



C E N T A U R[®]

CATALYTIC/ADSORPTIVE CARBON



CENTAUR HAS DRAMATICALLY ENHANCED THE ABILITY TO IMPROVE A BROAD RANGE OF MANUFACTURING PROCESSES AND ENVIRONMENTAL APPLICATIONS.

GRAPHITE PLATE OF CARBON STRUCTURE

CENTAUR STRUCTURE

CENTAUR HAS 10-100X MORE CATALYTIC SITES FOR ELECTRON TRANSFER

STANDARD ACTIVATED CARBON STRUCTURE

10-100X FEWER CATALYTIC SITES



(10,000,000X MAGNIFICATION)

RESEARCH CHEMISTS AT CALGON CARBON CORPORATION HAVE ENHANCED THE SURFACE CHARACTERISTICS OF ACTIVATED CARBON, ADDING THE CAPABILITIES OF CATALYSIS TO ADSORPTION.

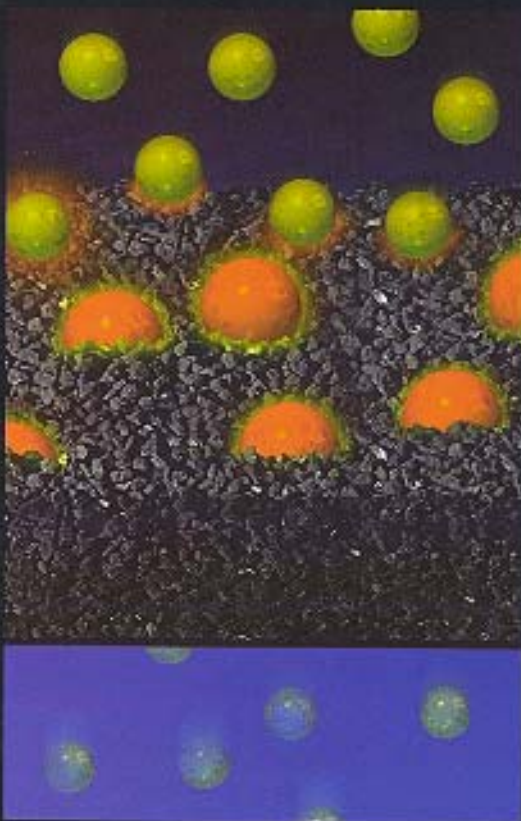
CENTAUR®:

GREATER PERFORMANCE

Calgon Carbon Corporation, the world leader in activated carbon technology, introduces Centaur, a new dimension in activated carbon technology. Now activated carbon has enhanced, controlled catalytic properties. Centaur accelerates reaction rates, reduces chemical requirements and results in efficient conversion of reactants into products.



- Centaur is activated carbon with its traditional adsorptive pore structure.
- It is manufactured using a process that changes its electronic character.
- Centaur is not impregnated, yet possesses many of the properties associated with impregnated carbons.
- It is a unique activated carbon with enhanced catalytic functionality.
- Centaur promotes a wide range of chemical reactions where conventional carbons are not effective.



CENTAUR PERFORMANCE – THE SYNERGY OF ADSORPTION WITH ENHANCED CATALYTIC CAPABILITY.

CENTAUR— HOW DOES IT WORK?

STEPS IN THE CATALYTIC REACTION

ADSORPTION

- REACTANTS ARE TRANSPORTED TO ACTIVE SITES WITHIN CARBON STRUCTURE
- ADSORPTION TAKES PLACE AT CATALYTIC SITE

CATALYSIS

- CHEMICAL REACTION OCCURS ON CARBON SURFACE
- REACTION PRODUCTS ARE FORMED

SITE RESTORATION

- CATALYTIC SITE IS RESTORED
- DESORPTION OF GASEOUS PRODUCT OCCURS
- REMOVAL OF RETAINED PRODUCTS TAKES PLACE



CENTAUR

THE CATALYTIC DIFFERENCE

Centaur is engineered to provide controlled catalytic activity. To ensure consistent product functionality, all Centaur carbon is manufactured to a Peroxide Number specification. The Peroxide Number provides a useful estimate of Centaur utility in a wide variety of potential applications.

