BENZENE LINE

TO PREPARE SAMPLE FOR CARBON DATING

What type of equipment do you need for c14 dating?

Equipment for radiocarbon dating

When discussing generally a set of lab equipment required for radiocarbon dating possibile are: Conventional Carbon Dating Method and Massspectrometry Method.

As a Conventional Carbon Dating Method laboratory is based on Radioactivity measurement by Proportional counter or by Liquid Scintillation Counting (LSC).

As for LSC based Conventional Carbon Dating Method, it is required modern liquid scintillation counter (spectrometer) like: QUANTULUS Liquid Scintillation Spectrometer or Tri-Carb Liquid Scintillation Counters both produced by PerkinElmer Inc..

We offer: Radiocarbon dating equipment: Benzene line to produce benzene for liquid scintillation as a counting media for radiocarbon sample. Enclosed package includes scheme of complete system and photos of recently equiped laboratories.

SOME REQUIREMENTS:

Staff required: 2-4 person. Rooms: at least 2 rooms of 20 square meter each (one as an chemical lab) and another for counting equipment. Both including water, electricity and ventillation system.

Additional: Vacuum pump (1 or 2).

Chemicals:

Liquid nitrogen: up to 0,5-1,0 L per sample. Lithium (metal as for synthesis) of 3,0 to 10,0 g per sample. Alcali (NaOH, 1-3%). Acid (HNO3, 1-3%). Hydrofluoric acid, (1-2%) Sulfuric Acid ...

Radiocarbon Dating Equipment offer: Benzene line developed for benzene syntheses used as counting media for radiocarbon dating or tritium analyses. The chemical laboratory for conventional C14 dating The laboratory consists of subsets of equipment technologically oriented for:

High temperature set:

- Charring samples of wood, peat, humic acids, collagen etc.
- Lithium carbide production.

Low temperature set:

- Acetylene production, purification and catching.
- Benzene synthesis and sublimation.
- LSC vials for Quantulus 1220TM

Equipment set is developed for wide application of vacuum pyrolysis process in sample preparing for LSC counting.



http://benzene-line.com

http://benzene-line.com/setup.htm http://benzene-line.com/benzene-line.html http://benzene-line.com/teflon-vials.html http://benzene-line.com/equipment.htm



1.
$$\operatorname{MnO}_2 \xrightarrow{-\operatorname{O}_2}_{530\mathrm{C}^\circ} \operatorname{Mn}_2\mathrm{O}_3 \xrightarrow{-\operatorname{O}_2}_{740\mathrm{C}^\circ} \operatorname{Mn}_3\mathrm{O}_4 \xrightarrow{-\operatorname{O}_2}_{900\mathrm{C}^\circ} \operatorname{MnO}$$

2. $2CO_2 + 10Li \rightarrow Li_2C_2 + 4Li_2O$

3. $Li_2C_2 + 2H_2O \rightarrow 2LiOH + C_2H_2$

 V_2O_5 catalyst $3C_2H_2$ $C_6 H_6$

List of equipment for conventional LSC C14 dating

1. The equipment for charring of wood, peat, humic acids, collagen and others.

- 1.1. A vertical furnace (800 watt, 220 volt).
- 1.2. Stainless steel reaction vessels with cover (3 small, 2 middle and 1 large).
- 1.3. Thermo destruction gas utilizing reactor.
- 1.4. A mounting for cooling and holding reaction vessels.
- 1.5. Set of auxiliary equipment.
- 2. The equipment for lithium carbide production.
- 2.1. A vertical furnace (800 watt, 220 volt).
- 2.2. A flat furnace for heating of cone reaction vessels (800 watt, 220 volt).
- 2.3. An easily discountable water-cooled hermetized head.
- 2.4. Stainless steel cylindrical reaction vessels (3 small and 2 large) and
- titanium liners (10) for lithium carbide production from charcoal (up to 20 g), from any samples by "vacuum- thermo destruction carbide process" and of
- small amounts of carbon dioxide (from 0.3 g to 3 g).

