

TheReporter

Reprinted from Volume 16, No. 5, 1997

T297015

© 1999 Sigma-Aldrich Co.

For more information, or current prices, contact your nearest Supelco subsidiary listed below. To obtain further contact information, visit our website (www.sigma-aldrich.com), see the Supelco catalog, or contact Supelco, Bellefonte, PA 16823-0048 USA.

ARGENTINA • Sigma-Aldrich de Argentina, S.A. • Av. Pueyrredon 2446/50 • Piso 5-B • Buenos Aires 1119
AUSTRALIA • Sigma-Aldrich Pty. Ltd. • Unit #2, 14 Anella Avenue • Castle Hill NSW 2154
AUSTRIA • Sigma-Aldrich Handels GmbH • Hebbelplatz 7 • A-1110 Wien
BELGIUM • Sigma-Aldrich N.V./S.A. • K. Cardijnplein 8 • B-2880 Bornem
BRAZIL • Sigma-Aldrich Quimica Brasil Ltda. • Rua Sabara, 566-Conj. 53 • 01239-010 São Paulo, SP
CANADA • Sigma-Aldrich Canada, Ltd. • 2149 Winston Park Dr., Oakville, ON L6H 6J8
CZECH REPUBLIC • Sigma-Aldrich s.r.o. • Pobrezni 46 • 186 21 Praha 8
DENMARK • Sigma-Aldrich Denmark A/S • Vejlegaardsvej 65B • DK-2665 Vallensbaek Strand
FINLAND • Sigma-Aldrich Finland/YA-Kemia Oy • Teerisuonkuja 4 • FIN-00700 Helsinki
FRANCE • Sigma-Aldrich Chimie • Chromatographie Supelco • L'Isle d'Abeau Chesnes - B.P. 701 • 38297 Saint-Quentin Fallavier Cedex
GERMANY • Sigma-Aldrich Chemie GmbH • Geschäftsbereich Supelco • Grünwalder Weg 30 • D-82041 Deisenhofen
GREECE • Sigma-Aldrich (o.m.) Ltd. • 72 Argonafton Str. • 16346 Ilioupoli, Athens
HUNGARY • Sigma-Aldrich Kft. • Nagy Diófa u. 7., IV fl. • H-1067 Budapest
INDIA • Sigma-Aldrich Co. • Survey No. 31/1, Sitharamapalaya • Mahadevapura P.O. • Bangalore 560 048
IRELAND • Sigma-Aldrich Ireland Ltd. • Airton Road • Tallaght • Dublin 24
ISRAEL • Sigma Israel Chemicals Ltd. • Park Rabin • Rohovot 76100
ITALY • Sigma-Aldrich s.r.l. • Via Gallarate, 154 • 20151 Milano
JAPAN • Sigma-Aldrich Japan K.K. • Division Supelco • JL Nihonbashi Building • 1-10-15 Nihonbashi Horidome-cho, Chuo-ku • Tokyo 103
KOREA • Sigma-Aldrich Korea • Samhan Camus Annex, 10th Floor • 17-26 Yoido-dong, Yungdeungpo-ku • Seoul
MALAYSIA • Sigma-Aldrich (M) Sdn. Bhd. • 9-2, Jalan 2/128, Taman Gembira • Off Jalan Kuchai Lama • 58200 Kuala Lumpur • Selangor
MEXICO • Sigma-Aldrich Quimica S.A. de C.V. • Calle 6 North No. 107 • Parque Industrial Toluca 2000 • 50200 Toluca
NETHERLANDS • Sigma-Aldrich Chemie BV • Postbus 27 • 3330 AA Zwijndrecht
NORWAY • Sigma-Aldrich Norway • Sandakerveien 102 • N-0483 Oslo
POLAND • Sigma-Aldrich Sp. z o.o. • Szelagowska 30 • 61-626 Poznań
PORTUGAL • Sigma-Aldrich Quimica, S.A. • P.O. Box 131 • Sintra 2710
RUSSIA • Sigma-Aldrich Russia • TOO Techmedbiochem • Makarenko Str. 2/21 • Building 1, Flat 22 • Moscow 103062
SINGAPORE • Sigma-Aldrich Pte. Ltd. • 102E Pasir Panjang Road • #08-01 Citilink Warehouse • Singapore 118529
SOUTH AFRICA • Sigma-Aldrich (pty) Ltd. • CNR Kelly & Ackerman Streets • Southern Life Industrial Park Unit • Unit 16/17 • Jet Park 1459
SPAIN • Sigma-Aldrich Quimica, S.A. • Apt. Correos 161 • 28100 Alcobendas, Madrid
SWEDEN • Sigma-Aldrich Sweden AB • Solkraftsvägen 14C • 135 70 Stockholm
SWITZERLAND • Supelco Switzerland • Industriestrasse 25 • P.O. Box 260 • CH-9471 Buchs
UNITED KINGDOM • Sigma-Aldrich Company Ltd. • Supelco UK • Fancy Road, Poole • Dorset BH12 4QH
UNITED STATES • Supelco • Supelco Park • Bellefonte, PA 16823-0048 • Phone 800-247-6628 or 814-359-3441 • Fax 800-447-3044 or 814-359-3044 • email:supelco@sial.com

H

This article is archived from a past issue of The Supelco Reporter. Information in the article was appropriate at the time of publication, but product specifications, catalog numbers, and availability may have changed over time.