In some applications, specific tests exist to measure activated carbon performance. For example, Galgon Carbon test method TM41 is used to measure the effectiveness of H_2S removal for municipal odor control. For an explanation of the TM41 test, see the opposite page.

The Peroxide Number Index Test Procedure

Buffer
0.4 moles
 H_2O_2

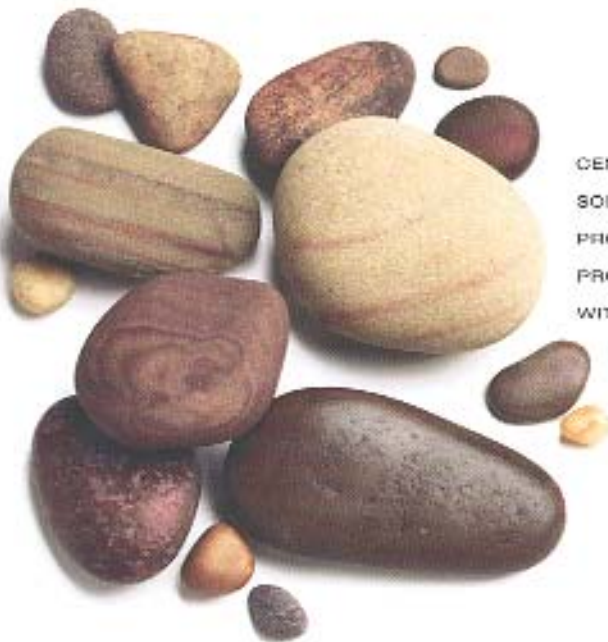
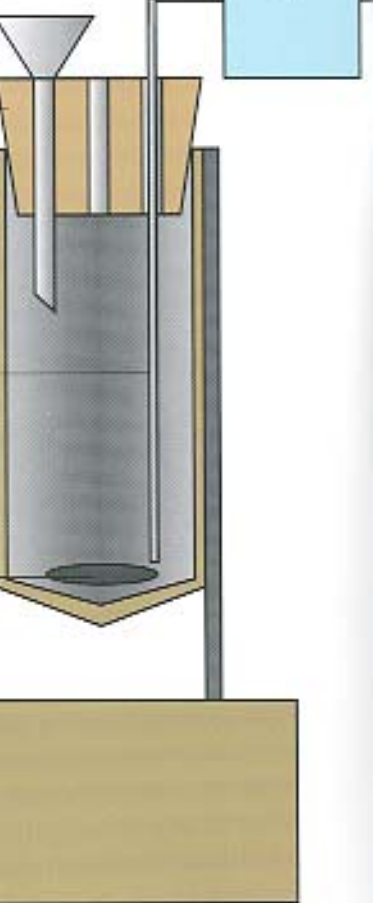
Dewar

