



Benzene line: equipment, laboratory setup and staff training

Equipment for radiocarbon dating Available Methods of Carbon Dating

Conventional Carbon Dating and Accelerator Mass-Spectrometry are two today's generally possible kinds of lab equipment and corresponding method applicable for radiocarbon dating.

Conventional Radiocarbon dating laboratory is based on Radioactivity measurement by Proportional counter or by Liquid Scintillation Counting (LSC).

LSC based Conventional Carbon Dating requires modern liquid scintillation counter (spectrometer) like: QUANTULUS - Liquid Scintillation Spectrometer or Tri-Carb Liquid Scintillation Counters both produced by PerkinElmer Inc.

and What kind of equipment is required for c14 dating?

Benzene line is developed for benzene syntheses used as counting media for radiocarbon dating or tritium analyses.

Benzene line is set of chemical equipment applied for sample preparation for conventional C-14 dating.

Sample material to be Carbon dated could be: (wood, charcoal, carbonate, peat, bone) and it is finally converted to C_6H_6 .

Carbon Conversion of sample includes combination of procedures: charring of sample, pyrolysis, and steps of synthesis: lithium carbide, acetylene and benzene. It includes modules, working under controlled vacuum, producing of benzene.

Vacuum line transports Carbon inside and between modules.

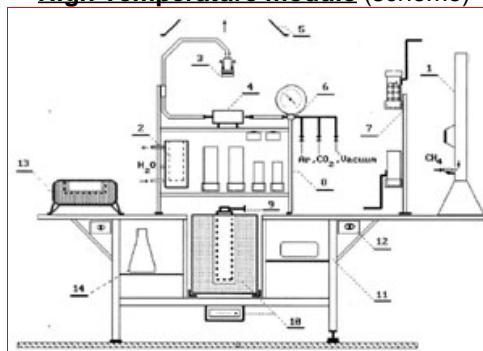
All it serves for Carbon dating by Liquid Scintillation when Radiocarbon activity is measured in benzene.

Two main sections work in line: High Temperature (800°C) and Low Temperature (up to 300°C), see below.

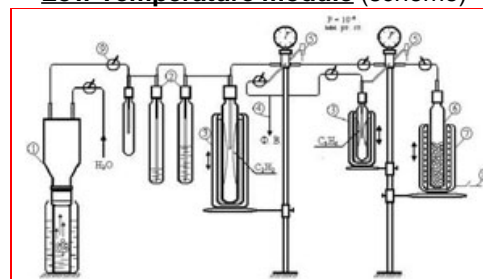
Recent developments in procedures of processing sample widened approaches for preparing benzene on base of datable carbon.

Stainless steel and Teflon are base materials in equipment

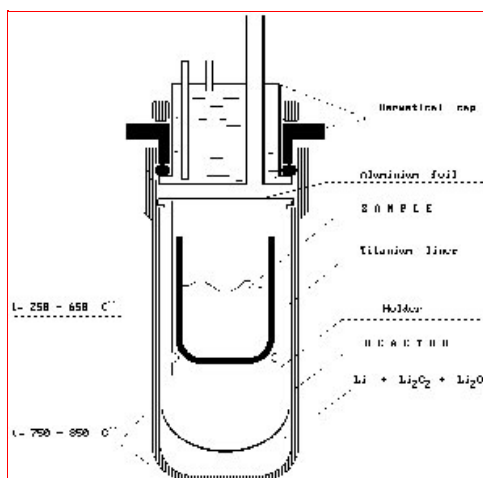
High Temperature module (scheme)



Low Temperature module (scheme)



Reaction vessel (scheme)



New lab (High T set)

High temperature module Charring and Carbide production

- Chimney (Is used for transfer of smoke while wood charring to charcoal).
- Water cooling system (cooling of reactor head and cooling of reactor vessel after processing).
- Water cooled reaction vessel head.
- Air (dust) filter.
- Ventilation cone.
- Manometer.
- Additional Stand.
- Main Stand.
- Holder of Reaction Vessel.
- Vertical Oven (up to 1000°C).
- Holder.
- Control unit (temperature).
- Plate Oven.
- Cone Reaction vessel.

Low temperature module Acetylene & benzene synthesis

- Hydrolyzator,
- Two stage line for chemical purification of acetylene using chromium solution (10 % CrO_3 solution in 10 % H_2SO_4 ,
- Cryogenic trap,
- Vacuum line,
- Check valve,
- Catalyst ($Cr_2O_3 + Al_2O_3 + SiO_2$),
- Oven to activate the catalyst,
- Electric grid,
- System of taps.

Reaction vessel is the Heart of benzene line - scheme corresponds to direct pyrolysis.

Reaction vessel is included in the high temperature module. It serves to synthesize lithium carbide by performing of chemical transformation reactions using Carbon of any kind of carbon containing sample material and lithium metal. It is covered with hermetic vacuumed and water cooled head and it works at 750-850°C as it was described at Skripkin, 1998.

Vacuum pyrolysis All reactions inside vessel flow, as it

concept.

Sample way to Carbon Dating by LSC **Based on Vacuum line**

- Sample pretreatment.
- Lithium carbide synthesis.
- Acetylene synthesis by carbide hydrolyzation.
- Acetylene purification (bubbling through the solution of chromium) and cryogenic freezing.
- Catalyst activation.
- Benzene synthesis (Trimerization on catalyst).
- Benzene cryogenic freezing.
- Benzene purification by sulfuric acid extraction and sublimation.
- Benzene counting (Modern liquid scintillation counting).

All steps listed above are performed in benzene line.

Sample Processing of Carbon and Carbon containing Materials (Lithium carbide processing schemes):

- - Charcoal sample - carbon - carbide;
- - Carbon dioxide - carbide;
- - Organic matter or carbonates sample - carbide, in one stage, using new highly efficiency technology.

Modern benzene line allows sample material conversion into benzene for at least 3-4 and up to 6-8 samples per day depending of kind of sample material and corresponding pretreatment required.

This is an Offer: Benzene line i.e. Equipment for carbon-14 dating, laboratory Set-Up and staff training

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New lab (Low T set)



Glassware Set (photo)



Contact us: c14@ukr.net

depends on sample condition, in one or two step without and/or with passive chemical oxidizer inside (pyrolusite). Such technology was published by Skripkin,1998. Some recent methodical developments were included in User Manual, into introduction lectures, into equipment introduction training and into metal in recent modifications of modern set of laboratory equipment - benzene line.

Low temperature module serves for acetylene synthesis, effective freezing, purification and compacting before benzene synthesis. High yield of acetylene conversion to benzene is achieved using of modern catalysts based on vanadium or chromium impregnated deeply into highly porous material.

Vacuum line is easy to be disassembled to change consumables and cleaning in case.

Small sample optimization of ability to produce a small sample of benzene based on use variable changeable quantity of high productivity catalyst allows minimization of "memory effect".

Laboratory glassware Hi Q glass

High quality tubes of three different diameters allow producing glass reaction vessels with cone connections.

Boron-silicate glass tubes are used to produce laboratory glassware applicable for all stages of sample conversion in benzene line.

Cone connections allow connecting glass reaction vessels with Teflon holders equipped with corresponding's.

Glassware production laboratory glass vessels, includes following main steps: cone formation, cone tuning, formation of tube bottom.

Working temperature range is : -200°C to +600°C.

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