tungstate (W_{12}(OH) 20386-), hexasodium, hydrate

CAS No.: 12141-67-2 ELINCS No.: 412-770-9

Hazard symbol: Xn

R-phrases: 22-41-52/53

3. HAZARD IDENTIFICATION: Harmful if swallowed. Risk of serious damage to eyes. Harmful to aquatic organisms.

May cause long-term adverse effects in the aquatic environment.

4. FIRST-AID MEASURES: After inhalation take the patient into fresh air. Symptomatic treatment.

After contact with skin, wash immediately with plenty of water.

After contact with eyes, rinse eyes with water for at least 15 minutes, keeping the lids open. Consult a doctor.

In case of swallowing drink plenty of water. Induce vomiting. Symptomatic treatment. Consult a doctor.

5. FIRE-FIGHTING MEASURES: Suitable extinguishing media: No restriction in fire situations.
For reasons of security unsuitable extinguishing media: None.
Special risk due to the substance or the preparation itself, its combustion products or the gas being produced: In case of fire, tungsten trioxide is formed.
Special protective equipment when fighting fires: Firemen have to wear self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES: Avoid contact with skin and eyes.
Use the personal protective equipment listed in Number 8.

Do not empty into drains or waters.

Take up mechanically, avoid dust formation. Fill into labeled, sealable containers.

7. HANDLING & STORAGE: Information on safe handling
Recommended is: Use filling and siphoning unit which can be sealed dust-tight.
Information On fire and explosion prevention: none
Storage requirements on storerooms and containers:
The Water Resources Management Act and the relevant Local Waste Water Legislation and the Regulations on Plants for Storing, Filling and Transportation of Substances which are Hazardous to Water must be observed.

Information on common storage:
Products of storage class 13 may be stored in the same section of the warehouse.
Further information on storage conditions: Keep in sealed containers in a dry place.
Storage class according to VCI: 13

8. EXPOSURE CONTROLS/ PERSONAL PROTECTION: *Respiratory protection:* particle filter, e.g. DIN 3181 - P 2
Hand protection: gloves

Eye protection: tightly fitting protective goggles (acid protection goggles).

Body protection: Wear protective clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES:

Form: crystals
Color: white to yellow
Odor: lachrymatory
pH value: approx. 3 at 4000 g/l water at 20 °C
Melting point: decomposition
Inflammability: no
Spontaneous flammability: no
Boiling point: not applicable for crystals
Boiling point of solution: 100 °C (depends on density of the aqueous solution)
Vapor pressure: not relevant
Density: approx. 5,47 g/cm^3 at 20 °C
Bulk density: approx. 1570 kg/m^3
Solubility in water: ›1000 g/l at 20 °C
Solubility in fat: ‹0,7 mg/100 g fat at 37 °C
Partition coefficient n-octanol/water: Log POW = ‹ - 5,2 at 20 °C
Viscosity: not applicable
Viscosity of the solution: 1 mPas (depends on density of the aqueous solution)

10. STABILITY AND REACTIVITY:

Conditions to avoid: none
Substance to avoid: none known
Hazardous decomposition products: In case of fire, tungsten trioxide is formed.

11. TOXICOLOGICAL INFORMATION:

Acute toxicity: LD50 oral, rat: 1715 mg/kg
Acute toxicity: LD50 dennal, rat: more than 2000 mg/kg
Irritation of the eyes/rabbit: irritant, risk of serious damage to eyes
(method: directive 84/449/EEC, B.5.).
Irritation of the skin/rabbit (exposure 4 h): non-irritant. (method: directive 84/449/EEC, B.4.).

Non sensitizising (method: directive 84/449/EEC, B.6.): Magnusson and Kligmann maximization test

Subacute toxicity: NOEL, oral, rat: 150 mg (28-day test)

Mutagenic effect: Salmonella/microsome test (Ames test): No indication of mutagenic effects.
Micronucleus test: No indication of pI as to genic effects.

12. ECOLOGICAL INFORMATION:

Aquatic toxicity

Acute fish toxicity
96 h LCo = 320 mg/l (Cyprinus carpio)
96 h LC50 = 420 mg/l (Cyprinus carpio)
24 h LC50 = 420 mg/l (Cyprinus carpio)

Acute toxicity for daphnia:
48 h NOEC: 32 mg/l (Daphnia magna)
48 h EC50 : 83 mg/l (Daphnia magna)
24 h EC50 : 261 mg/l (Daphnia magna)

13 DISPOSAL CONSIDERATIONS:

Unused material: reuse if possible. May be disposed of on approved landfills after chemical/physical conditioning.

Waste code number: 51540

14 TRANSPORT INFORMATION:

GGV See/IMDG Code: -- UN No. : -- EmS: --

PG: -- MPO: NO

GGVE/GGVS: Class -- No. -- RID/ADR: Class -- No. --

Warning sign: Hazard no. -- Substance no. --

ADNR: Class -- No. -- Cat -- ICAO/IATA-DGR: not restr

Declaration for land shipment: --

Declaration for sea shipment: --

Declaration for shipment by air: --

Other information: Not dangerous cargo. Keep separated from foodstuffs.

15. REGULATORY INFORMATION:

Labeling in accordance with directive 79/831/EEC (definition principle) and its amendments and adaptations:

Symbol: Xn, hazard description : harmful sodium metatungstate

R 22: Harmful if swallowed.