Thermocouple
 $2H_2O_2 =$
 $2H_2O + O_2 + \text{Heat}$

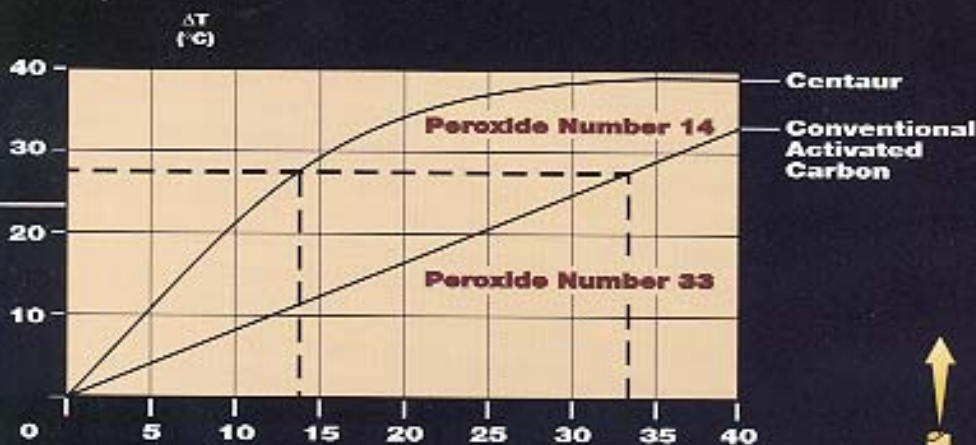
0.5cc
Powdered
Carbon

Magnetic
Stirrer

Thermocouple
Ice Point
Compensator



CENTAUR CAN HELP
SOLVE MANUFACTURING
PROCESS AND ENVIRONMENTAL
PROBLEMS MORE EFFICIENTLY
WITH ITS UNIQUE COMBINATION
OF PROPERTIES.

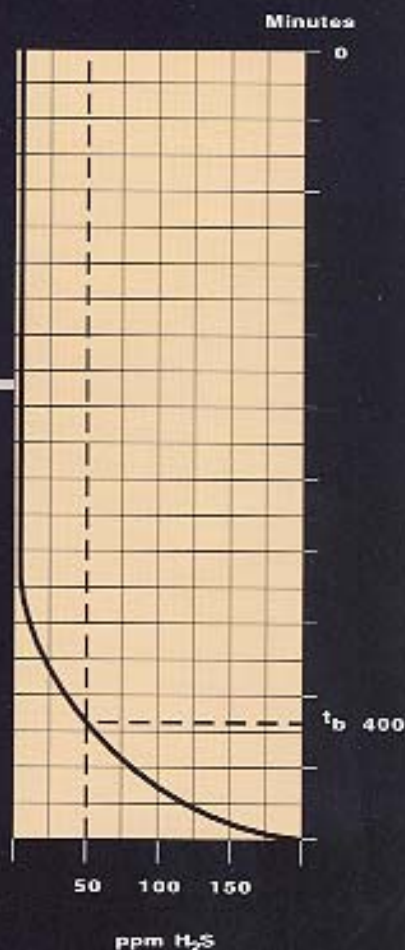


TIME (MINUTES)

THE PEROXIDE NUMBER MEASURES THE RATE OF DECOMPOSITION OF HYDROGEN PEROXIDE BY THE CARBON AND IS AN INDICATOR OF THE AMOUNT OF CATALYTIC ACTIVITY. THE LOWER THE NUMBER, THE MORE ACTIVE THE PRODUCT IS IN TERMS OF ITS ABILITY TO ACCELERATE A CHEMICAL REACTION.



1 VOL% H_2S IN
80% RH AIR AT
1,450 CC/MIN.



THE TM41 TEST FOR ODOR CONTROL APPLICATIONS MEASURES H_2S CAPACITY. A MOIST AIR STREAM CONTAINING 1% H_2S (TOTAL FLOW RATE OF 1,450 CC/MIN.) IS PASSED THROUGH A 0.725-INCH DIAMETER 9-INCH LONG COLUMN OF ACTIVATED CARBON AND MONITORED TO 50 PPM H_2S BREAKTHROUGH.



(RIGHT BEAKER)
HYDROGEN PEROXIDE
CONTAINING CENTAUR
SHOWS ENHANCED
CATALYTIC ACTIVITY.
STANDARD CARBON
(LEFT BEAKER) SHOWS
NO VISIBLE ACTIVITY.



