



## **CONTACT INFORMATION**

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PRINTED: 08/02/2001

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: GRACE CHABAZITE

ALTERNATE NAMES:

SAN SIMON CREEK  
GRACE 1-4  
GSA RESOURCES CHABAZITE

COCHISE COUNTY MILS NUMBER: 674

LOCATION: TOWNSHIP 12 S RANGE 29 E SECTION 2 QUARTER S2  
LATITUDE: N 32DEG 25MIN 12SEC LONGITUDE: W 109DEG 21MIN 25SEC  
TOPO MAP NAME: MARTIN WELL - 7.5 MIN

CURRENT STATUS: PRODUCER

COMMODITY:

ZEOLITES CHABAZITE

BIBLIOGRAPHY:

AZ. STATE LAND DEPT. MINERALS LEASE LIST 1979  
LEASE NO. 69657  
ELEVATORSKI, E.A. 1978, ARIZ IND MINERALS P.20  
ADM MR MINERAL RPT. NO.2  
PRODUCTION ALSO FROM PITS IN SECS. 1 & 12  
AIME INDUSTRIAL MINERALS, VOL 2 P 1399  
ADM MR GRACE CHABAZITE FILE

NUMBER 674	FILE F	CONT 0	CONT1 N	PRINAME GRACE CHABAZITE						
ALTNAME1 SAN SIMON CREEK				ALTNAME2 GRACE 1-4						
ALTNAME3 GSA RESOURCES CHABAZITE				ALTNAME4						
ALTNAME5				ALTNAME6						
CURSTAT PRODUCER	MNAME MARTIN WELL - 7.5 MIN			NLATDEG 32	NLATMIN 25					
NLATSEC 12	WLONGDEG 109	WLONGMIN 21	WLONGSEC 25	TOWN 12 S	RANGE 29 E	SECTION 2	QUARTER S2	COM1 ZEO		
MODI1 CHABAZITE	COM2	MODI2	COM3	MODI3	COM4	MODI4				
COM5	MODI5	COM6	MODI6	COM7	MODI7					
BIB1 AZ. STATE LAND DEPT. MINERALS LEASE LIST 1979										
BIB2 LEASE NO. 69657										
BIB3 ELEVATORSKI,E.A.1978,ARIZ IND MINERALS P.20										
BIB4 ADM MR MINERAL RPT. NO.2										

ABSTRACTED FROM ADMMR ACTIVE MINES DIRECTORY, 1991

*Grace 1-4 file to be made  
Cochise County*

**GSA RESOURCES INC.**

P.O. Box 509, Cortaro, AZ 85652 - Phone 297-4330 - Employees: (including contractors) 16.

President .....

Ted H. Eyde

Vice President ..... Daniel

T. Eyde

**Grace Chabazite Mine T12S R29E Secs. 1, 2, 12**

Open pit mine located 13 miles north of Bowie - Crude chabazite used for cation exchange media and specialty adsorbants and deodorizers

- Shipped out of state for further processing.

ABSTRACTED FROM ADMMR ACTIVE MINES DIRECTORY, 1988

**GSA RESOURCES INC.**

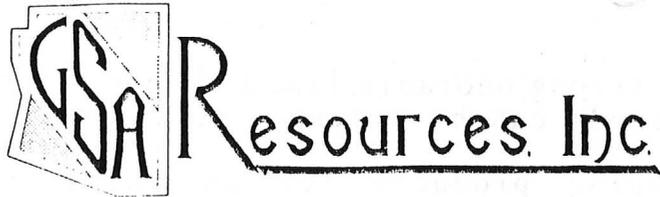
P.O. Box 509, Cortaro 85652 - Phone 297-4330 - Employees (including contractors) 16.

President ..... Ted H. Eyde  
Vice President ..... Daniel T. Eyde

**Grace Chabazite Mine**

T12S R29E Secs. 1,2,12

Open pit mine located 13 miles north of Bowie - Crude chabazite used for cation exchange media and specialty adsorbants and deoderizers - Shipped out of state for further processing.



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### CABSORB Product Information

GSA Resources Incorporated is the only independent producer of high purity natural chabazite products sold under the CABSORB® Trademark. Our company purchased the Grace Mine from W. R. Grace and Company when their Davison Chemical Division left the specialty adsorbent business in 1986.

GSA Resources Incorporated produces both activated and hydrated chabazite in several mesh sizes which are tailored to specific applications. Activated CABSORB ZC500A 4x8 mesh products are used in gas separation applications which require a high tolerance to acidic components in the gas stream. The product is the equivalent of Linde AW 500, and is related to LZ 218, Linde D, Linde R, SAPO-34, MAPO-44, MAPO-47, KZ-14 and ZYT-6. The attached isotherms show the product performance for selected gases and water adsorption.

CABSORB products are also used in ion exchange applications to remove ammonia and other cations from effluents. CABSORB ZS500 and ZC500 are highly selective for silver, lead, cesium 137 and strontium 90. The product is the equivalent of the Linde Ion Sieve IE 96 which was used in the clean up of the radioactive effluent from the Three Mile Island reactor accident.

We have been able to both reduce our prices and improve the quality of our products since production began in 1986. CABSORB ZS/ZC 500A has about 47% void space and a surface area about 500 square meters per gram which is larger than any other natural zeolite mineral. This means the rate of both sorption and ion exchange are higher than in any other natural zeolite.

Because of its superior ion exchange capacity and low moisture content as shipped, CABSORB products competitive on both a price and performance basis with the less expensive clinoptilolite products which we also market. Heavy metal-ion uptake capabilities are superior to those of the synthetic zeolites 3A, 4A, 5A and nearly equivalent to 13X for the removal of  $\text{Cu}^{+2}$ ,  $\text{Pb}^{+2}$ , and  $\text{Zn}^{+2}$  from solution.

A new markets for our products include odor control and animal feeds. Animal feed applications use clinoptilolite to promote animal growth and decrease mortality and morbidity. In odor

control applications strong odorants like hydrogen sulfide, sulphur dioxide and formaldehyde can be controlled.