If you have questions about applying methodology described in this article to a current application, please contact our technical service chemists.



Supelco is a member of the Sigma-Aldrich family. Supelco products are sold through Sigma-Aldrich, Inc. Sigma-Aldrich warrants that its products conform to the information contained in this and other Sigma-Aldrich publications. Purchaser must determine the suitability of the product for a particular use. Additional terms and conditions may apply. Please see the reverse side of the invoice or packing slip.

Carbon Adsorbents in Space Exploration Applications

B. Betz, Gas Chromatography, Supelco, Bellefonte, PA, USA



The National Aeronautics and Space Administration (NASA) has been studying planets in our solar system for several decades. The missions attempt to obtain a breadth of knowledge by gathering data on the electromagnetic spectrum, magnetic fields, particle analyses, and atmosphere constituents of these planets. Some information may lead to determining the birth of the solar system and origins of life on Earth. To assist in these studies, Supelco designed unique carbon adsorbents for analyzing atmospheric constituents under the arduous constraints of space exploration.

The Galileo Probe, which arrived at Jupiter in 1995, employed a column packed with a Carbosieve™ carbon molecular sieve adsorbent, as part of a mass spectrometer experiment. This adsorbent was developed to separate and quantify the gases in Jupiter's atmosphere — methane, water, argon, neon, hydrogen sulfide, krypton, xenon, ammonia, and isotopes of helium and hydrogen. The adsorption/desorption properties of the adsorbent allowed concentration of these gases of interest, and their subsequent desorption to a mass spectrometer sensor for analysis.

NASA's latest project is the Cassini Mission to Saturn. The journey to the ringed planet will last approximately seven years, and exploration will continue for four years. A total of 27 experiments will be performed, with the involvement of a number of international space agencies, academic institutions, and industrial partners. Supelco participated in composing the atmosphere sampling experiments.

The Cassini spacecraft consists of two parts — the Saturn orbiter will collect data, communicate with Earth, and power the spacecraft; the Huygens probe will separate from the orbiter and travel to Titan, Saturn's largest moon.

A gas chromatograph/mass spectrometer (GC/MS) in the Huygens probe will analyze the organic components of Titan's atmosphere. Light hydrocarbons will be concentrated using a new, porous graphitized carbon developed at Supelco specifically for this application. This carbon will trap the C2 to C8 hydrocarbon fraction — an important indicator of the presence of life.

Supelco scientists graphitized a carbon molecular sieve to optimize the analysis of light hydrocarbons and efficiently release the trapped analytes under conditions specific to a totally new GC/MS flow design. The carbon molecular sieve base withstands the vibrations of the launch and entry into Titan's atmosphere.

Also onboard the Huygens probe is another carbon molecular sieve, Carboxen™-1004. As the atmosphere of Titan is believed to be similar to that of ancient Earth, Supelco provided an adsorbent that will trap permanent gases. Scientists working at the University of Paris, packed a microcolumn with Carboxen-1004, for *in situ* GC/MS analysis.

A carbon molecular sieve is the carbon skeletal framework remaining after the pyrolysis of a polymeric precursor. They are used primarily for the collection of very small molecular-sized compounds. The size and shape of the molecule, and of the pores in the adsorbent particle, determine

how well the analyte is adsorbed and desorbed. Supelco offers numerous types of carbon molecular sieves, all of which have upper temperature limits of at least 400°C.

Supelco's carbon laboratory is one of the finest in the world. In addition to developing new carbon molecular sieves and making recent developments with porous graphitized carbon, we also produce a variety of graphitized carbon blacks (GCBs).

We can prepare carbons in sub-micron particle sizes (for capillary GC applications) to 1.0mm sizes (for sample preparation applications where pressure drop considerations are required). Some carbons are available in larger sizes. The temperature capability of our furnace reaches 3000°C, and its capacity extends from bench- to pilot-scale. We pride ourselves on being able to tailor carbon adsorbents to specific applications. The graphitized carbon molecular sieve designed specifically for NASA is just one example.

Supelco™ carbon adsorbents are available in bulk, and packed in columns, sampling tubes, or gas purifiers. Custom requests are welcome, even if your demands are earthbound.

Ordering Information:

Description	Cat. No.
PLOT Capillary GC Columns	
Carboxen 1010 Columns	
Carbon molecular sieve;	
for permanent gases.	
30m x 0.32mm ID	24246
30m x 0.53mm ID	25467

Carbosieve, Carboxen, and Supelco are trademarks of Sigma-Aldrich Co.

Fused silica columns manufactured under HP US Pat. No. 4,293,415.

German Pat. No. 1935500. Patent holder - Badische Anilin & Soda-Fabrik Aktiengesellschaft.