CENTAUR



EFFECTIVE HYDROGEN
SULFIDE REMOVAL FROM
GROUNDWATER



FASTER CHLORAMINE
REMOVAL THAN STANDARD
ACTIVATED CARBONS

THE WIDE RANGE OF PROV

OXIDATION/REDUCTION REACTIONS

CUSTOMER NEED

CENTAUR SOLUTION

Hydrogen Sulfide Removal
- Vapor Phase

Converts H_2S to sulfuric acid;
spent carbon is water regenerable^A

Hydrogen Sulfide Removal
- Liquid Phase

Converts H_2S to sulfate to eliminate
sour taste/odor in potable water

Sulfur Dioxide Emissions
Abatement^F

Fast reaction rate with wide
range of concentrations; spent carbon
is water regenerable

Nitrogen Oxide Abatement

Converts to nitrogen without reheating

Iron Oxidation

Promotes faster oxidation rates than
aeration

Phosphine Abatement

Converts phosphine to
phosphonic acid; spent carbon
is water regenerable

Sulfite Oxidation

Converts sulfites to sulfates

NEW APPLICATIONS ARE CREATED BY
CATALYTIC REACTIONS NEVER BEFORE
POSSIBLE WITH STANDARD
ACTIVATED CARBONS.





IDEAL FOR REMOVAL
OF RESIDUAL PEROXIDE
FROM WASTEWATER

EN CENTAUR APPLICATIONS

DECOMPOSITION REACTIONS

CUSTOMER NEED

CENTAUR SOLUTION

Peroxide Destruction

Eliminates residual peroxide with short contact time

Chloramine Removal

Decomposes chloramine in potable water faster than standard activated carbons

Hydrazine Decomposition

Complete destruction with short contact time



A CALGON CARBON CORPORATION ODOR CONTROL SYSTEM (ABOVE LEFT), AND PHOENIX™ ODOR CONTROL SYSTEM. BOTH ARE IDEALLY SUITED TO UTILIZE CENTAUR FOR HYDROGEN SULFIDE REMOVAL.*

CENTAUR PROVIDES SOLUTIONS FOR NO_x AND SO_x EMISSIONS.

*Purchase of this product from Calgon Carbon Corporation includes a license under the following U.S. Patents: Numbers 5350548 and 5494899.

†Centaur's® use in certain applications of this type is covered under certain licensing arrangements. Please check with your technical sales representative regarding your specific application.



CENTAUR TRANSCENDS THE TRADITIONAL BARRIERS OF STANDARD ACTIVATED CARBONS, CREATING A FERTILE GROUND FOR NEW IDEAS, NEW TECHNOLOGIES.



