URANIUM SALTS FOR STAINING

Uranyl Acetate
Product No. 19481

PREPARATION

Uranyl Acetate – 7% aqueous

Place 45ml distilled water into a 100ml graduated glass beaker. Place the beaker onto a magnetic stirrer, and its stirring bar into the beaker. Start stirring with the magnetic stirrer. Slowly add 3.5g uranyl acetate, about 1g at a time, waiting for each portion to dissolve and become clear in the solution. This usually takes between 5 to 10 minutes, possibly more. The volume should be brought up to 50ml with distilled water. It now needs to be stored in a small brown bottle since this solution is light sensitive.

Uranyl Acetate – 10% in 50% methanol

Place 30ml absolute methyl alcohol into a 100ml graduated glass beaker with a small clean stirring bar onto a magnetic stirrer. Start stirring with the magnetic stirrer. Slowly add 5g uranyl acetate, about 1g at a time, waiting for each portion to dissolve and become clear in the solution. This can take 10 to 15 minutes, possibly more. Since this dissolution is endothermic, it can be hastened by holding the beaker in a simple warm water bath from a hot water faucet for a minute or two between additions. Add a little methanol if needed to maintain a 25ml volume. When all of the chemical is dissolved, add distilled water to 50ml and store in a small brown bottle.

STAINING

Alcoholic solutions of uranyl salts generally stain plastic sections more rapidly than aqueous solutions. Stain sections for 10 to 60 or more minutes at room temperature. Penetration can be increased with higher temperatures of 37ºC up to 60ºC, but care must be taken to inhibit evaporation. Concentrations up to 25% or 30% can be used for dense staining, especially for high voltage EM.

Aqueous solutions of uranyl salts are used for 15 to 45 minutes to stain plastic sections.

Consult the references below for further details.

REFERENCES

Lewis, P. R. and Knight, D.P. (1977) Staining methods for sectioned material, in: Practical methods in electron microscopy, A.M. Glauert, ed. 5(I):45-47.

TED PELLA, INC.
Tools for Science and Industry
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Measurements on 100 gram sample of Uranyl Acetate. All measurements have been done above an open bottle.

1a. Alpha (α)
<2 counts/sec
using a 540 scintillation meter with AP-2 Probe

1b. Beta (β)
>500 Counts/sec
using a 540El probe coupled to a GM Meter (this determines beta events and some low energy gamma events.

1c. Gamma dose Rate (energy field) (γ)

Two measurements done:

A. Mini monitor type R with GM Probe. This is more specific to Gamma due in fact to being constructed to accept a narrow energy range (discriminates against beta) field: 0.6mR/hr (mainly gamma).

B. Ionization chamber DMM 95/0500 – 1/6 for total Beta and Gamma energy field 5m/R/hr (γ + β).

Please note that a high efficiency scintillation counter will measure many of these events, but it will say nothing about the energy field. The customer must use a dose rate meter. (You can see the difference between the energy events and gamma dose rate). A Geiger counter will not do the job.

2. Our uranium is U235 depleted. Typical Isotopic Composition is:

U238 99.6 – 99.7%
U235 0.3 – 0.4%

Natural Uranium has two main Isotopes: U^{238} and U^{235}

Natural Isotopic composition would be:
U238 – 99.3%
U235 – 0.7%

That is to say material supplied by Ted Pella, Inc. is Uranium depleted, i.e., the U^{235} content is reduced from 0.7% to between 0.3 – 0.4%. Both natural and depleted Uranium, being a mixture of isotopes and daughters, will be expected to demonstrate alpha, beta and gamma activity.

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RADIOACTIVE MATERIAL

The average number of atomic transformations occurring per second is termed the activity of the radioactive material.

The old, traditional unit of activity is Curie (Ci), which is defined as 3.7 x 10^{10} atomic transformations per seconds. For smaller quantities, the one-thousandth and one-millionth units are used; namely, the millicurie (mCi) and the microcurie (µ/Ci).

However, by International agreement, the unit of activity is currently being changed. The new unit of activity is the becquerel (Bq) which is defined as one atomic transformation per second. Becquerel is an extremely small unit. Larger units are used; namely, the kilobecqueral (1kBq – 10^3Bq), the megabecquerel (1MBq = 10^6Bq), the gigabecquerel (1 GBq = 10^9Bq) and the tetrabecquerel (1 TBq = 10^{12}Bq).

It may be noted that: 1 Ci = 3.7 x 10^{10}Bq = 37GBq = p.037TBq.

A material must have a specific activity greater than 74 becquerel per gram (Bq/g) (0.002µCi/g) or 74 kBq/kg in order to be regarded as a radioactive material.

Uranyl Acetate sold by Ted Pella, Inc. has an activity of:
U (depleted) .28µCi •gm^{-1} (µCi = microcuries)

Formula for conversion to Bq is: 1 Ci = 3.7 x 10^{10}Bq

$\therefore$ for U (depleted) Specific Activity = 0.51 x 10^{-6} x 3.7 x 10^{10}Bq•gm^{-1} = 1.887 x 10^4Bq•gm^{-1}
Uranyl Acetate Specific Activity (U approx. 55%) = 1.04 x 10^4Bq•gm^{-1} or 10.4 kBq•gm^{-1}

$\therefore$ Uranyl Acetate will exhibit 10,400 disintegrations/sec/gm.

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