We are also developing products for specialty environmental applications. Our organophilic absorbent is intended to separate organics from water. We have also treated a chabazite to be selective for anionic compounds including such problem materials like hexavalent chrome. Finally we are working to modify the structure of chabazite to make the material organophilic rather than hydrophilic. This should greatly enhance the odor control properties of the material.

GSA Resources Incorporated controls one of the largest chabazite deposits in the world. Our company can provide a dependable supply of CABSORB chabazite products for almost any application. Let us know if our products might have an application with your company. We are planning to build an extrusion facility to make products that could have specialty applications in catalysis and adsorption.



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## MATERIAL SAFETY DATA SHEET - CABSORB CHABAZITE PRODUCTS

**CABSORB-ZS500H, ZC500H, ZC400H**  
**Hydrous Sodium Aluminosilicate or Calcium Aluminosilicates**  
**Natural Chabazite (CHA)**  
**(Zeolite Powder and Granules)**

Date: 10/14/88

Revised: 11/17/93

Supersedes: 01/11/93

### **I. PRODUCT IDENTIFICATION**

Trade Name: NONE  
Chemical Name: Hydrated sodium aluminosilicate mineral  
Synonyms: Zeolite, chabazite  
CAS Registry No: 1318-02-1  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

### **II. PHYSICAL DATA**

Appearance and Odor: Dry tan powder, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

### **III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: None

## MATERIAL SAFETY DATA SHEET - CABSORB CHABAZITE

### IV. REACTIVITY DATA

Stability: Stable  
Conditions to Avoid: N. A.  
Incompatibility (Materials to Avoid): N.A.  
Hazardous Decomposition Products: None

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.  
Spillage: Sweep, scoop, or vacuum discharged material.  
Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.  
Skin Contact: May cause irritation.  
Inhalation: Causes Irritation.  
Ingestion: No hazards known or suspected.  
Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.  
Gloves: Plastic, rubber or cotton.  
Eye Protection: Safety glasses, or chemical goggles.  
Other Protective Equipment: N.A.  
Personal Hygiene: Avoid breathing dust.  
Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.  
Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.  
Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

Contact: Ted H. Eyde  
GSA Resources, Inc.  
Box 509  
Cortaro, Arizona 85652  
Telephone (602) 744-8845  
FAX (602) 744-7770

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## MATERIAL SAFETY DATA SHEET - CABSORB SC1502A

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.  
Spillage: Sweep, scoop, or vacuum discharged material.  
Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.  
Skin Contact: May cause irritation.  
Inhalation: Causes Irritation.  
Ingestion: No hazards known or suspected.  
Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

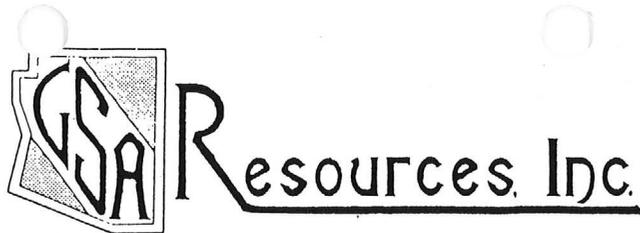
Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.  
Gloves: Plastic, rubber or cotton.  
Eye Protection: Safety glasses, or chemical goggles.  
Other Protective Equipment: N.A.  
Personal Hygiene: Avoid breathing dust.  
Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.  
Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.  
Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

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**MATERIAL SAFETY DATA SHEET - CABSORB SC1502A**  
**(Thermally Activated Montmorillonite)**

Date: 10/14/88

Revised: 03/19/93

Supersedes: N.A.

**I. PRODUCT IDENTIFICATION**

Trade Name: CABSORB TAM  
Chemical Name: Anhydrous calcium magnesium montmorillonite  
Synonyms: smectite, calcium magnesium bentonite  
CAS Registry No: 1302-78-9  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

**II. PHYSICAL DATA**

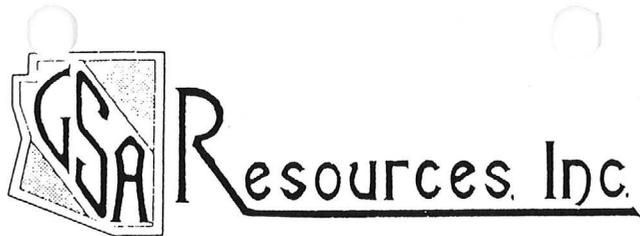
Appearance and Odor: Dry off-white powder or granules, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

**III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: None

**IV. REACTIVITY DATA**

Stability: Stable  
Conditions to Avoid: N.A.  
Incompatibility (Materials to Avoid): N.A.  
Hazardous Decomposition Products: None



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## MATERIAL SAFETY DATA SHEET - CABSORB Chabazite Products

CABSORB-ZS500A, ZC500A, ZC400A

Anhydrous Sodium Aluminosilicate or Calcium Alumina Silicate

Natural Chabazite (CHA)

(Zeolite Powder and Granules)

Date: 10/14/88

Revised: 11/17/93

Supersedes: 11/04/93

### I. PRODUCT IDENTIFICATION

Trade Name: NONE  
Chemical Name: Hydrated sodium aluminosilicate mineral  
Synonyms: Zeolite, chabazite  
CAS Registry No: 1318-02-1  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

### II. PHYSICAL DATA

Appearance and Odor: Dry tan powder, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

### III. FIRE AND EXPLOSION HAZARD DATA

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: In their fresh, unused, activated condition CABSORB Chabazite products are not flammable. When exposed to water, however, the products get hot. When first wetted these these products can heat to the boiling point of water. Flooding will reduce the temperature to safe limits.

## MATERIAL SAFETY DATA SHEET - CABSORB SODIUM Chabazite

### IV. REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Moisture (water) can cause a rise in temperature which may result in burns.

Incompatibility (Materials to Avoid): N.A.

Hazardous Decomposition Products: None

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.

Spillage: Sweep, scoop, or vacuum discharged material.

Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.

Skin Contact: May cause irritation.

Inhalation: Causes Irritation.

Ingestion: No hazards known or suspected.

Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.

Gloves: Plastic, rubber or cotton.

Eye Protection: Safety glasses, or chemical goggles.