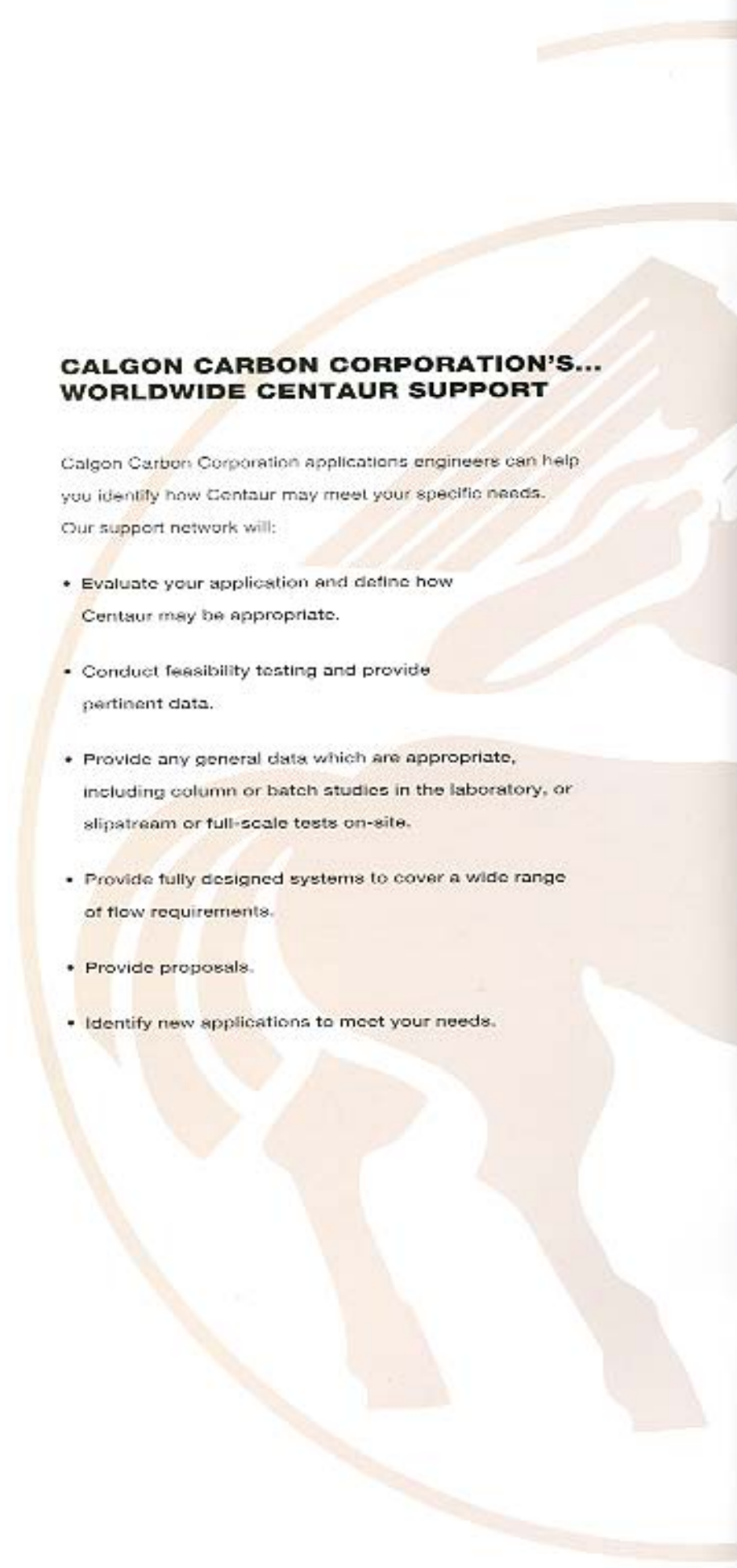
CALGON CARBON CORPORATION'S RESEARCH TEAM AND APPLICATIONS ENGINEERS ARE READY TO ANSWER YOUR QUESTIONS AND PROVIDE TECHNICAL SUPPORT.

CALGON CARBON CORPORATION'S... WORLDWIDE CENTAUR SUPPORT

Calgon Carbon Corporation applications engineers can help you identify how Centaur may meet your specific needs.

Our support network will:

- Evaluate your application and define how Centaur may be appropriate.
- Conduct feasibility testing and provide pertinent data.
- Provide any general data which are appropriate, including column or batch studies in the laboratory, or slipstream or full-scale tests on-site.
- Provide fully designed systems to cover a wide range of flow requirements.
- Provide proposals.
- Identify new applications to meet your needs.