2.5. Cone metal reaction vessels (3) for lithium carbide production from carbon dioxide (from 3 g to 40 g).

2.6. A holder for mounting a vacuum gauge with valves for vacuum, argon and carbon dioxide, with fast-cooling system for reactor vessels and with seats for storing clean reactor vessels.

- 2.7. Small set auxiliary equipment.
- 3. The equipment for acetylene production.
- 3.1. A lithium carbide hydrolysis module (1 small and 1 large).
- 3.2. The equipment for chemical purification and catching of acetylene.
- 3.3. Stainless steel variable volume storage vessel (for 6 litter of acetylene maximum) - 2 vessel.
- 4. The equipment for benzene synthesis.

4.1. Benzene synthesis modules (one double module). The module consists of: two vacuum manifolds with gauges, Teflon valves, cryogenic traps, reaction vessel with catalyst, heater - cooler system with temperature controller.

http://benzene-line.com/technology.htm

benzeneline@gmail.com http://benzene-line.com tel.: +380507192344

It includes:

Direct chemisorptions of carbon-containing gases produced by the controlled thermal degradation of organic materials under vacuum into a lithium alloy.

Fast, efficient, powerful, highly economical.

Vacuum pyrolysis Considerable simplificate and accelerate LS radiocarbon analyses, especially such materials as organic and soil organic, charcoal (even in ceramic)

"Vacuum pyrolysis" technology

1. Bulk material sample is mixed with manganese dioxide. Addition of manganese dioxide plays an important role. When the temperature is above 550 °C the manganese dioxide disintegrates with active oxygen liberation all over the volume of mixture. Oxygen liberation runs quietly, under the broad range of temperatures (550-940 °C). 2. Carbon-containing materials therewith are oxidized to carbon oxide and dioxide, and in such

kind are absorbed by melted lithium. 3. Resulted lithium carbide is subjected to hydrolysis.

4. Gassing acetylene is converted into benzene on vanadium catalyst.

How it looks like



The module is designed for benzene production using of 0.1 - 10 g acetylene. All constructional materials were selected in order to minimize of the "memory effect". Practically complete lack of this effect has been achieved. One technician can serve more than two double modules simultaneously and by normal work it is possible to carry out 4-10 synthesis of benzene per a day.

4.2. The glass benzene recovery vials with Teflon caps for refining and storage of benzene (40 vials of different sizes).

5. The equipment for benzene purification by sublimation.

The system allows to carry out a sublimate distillation of two benzene samples simultaneously (and to place benzene into micro-vials by special head).

6. LS vials for Quantulus - 1 ml, 2 ml, 3 ml, 5 ml, 7 ml.

This equipment allows obtaining lithium carbide according to following schemes:

- Sample - carbon - carbide;

- Carbon dioxide - carbide;

- Sample (organic matter or carbonates) -carbide, in one stage, using new highly efficiency technology.

And more:

- Acetylene production equipment could be used with already working systems of any laboratory.

- The acetylene loss is below 0.5%.

- One separate benzene synthesis module allows producing **daily** <u>5</u> samples of 3 g benzene each or 3 sample 7 g benzene each.

- The benzene yield is more than 92%.

- All specific materials used were selected to minimize "memory effect".

You could upgrade your existing conventional C14 dating laboratory!

You will get:

- Equipment for intensive operation;

- Novel technology "direct pyrolisis" applicable for most kind of sample materials;

- Step forward in lab possibilities.

References

- 1. Vadim V Skripkin, Nikolai N Kovaliukh. Recent developments in the procedures used at the SSCER Laboratory for the routine preparation of lithium carbide.RADIOCARBON. Vol 40, No 1 (1998) PP. 211-214
- 2. Michael Buzinny & Vadim Skripkin. Newly Designed 0.8-ML Teflon® Vial for Micro-volume Radiocarbon Dating.RADIOCARBON. Vol 37, No 2 (1995) PP. 743-747



Another complete laboratory

Teflon vials