R 41: Risk of serious damage to eyes.

R 52: Harmful to aquatic organisms.

R 53: May cause long-term adverse effects in the aquatic environment.

S 22: Do not breathe dust.

S 26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 39: Wear eye/face protection.

S 61: Avoid release to the environment. Refer to special instructions/Safety data sheets.

16. OTHER INFORMATION:

The data given here is based on current knowledge and experience. The purpose of this Safety Data Sheet is to describe the products in terms of their safety requirements. The data does not signify any warranty with regard to the products' properties.

DIRECTIONS FOR USE:

HOW DO I WORK WITH SODIUM POLYTUNGSTATE?

a) Use only distilled or demineralized water.
b) Use only glass, plastic or stainless steel containers.
c) Always add solutions in portions to water, not vice versa, in order to expedite formation of solution.
d) Do not allow the solution to come in contact with reducing agents.
e) The samples to be separated should be free of soluble calcium ions.
f) Laboratory centrifuges should be used for very rapid separations in the higher density range.
g) Avoid evaporation of the solution to dryness, since it takes many hours to redissolve the concrete-like solid formed which cannot be removed mechanically from glass containers.

RECOVERY OF SODIUM POLYTUNGSTATE
The polytungstate solution can be recovered by washing respective particles with distilled or demineralized water and then evaporating to the desired density respectively solid polytungstate is added.

1. THE VISCOSITY INCREASES RAPIDLY IN THE HIGH DENSITY RANGE
   Whenever possible, use a centrifuge (not a separatory funnel) for your work, since it shortens very substantially the separation process and in overcoming problems caused by viscosity in high concentration ranges.

2. THE SAMPLES TO BE PROCESSED CONTAIN SOLUBLE CALCIUM IONS
   The sample material to be separated should be free of soluble calcium ions. Otherwise, insoluble calcium polytungstate is formed. A respective example are clay-type minerals. If in doubt, wash sample thoroughly in hot water. If experiments show that there is still a reaction, simply use a minor amount of ethylenediamine tetraacetic acid, the common water softening agent. This complex is water soluble.

3. IF THE SOLUTION SUDDENLY TURNS BLUE
   The solution has come into contact with reducing agents. This, however, does not influence the selected density. If the color is not to dark let the solution stand for a few days under admission of air or add a few droplets of hydrogen peroxide. The solution then returns to its original color or slightly yellow.

4. IF YOU WORK WITH SULFIDES, ETC.
   These could act as reducing agents. Wash the samples before separation with hot water or decompose the same with a diluted mineral acid.
   - Depending on whether the specified SPT you work with has 2, 12 or 24 H2O bonded as crystal water, there may be slight variations.
   - Example: A solution with a density of 2.94 g/cm3 at 20ºC is obtained by an 84 mass % solution (e.g. 840g solid and 160g water).

5. PROCEDURE FOR RECYCLING SODIUM POLYTUNGSTATE
   a) Pour Na Polytungstate through a 55mm glass microfibre filter (Whatman Cat. No. 1820 055)
   b) Discard the filters (use many to filter a 2-liter solution)
   c) Pour the filtrate into plastic pans, and place in oven at 50C. After 2–3 days, the liquid has evaporated, leaving a solid.
   d) Grind solid, recycled Na Polytungstate using a mortar and pestle.

SODIUM POLYTUNGSTATE GENERAL INFORMATION:

Should you encounter difficulties or make observations not mentioned on these pages, we would appreciate your respective information so that we will be able to assist you.

WHY SODIUM POLYTUNGSTATE?
Because it is superior to known and so far used heavy liquids

a) It is non-toxic
b) It is safe in respect to ecology and simple to handle
c) It is easy to recover almost fully
We have developed this product for you- and worldwide many of your colleagues avail themselves of sodium polytungstate for mineral separations and for the density gradient centrifugation. Earthquake researchers also use the product.
It is by no means difficult to switch from a familiar but health damaging chemical like TBE
to a non-toxic product, which additionally offers many advantages.

CHEMICAL DESCRIPTION
Sodium Polytungstate (SPT) is the generic name for the compound here involved: Sodium metatungstate Ns6(H_2 W_{12} O_{40}), which is a spherical molecule having 40 oxygen atoms in its outer shell, 12 tungsten atoms in tetrahedrsl configuration in an inner shell and 2 hydrogen atoms in the center, all surrounded by 6 sodium cations.
The analytic data are: WO_3 = 86.66%; Na 4.50%; H_2O= 8.84%.

TRACE ELEMENTS
As< 5 ppm; Bi< 2 ppm; Co< 1 ppm; Cu< 1 ppm; Fe< 1 ppm; Mn< 1 ppm;
Mo< 2 ppm; Nb= 6 ppm; Ni< 1 ppm; P= 8 ppm; Pb< 1 ppm; Sb= 2 ppm;
Si= 17 ppm; Sn= 7 ppm; Sr< 1 ppm; Ta< 1 ppm; Ta< 1 ppm; U< 10 ppm.

In view of the high water solubility of SPT, these trace elements can be totally removed from the separated goods by a few washings with a little water.

*US Pat. 4,557,718

DENSITY VERSES CONCENTRATION AT 20°C