Other Protective Equipment: N.A.

Personal Hygiene: Avoid breathing dust.

Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.

Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.

Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

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**Resources Inc.**

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**ZEOLITE AMMONIA EXCHANGE CAPACITY  
AMMONIA SPECIFIC ION ELECTRODE METHOD  
GSA RESOURCES CABSORB AND COMPETITIVE PRODUCTS**

Sample	Ammonia meq/g
Teague Minerals Zeofil	1.00
<b>GSA Resources CABSORB Sodium</b>	<b>2.20</b>
Magic Mountain XTRASORB	0.21
Japanese Clinoptilolite	1.56
Texas-Arizona crude	1.20
Serra Company coarse	1.20
Serra Company fine	1.20

**WESTINGHOUSE OIL & WATER ABSORPTION  
GSA RESOURCES CABSORB AND COMPETITIVE PRODUCTS**

Sample	Oil Absorption	Water Absorption
Teague Minerals Zeofil	18.7%	69.4%
<b>GSA Resources CABSORB Sodium</b>	<b>97.0%</b>	<b>107.0%</b>
Magic Mountain XTRASORB	16.4%	30.5%
Japanese Clinoptilolite	20.8%	39.1%





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**CABSORB-ZS500A**  
**(CABSORB SODIUM)**

Anhydrous Sodium Aluminosilicate  
Natural Herschelite-Sodium Chabazite (CHA)  
(Zeolite Powder and Granules)

**TYPICAL PROPERTIES**

Form	Powder or Granules
Color	Dark Brown (Dry Brightness 40)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	520.95 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 513kg/m <sup>3</sup> (32 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 3% by weight
pH of 1% Dispersion	8.5
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g
Sorption Capacity	Greater than 15 wt.% H <sub>2</sub> O at 10% R.H.

## TYPICAL CHEMICAL ANALYSIS

(Anhydrous Basis)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>Dominant Cation</u>
68.10	18.59	2.84	0.27	0.75	8.32	1.12	Na

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## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

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Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial pH indicated for each solution.

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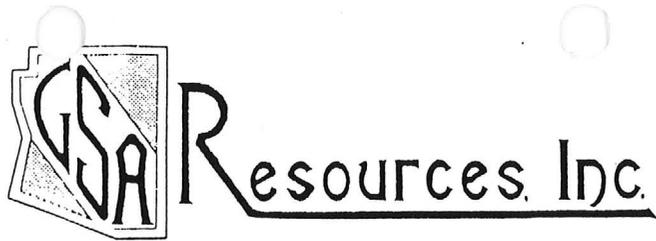
<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

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## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite

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## CABSORB-ZC400H

Hydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light yellowish brown (Dry Brightness 56)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 80%
Density	1.62 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.353 cm <sup>3</sup> /g
Surface Area	354 m <sup>2</sup> /g
Crystal Void Volume	N.D.
Packing Density	Approx. 536kg/m <sup>3</sup> (33 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 15% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	1.90 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
56.5	11.4	3.43	3.96	N.D.	2.15	1.20	N.D.	Ca

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## EXCHANGE SELECTIVITIES

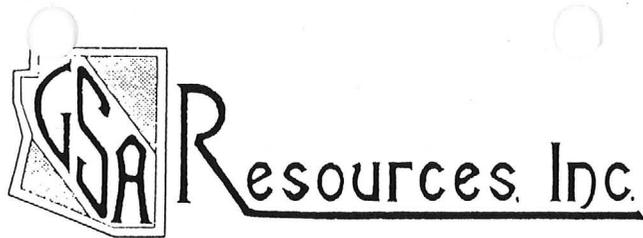
$Tl^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

---

## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite
Herschelite	

Information herein is accurate to the best of our knowledge. Suggestions are made without warranty or guarantee of results. Before using, user should determine the suitability of the product for his intended use and user assumes the risk and liability in connection therewith.



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## CABSORB-ZC500A

Anhydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)  
(Zeolite Powder and Granules)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Dark yellowish Brown (Dry Brightness 48)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Surface Area	462.20 m <sup>2</sup> /g
Total Pore Volume	.468 cm <sup>3</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 513kg/m <sup>3</sup> (32 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 3% by weight
pH of 1% Dispersion	8.5
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g
Sorption Capacity	Greater than 15 wt. % H <sub>2</sub> O at 10% R.H.

## TYPICAL CHEMICAL ANALYSIS

(Anhydrous Basis)

---

<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>TiO<sub>2</sub></u>	<u>Dominant Cation</u>
69.50	16.60	4.33	4.49	0.89	2.40	1.32	0.47	Ca

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution  $AgNO_3$ ,  $Pb(NO_3)_2$ ,  $CoSO_4$  and a 0.025 mg/ml solution of  $CuSO_4$  at the initial pH indicated for each solution.

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<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

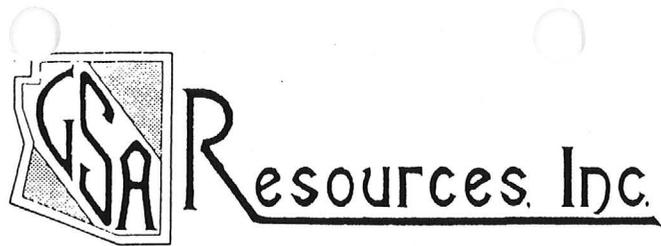
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## RELATED MATERIALS

Linde AW 500  
Linde Ion Sieve IE 95  
Linde Ion Sieve IE 96  
Linde D  
Linde R  
LZ 218  
MAPO 44  
MAPO 47  
Hershelite

Sapo 34      Hershelite  
TSM 300  
2 K - 14  
2 YT - 6  
Acadialite  
Haydenite  
Seebachite  
Willhendersonite

Information herein is accurate to the best of our knowledge. Suggestions are made without warranty or guarantee of results. Before using, user should determine the suitability of the product for his intended use and user assumes the risk and liability in connection therewith.