CENTAUR- FEATURES/BENEFITS

FEATURE

BENEFIT

CATALYTIC ACTIVITY

PROMOTES A WIDE VARIETY OF CHEMICAL REACTIONS WHERE CONVENTIONAL CARBONS ARE NOT EFFECTIVE

NON-IMPREGNATED

ELIMINATES SAFETY CONCERNS WITH EXOTHERM, IGNITION TEMPERATURE AND DISPOSAL

ON-SITE REGENERATION CAPABILITY*

REDUCED OPERATING COST, EXTENDED SERVICE LIFE

THERMAL REACTIVATION OPTION

CAN BE RECYCLED AND REUSED

HIGH CONVERSION RATES

EFFICIENT USE OF REACTANTS

SIMPLE EQUIPMENT DESIGN

HANDLES FLUCTUATING INLET CONCENTRATIONS, REPLACES MORE COSTLY TECHNOLOGIES WITH A PASSIVE SYSTEM

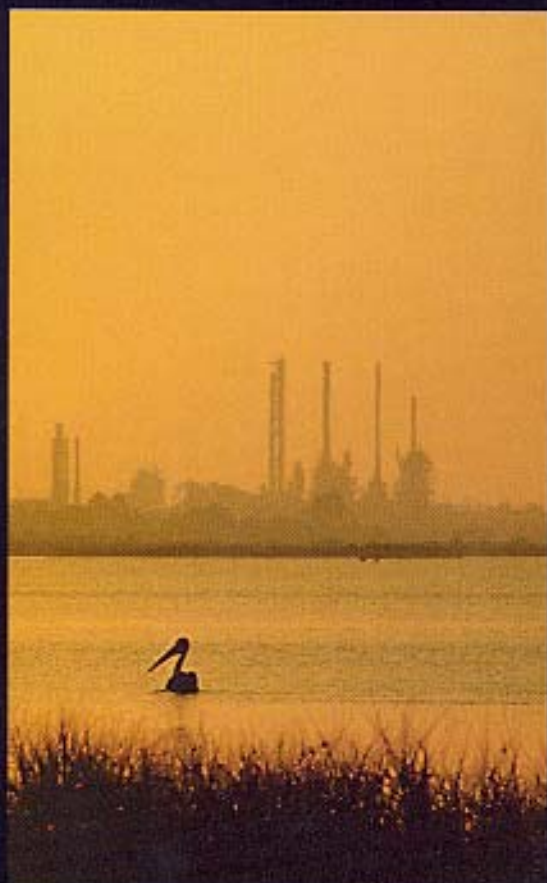
FASTER CHEMICAL REACTION RATES

REDUCED CARBON REQUIREMENTS, SMALLER EQUIPMENT

ONLY CENTAUR...

- is manufactured to enhance and control catalytic functionality, while at the same time providing maximum adsorptive capabilities
- possesses unique pore structure that facilitates catalytic functionality
- is suitable for a wide range of catalytic applications
- eliminates ignition and exotherm concerns with metal and alkali-impregnated carbons
- provides faster reaction rates in some applications, requiring smaller adsorption equipment and less carbon in use
- offers an alternative to expensive catalysts or scrubber/incinerator systems
- minimizes or eliminates chemical addition
- works well at low reactant concentrations
- can be regenerated on-site or recycled through off-site thermal reactivation





WITH ITS POTENTIAL
FOR SURPASSING THE
PERFORMANCE OF
STANDARD ACTIVATED
CARBONS, CENTAUR
REPRESENTS A MAJOR
TECHNOLOGICAL
ADVANCE IN SOLVING
ENVIRONMENTAL AND
PROCESS PROBLEMS.



C E N T A U R

**FOR MORE INFORMATION
ON CENTAUR.**

CALL CALGON CARBON CORPORATION
AT 1-800-4-CARBON.
OUTSIDE THE U.S.,
CALL 412-787-4519.

CHEMVIRON CARBON

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B-1200 BRUSSELS, BELGIUM

IN LATIN AMERICA

CALL CALGON CARBON CORPORATION
AT 412-787-4519

IN CANADA

CALL CALGON CARBON
CANADA, INC.
AT 905-857-9815

**IN EUROPE, MIDDLE EAST
AND AFRICA**

CALL CHEMVIRON CARBON
AT 322-773-0211

IN JAPAN

CALL CALGON FAR EAST
AT 81-3-3582-1861

**IN AUSTRALASIA, PHILIPPINES
AND SOUTHEAST ASIA**

CALL CALGON CARBON ASIA
AT 65-221-3500

IN CHINA, KOREA AND TAIWAN

CALL CALGON CARBON ASIA
AT 81-3-3560-7505



CALGON CARBON CORPORATION
The World Leader in Activated Carbon Technology



RECYCLABLE
PAPER

DF-001-01/20