P.O. Box 509  
(602) 744-8845

Cortaro, Arizona 85652  
Fax (602) 744-7770

## CABSORB-ZC500H

Hydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light yellowish-Brown (Dry Brightness 50)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	462.20 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 577kg/m <sup>3</sup> (36 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 15% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
55.3	13.2	3.40	3.25	0.98	2.85	1.15	19.1	Ca

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial Mitial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34	Herschelite
Linde Ion Sieve IE 95	TSM 300	
Linde Ion Sieve IE 96	2 K - 14	
Linde D	2 YT - 6	
Linde R	Acadialite	
LZ 218	Haydenite	
MAPO 44	Seebachite	
MAPO 47	Willhendersonite	
	Herschelite	

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**CABSORB SC1502A**  
**(CABSORB TAM)**  
Magnesium Calcium Aluminosilicate  
Thermally activated Smectite (Bentonite)  
Bentonite Powder and Granules

Typical Properties

Form	Powder or Granules
Color	Gray
Smectite Content	+ 90%
Layer Spacing	15.5 Angstroms
Surface Area	97m <sup>2</sup> /g
Packing Density	993Kg/m <sup>3</sup> (62lbs/ft <sup>3</sup> )
Moisture as Packaged	Less than 2% by weight
pH of 1% Dispersion	8.0
Ion Exchange Capacity	125meq/100g. major exchange cation Ca

Typical Chemical Analyses in weight percent after drying at 110°C

Wt.%

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	LOI
61.00	18.10	1.38	2.66	5.84	0.19	0.11	11.67

Adsorption Capacities at 25°C After 2 Hrs. Activation at 175°C

Relative Humidity %

Water Vapor Adsorption wt/%

10

7

20

11

40

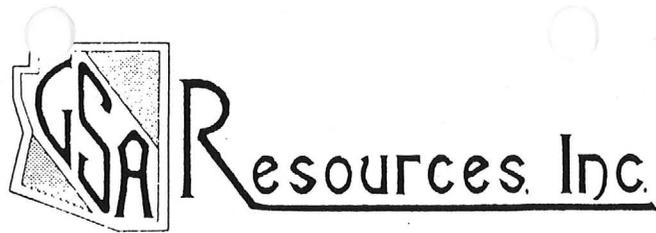
19

60

23

80

29



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## CABSORB-ZS500H (CABSORB SODIUM)

Hydrous Sodium Aluminosilicate  
Natural Herschelite-Sodium Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light Brown (Dry Brightness 43)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	520.95 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 577kg/m <sup>3</sup> (36 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 10% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

---

<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
54.6	14.9	2.28	0.22	0.60	6.67	0.90	19.4	Na

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial initial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

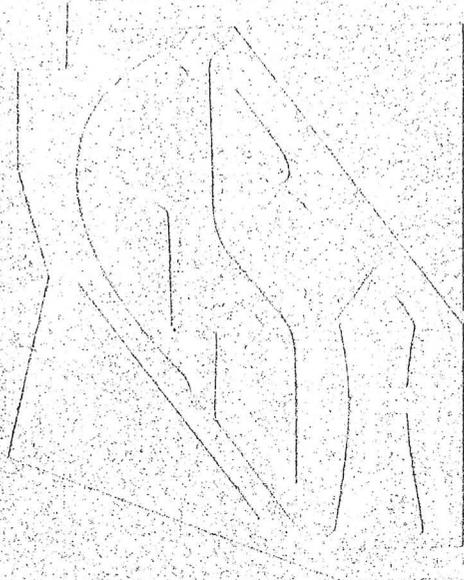
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## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite

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Grace Chabazite <sup>HMC</sup>  
(f) Cockise <sup>File</sup>  
~~modify~~  
~~files~~



**Dan Eyde**

Vice President

Registered Professional Geologist

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Cortaro, Arizona 85652

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**Ted H. Eyde**

President

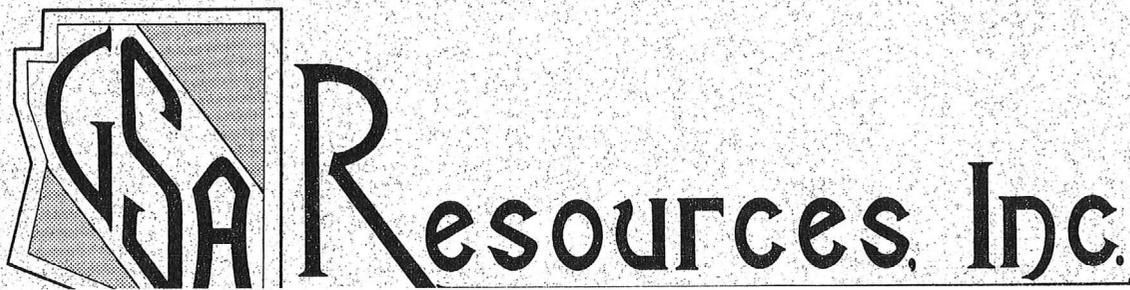
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FOLDER CONTENTS--LEFT SIDE

EPD CONGRESS - 1993 pgs. 382-393

CARBONIZED NATURAL ZEOLITES FOR REMOVAL OF LEAD & WW pgs. 153-155

NATURAL ZEOLITE WATER-FILTER MEDIA FOR SMALL COMMUNITIES pgs 33-35

CONTROLLED-RELEASE FERTILIZER USING ZEOLITES pgs. 85-86

TREATMENT OF CONTAMINATED WASTEWATER AT OAK RIDGE LAB. pgs. 172-173

ABSORB. OF ORGAN. MOLECULES FROM AQUEOUS SOLUTIONS pgs. 57-  
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**FOLDER-CONTENTS-MSDS SHEETS AND PROPERTY SHEETS**

**MSDS**

**CABSORB ZS500H, ZC500H, ZC400H**

**CABSORB SC1502A**

**CABSORB ZS500A, ZC500A, ZC400A**

**CABSORB ZK406H**

**PROPERTY OR SPEC SHEETS**

**CABSORB PRODUCT INFORMATION**

**ZEOLITE AMMONIA EXCHANGE CAPACITY AMMONIA SPEC. ION**

**CABSORB ZS500H**

**CABSORB ZK406H**

**CABSORB ZS500A**

**CABSORB ZC400H**

**CABSORB ZC500A**

**CABSORB ZC500H**

**CABSORB SC1502A**



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### CABSORB Product Information

GSA Resources Incorporated is the only independent producer of high purity natural chabazite products sold under the CABSORB® Trademark. Our company purchased the Grace Mine from W. R. Grace and Company when their Davison Chemical Division left the specialty adsorbent business in 1986.

GSA Resources Incorporated produces both activated and hydrated chabazite in several mesh sizes which are tailored to specific applications. Activated CABSORB ZC500A 4x8 mesh products are used in gas separation applications which require a high tolerance to acidic components in the gas stream. The product is the equivalent of Linde AW 500, and is related to LZ 218, Linde D, Linde R, SAPO-34, MAPO-44, MAPO-47, KZ-14 and ZYT-6. The attached isotherms show the product performance for selected gases and water adsorption.

CABSORB products are also used in ion exchange applications to remove ammonia and other cations from effluents. CABSORB ZS500 and ZC500 are highly selective for silver, lead, cesium 137 and strontium 90. The product is the equivalent of the Linde Ion Sieve IE 96 which was used in the clean up of the radioactive effluent from the Three Mile Island reactor accident.

We have been able to both reduce our prices and improve the quality of our products since production began in 1986. CABSORB ZS/ZC 500A has about 47% void space and a surface area about 500 square meters per gram which is larger than any other natural zeolite mineral. This means the rate of both sorption and ion exchange are higher than in any other natural zeolite.

Because of its superior ion exchange capacity and low moisture content as shipped, CABSORB products competitive on both a price and performance basis with the less expensive clinoptilolite products which we also market. Heavy metal-ion uptake capabilities are superior to those of the synthetic zeolites 3A, 4A, 5A and nearly equivalent to 13X for the removal of  $\text{Cu}^{+2}$ ,  $\text{Pb}^{+2}$ , and  $\text{Zn}^{+2}$  from solution.

A new markets for our products include odor control and animal feeds. Animal feed applications use clinoptilolite to promote animal growth and decrease mortality and morbidity. In odor

control applications strong odorants like hydrogen sulfide, sulphur dioxide and formaldehyde can be controlled.

We are also developing products for specialty environmental applications. Our organophilic absorbent is intended to separate organics from water. We have also treated a chabazite to be selective for anionic compounds including such problem materials like hexavalent chrome. Finally we are working to modify the structure of chabazite to make the material organophilic rather than hydrophilic. This should greatly enhance the odor control properties of the material.

GSA Resources Incorporated controls one of the largest chabazite deposits in the world. Our company can provide a dependable supply of CABSORB chabazite products for almost any application. Let us know if our products might have an application with your company. We are planning to build an extrusion facility to make products that could have specialty applications in catalysis and adsorption.



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## MATERIAL SAFETY DATA SHEET - CABSORB CHABAZITE PRODUCTS

**CABSORB-ZS500H, ZC500H, ZC400H**  
**Hydrous Sodium Aluminosilicate or Calcium Aluminosilicates**  
**Natural Chabazite (CHA)**  
**(Zeolite Powder and Granules)**

Date: 10/14/88

Revised: 11/17/93

Supersedes: 01/11/93

### **I. PRODUCT IDENTIFICATION**

Trade Name: NONE  
Chemical Name: Hydrated sodium aluminosilicate mineral  
Synonyms: Zeolite, chabazite  
CAS Registry No: 1318-02-1  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

### **II. PHYSICAL DATA**

Appearance and Odor: Dry tan powder, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

### **III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: None

## MATERIAL SAFETY DATA SHEET - CABSORB CHABAZITE

### IV. REACTIVITY DATA

Stability: Stable  
Conditions to Avoid: N. A.  
Incompatibility (Materials to Avoid): N.A.  
Hazardous Decomposition Products: None

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.  
Spillage: Sweep, scoop, or vacuum discharged material.  
Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.  
Skin Contact: May cause irritation.  
Inhalation: Causes Irritation.  
Ingestion: No hazards known or suspected.  
Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.  
Gloves: Plastic, rubber or cotton.  
Eye Protection: Safety glasses, or chemical goggles.  
Other Protective Equipment: N.A.  
Personal Hygiene: Avoid breathing dust.  
Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.  
Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.  
Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

Contact: Ted H. Eyde  
GSA Resources, Inc.  
Box 509  
Cortaro, Arizona 85652  
Telephone (602) 744-8845  
FAX (602) 744-7770

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## MATERIAL SAFETY DATA SHEET - CABSORB SC1502A

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.  
Spillage: Sweep, scoop, or vacuum discharged material.  
Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.  
Skin Contact: May cause irritation.  
Inhalation: Causes Irritation.  
Ingestion: No hazards known or suspected.  
Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

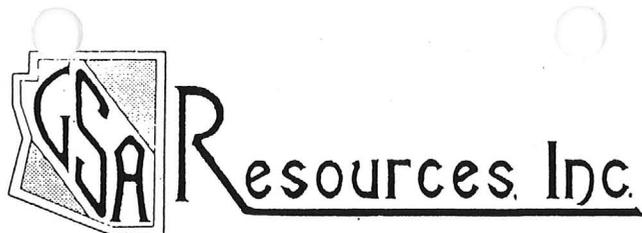
Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.  
Gloves: Plastic, rubber or cotton.  
Eye Protection: Safety glasses, or chemical goggles.  
Other Protective Equipment: N.A.  
Personal Hygiene: Avoid breathing dust.  
Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.  
Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.  
Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

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**MATERIAL SAFETY DATA SHEET - CABSORB SC1502A**  
**(Thermally Activated Montmorillonite)**

Date: 10/14/88

Revised: 03/19/93

Supersedes: N.A.

**I. PRODUCT IDENTIFICATION**

Trade Name: CABSORB TAM  
Chemical Name: Anhydrous calcium magnesium montmorillonite  
Synonyms: smectite, calcium magnesium bentonite  
CAS Registry No: 1302-78-9  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

**II. PHYSICAL DATA**

Appearance and Odor: Dry off-white powder or granules, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

**III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: None

**IV. REACTIVITY DATA**

Stability: Stable  
Conditions to Avoid: N.A.  
Incompatibility (Materials to Avoid): N.A.  
Hazardous Decomposition Products: None



**Resources Inc.**

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**MATERIAL SAFETY DATA SHEET - CABSORB Chabazite Products**

**CABSORB-ZS500A, ZC500A, ZC400A**  
**Anhydrous Sodium Aluminosilicate or Calcium Alumina Silicate**  
**Natural Chabazite (CHA)**  
**(Zeolite Powder and Granules)**

Date: 10/14/88

Revised: 11/17/93

Supersedes: 11/04/93

**I. PRODUCT IDENTIFICATION**

Trade Name: NONE  
Chemical Name: Hydrated sodium aluminosilicate mineral  
Synonyms: Zeolite, chabazite  
CAS Registry No: 1318-02-1  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

**II. PHYSICAL DATA**

Appearance and Odor: Dry tan powder, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

**III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: In their fresh, unused, activated condition CABSORB Chabazite products are not flammable. When exposed to water, however, the products get hot. When first wetted these these products can heat to the boiling point of water. Flooding will reduce the temperature to safe limits.

## MATERIAL SAFETY DATA SHEET - CABSORB SODIUM Chabazite

### IV. REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Moisture (water) can cause a rise in temperature which may result in burns.

Incompatibility (Materials to Avoid): N.A.

Hazardous Decomposition Products: None

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.

Spillage: Sweep, scoop, or vacuum discharged material.

Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.

Skin Contact: May cause irritation.

Inhalation: Causes Irritation.

Ingestion: No hazards known or suspected.

Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.

Gloves: Plastic, rubber or cotton.

Eye Protection: Safety glasses, or chemical goggles.

Other Protective Equipment: N.A.

Personal Hygiene: Avoid breathing dust.

Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.

Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.

Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

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P.O. Box 509  
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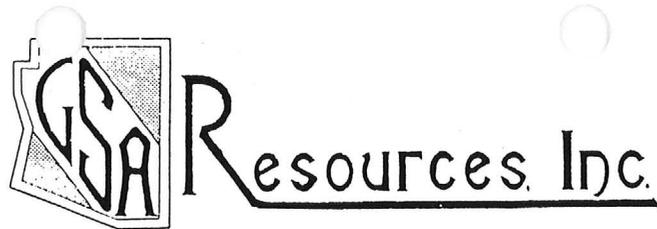
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**ZEOLITE AMMONIA EXCHANGE CAPACITY  
AMMONIA SPECIFIC ION ELECTRODE METHOD  
GSA RESOURCES CABSORB AND COMPETITIVE PRODUCTS**

Sample	Ammonia meq/g
Teague Minerals Zeofil	1.00
<b>GSA Resources CABSORB Sodium</b>	<b>2.20</b>
Magic Mountain XTRASORB	0.21
Japanese Clinoptilolite	1.56
Texas-Arizona crude	1.20
Serra Company coarse	1.20
Serra Company fine	1.20

**WESTINGHOUSE OIL & WATER ABSORPTION  
GSA RESOURCES CABSORB AND COMPETITIVE PRODUCTS**

Sample	Oil Absorption	Water Absorption
Teague Minerals Zeofil	18.7%	69.4%
<b>GSA Resources CABSORB Sodium</b>	<b>97.0%</b>	<b>107.0%</b>
Magic Mountain XTRASORB	16.4%	30.5%
Japanese Clinoptilolite	20.8%	39.1%



P.O. Box 509  
(602) 744-8845

Cortaro, Arizona 85652  
Fax (602) 744-7770

**CABSORB-ZS500A**  
**(CABSORB SODIUM)**

Anhydrous Sodium Aluminosilicate  
Natural Herschelite-Sodium Chabazite (CHA)  
(Zeolite Powder and Granules)

TYPICAL PROPERTIES

Form	Powder or Granules
Color	Dark Brown (Dry Brightness 40)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	520.95 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 513kg/m <sup>3</sup> (32 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 3% by weight
pH of 1% Dispersion	8.5
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g
Sorption Capacity	Greater than 15 wt.% H <sub>2</sub> O at 10% R.H.

## TYPICAL CHEMICAL ANALYSIS

(Anhydrous Basis)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>Dominant Cation</u>
68.10	18.59	2.84	0.27	0.75	8.32	1.12	Na

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite

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**Resources Inc.**

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## **CABSORB-ZC400H**

Hydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)

### **TYPICAL PROPERTIES**

Form	Powder or Granules
Color	Light yellowish brown (Dry Brightness 56)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 80%
Density	1.62 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.353 cm <sup>3</sup> /g
Surface Area	354 m <sup>2</sup> /g
Crystal Void Volume	N.D.
Packing Density	Approx. 536kg/m <sup>3</sup> (33 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 15% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	1.90 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
56.5	11.4	3.43	3.96	N.D.	2.15	1.20	N.D.	Ca

---

## EXCHANGE SELECTIVITIES

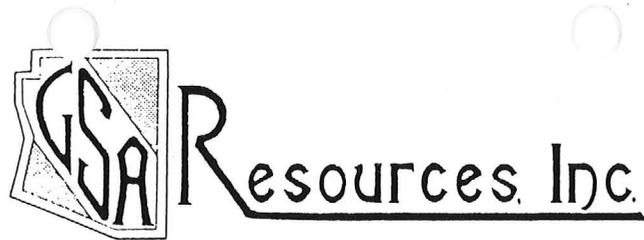
$Tl^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

---

## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite
Herschelite	

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## CABSORB-ZC500A

Anhydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)  
(Zeolite Powder and Granules)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Dark yellowish Brown (Dry Brightness 48)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Surface Area	462.20 m <sup>2</sup> /g
Total Pore Volume	.468 cm <sup>3</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 513kg/m <sup>3</sup> (32 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 3% by weight
pH of 1% Dispersion	8.5
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g
Sorption Capacity	Greater than 15 wt. % H <sub>2</sub> O at 10% R.H.

## TYPICAL CHEMICAL ANALYSIS

(Anhydrous Basis)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>TiO<sub>2</sub></u>	<u>Dominant Cation</u>
69.50	16.60	4.33	4.49	0.89	2.40	1.32	0.47	Ca

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34	Hershelite
Linde Ion Sieve IE 95	TSM 300	
Linde Ion Sieve IE 96	2 K - 14	
Linde D	2 YT - 6	
Linde R	Acadialite	
LZ 218	Haydenite	
MAPO 44	Seebachite	
MAPO 47	Willhendersonite	
Hershelite		

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**Resources, Inc.**

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## CABSORB-ZC500H

Hydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light yellowish-Brown (Dry Brightness 50)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	462.20 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 577kg/m <sup>3</sup> (36 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 15% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

---

<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
55.3	13.2	3.40	3.25	0.98	2.85	1.15	19.1	Ca

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution  $AgNO_3$ ,  $Pb(NO_3)_2$ ,  $CoSO_4$  and a 0.025 mg/ml solution of  $CuSO_4$  at the initial initial pH indicated for each solution.

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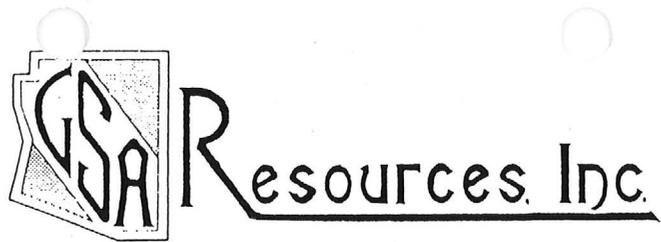
<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34	Herschelite
Linde Ion Sieve IE 95	TSM 300	
Linde Ion Sieve IE 96	2 K - 14	
Linde D	2 YT - 6	
Linde R	Acadialite	
LZ 218	Haydenite	
MAPO 44	Seebachite	
MAPO 47	Willhendersonite	
	Herschelite	

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**CABSORB SC1502A**  
**(CABSORB TAM)**  
Magnesium Calcium Aluminosilicate  
Thermally activated Smectite (Bentonite)  
Bentonite Powder and Granules

Typical Properties

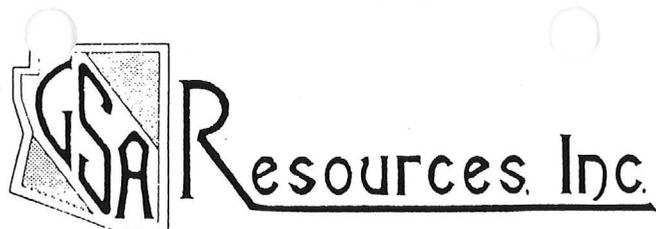
Form	Powder or Granules
Color	Gray
Smectite Content	+90%
Layer Spacing	15.5 Angstroms
Surface Area	97m <sup>2</sup> /g
Packing Density	993Kg/m <sup>3</sup> (62lbs/ft <sup>3</sup> )
Moisture as Packaged	Less than 2% by weight
pH of 1% Dispersion	8.0
Ion Exchange Capacity	125meq/100g. major exchange cation Ca

Typical Chemical Analyses in weight percent after drying at 110°C

<u>Wt.%</u>							
SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	LOI
61.00	18.10	1.38	2.66	5.84	0.19	0.11	11.67

Adsorption Capacities at 25°C After 2 Hrs. Activation at 175°C

<u>Relative Humidity %</u>	<u>Water Vapor Adsorption wt/%</u>
10	7
20	11
40	19
60	23
80	29



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## CABSORB-ZS500H (CABSORB SODIUM)

Hydrous Sodium Aluminosilicate  
Natural Herschelite-Sodium Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light Brown (Dry Brightness 43)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	520.95 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 577kg/m <sup>3</sup> (36 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 10% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
54.6	14.9	2.28	0.22	0.60	6.67	0.90	19.4	Na

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial Mitial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite

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### CABSORB Product Information

GSA Resources Incorporated is the only independent producer of high purity natural chabazite products sold under the CABSORB® Trademark. Our company purchased the Grace Mine from W. R. Grace and Company when their Davison Chemical Division left the specialty adsorbent business in 1986.

GSA Resources Incorporated produces both activated and hydrated chabazite in several mesh sizes which are tailored to specific applications. Activated CABSORB ZC500A 4x8 mesh products are used in gas separation applications which require a high tolerance to acidic components in the gas stream. The product is the equivalent of Linde AW 500, and is related to LZ 218, Linde D, Linde R, SAPO-34, MAPO-44, MAPO-47, KZ-14 and ZYT-6. The attached isotherms show the product performance for selected gases and water adsorption.

CABSORB products are also used in ion exchange applications to remove ammonia and other cations from effluents. CABSORB ZS500 and ZC500 are highly selective for silver, lead, cesium 137 and strontium 90. The product is the equivalent of the Linde Ion Sieve IE 96 which was used in the clean up of the radioactive effluent from the Three Mile Island reactor accident.

We have been able to both reduce our prices and improve the quality of our products since production began in 1986. CABSORB ZS/ZC 500A has about 47% void space and a surface area about 500 square meters per gram which is larger than any other natural zeolite mineral. This means the rate of both sorption and ion exchange are higher than in any other natural zeolite.

Because of its superior ion exchange capacity and low moisture content as shipped, CABSORB products competitive on both a price and performance basis with the less expensive clinoptilolite products which we also market. Heavy metal-ion uptake capabilities are superior to those of the synthetic zeolites 3A, 4A, 5A and nearly equivalent to 13X for the removal of  $\text{Cu}^{+2}$ ,  $\text{Pb}^{+2}$ , and  $\text{Zn}^{+2}$  from solution.

A new markets for our products include odor control and animal feeds. Animal feed applications use clinoptilolite to promote animal growth and decrease mortality and morbidity. In odor



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**MATERIAL SAFETY DATA SHEET - CABSORB CHABAZITE PRODUCTS**

**CABSORB-ZS500H, ZC500H, ZC400H**  
**Hydrous Sodium Aluminosilicate or Calcium Aluminosilicates**  
**Natural Chabazite (CHA)**  
**(Zeolite Powder and Granules)**

Date: 10/14/88

Revised: 11/17/93

Supersedes: 01/11/93

**I. PRODUCT IDENTIFICATION**

Trade Name: NONE  
Chemical Name: Hydrated sodium aluminosilicate mineral  
Synonyms: Zeolite, chabazite  
CAS Registry No: 1318-02-1  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

**II. PHYSICAL DATA**

Appearance and Odor: Dry tan powder, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

**III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: None

## MATERIAL SAFETY DATA SHEET - CABSORB CHABAZITE

### IV. REACTIVITY DATA

Stability: Stable  
Conditions to Avoid: N. A.  
Incompatability (Materials to Avoid): N.A.  
Hazardous Decomposition Products: None

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.  
Spillage: Sweep, scoop, or vacuum discharged material.  
Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.  
Skin Contact: May cause irritation.  
Inhalation: Causes Irritation.  
Ingestion: No hazards known or suspected.  
Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.  
Gloves: Plastic, rubber or cotton.  
Eye Protection: Safety glasses, or chemical goggles.  
Other Protective Equipment: N.A.  
Personal Hygiene: Avoid breathing dust.  
Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.  
Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.  
Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

Contact: Ted H. Eyde  
GSA Resources, Inc.  
Box 509  
Cortaro, Arizona 85652  
Telephone (602) 744-8845  
FAX (602) 744-7770

c:\wp51\zeolites\ZS500H.MSD

## MATERIAL SAFETY DATA SHEET - CABSORB SC1502A

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.  
Spillage: Sweep, scoop, or vacuum discharged material.  
Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.  
Skin Contact: May cause irritation.  
Inhalation: Causes Irritation.  
Ingestion: No hazards known or suspected.  
Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

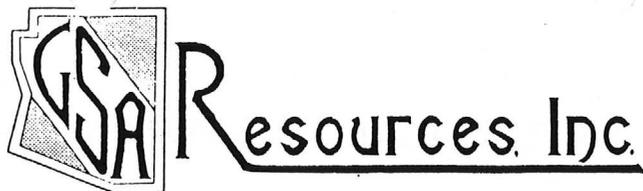
Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.  
Gloves: Plastic, rubber or cotton.  
Eye Protection: Safety glasses, or chemical goggles.  
Other Protective Equipment: N.A.  
Personal Hygiene: Avoid breathing dust.  
Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.  
Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.  
Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

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**MATERIAL SAFETY DATA SHEET - CABSORB SC1502A**  
**(Thermally Activated Montmorillonite)**

Date: 10/14/88

Revised: 03/19/93

Supersedes: N.A.

**I. PRODUCT IDENTIFICATION**

Trade Name: CABSORB TAM  
Chemical Name: Anhydrous calcium magnesium montmorillonite  
Synonyms: smectite, calcium magnesium bentonite  
CAS Registry No: 1302-78-9  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

**II. PHYSICAL DATA**

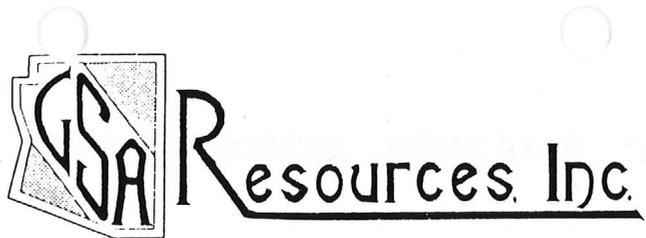
Appearance and Odor: Dry off-white powder or granules, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

**III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: None

**IV. REACTIVITY DATA**

Stability: Stable  
Conditions to Avoid: N.A.  
Incompatibility (Materials to Avoid): N.A.  
Hazardous Decomposition Products: None



P.O. Box 509  
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Cortaro, Arizona 85652  
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**MATERIAL SAFETY DATA SHEET - CABSORB Chabazite Products**

**CABSORB-ZS500A, ZC500A, ZC400A**

**Anhydrous Sodium Aluminosilicate or Calcium Alumina Silicate**

**Natural Chabazite (CHA)**

**(Zeolite Powder and Granules)**

Date: 10/14/88

Revised: 11/17/93

Supersedes: 11/04/93

**I. PRODUCT IDENTIFICATION**

Trade Name: NONE  
Chemical Name: Hydrated sodium aluminosilicate mineral  
Synonyms: Zeolite, chabazite  
CAS Registry No: 1318-02-1  
DOT Hazard Class: N.A.  
DOT Shipping Name: N.A.

**II. PHYSICAL DATA**

Appearance and Odor: Dry tan powder, Odorless.  
Specific Gravity (liquids only): N.A.  
Solubility in Water: Negligible.  
Vapor Pressure (mm Hg at ° F, nonaqueous liquids only): N.A.  
Evaporation Rate (Butyl acetate = 100, nonaqueous liquids only): N.A.  
Solids Content (solutions, dispersions, or pastes only): N.A.  
Boiling Point (° F, nonaqueous liquids only): N.A.  
pH (aqueous liquids only): N.A.

**III. FIRE AND EXPLOSION HAZARD DATA**

Flash Point (° F): N.A.  
Flammable Limits (vapor in air, Vol. %): N.A.  
Fire Extinguishing Media: N.A.  
Unusual Fire and Explosion Hazards: In their fresh, unused, activated condition CABSORB Chabazite products are not flammable. When exposed to water, however, the products get hot. When first wetted these these products can heat to the boiling point of water. Flooding will reduce the temperature to safe limits.

## MATERIAL SAFETY DATA SHEET - CABSORB SODIUM Chabazite

### IV. REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Moisture (water) can cause a rise in temperature which may result in burns.

Incompatibility (Materials to Avoid): N.A.

Hazardous Decomposition Products: None

### V. SPILL OR LEAK PROCEDURES

Environmental Hazards: No known adverse effects.

Spillage: Sweep, scoop, or vacuum discharged material.

Waste Disposal Method: Landfill according to local, state, and federal regulations.

### VI. HEALTH HAZARD DATA

Eye Contact: May cause irritation.

Skin Contact: May cause irritation.

Inhalation: Causes Irritation.

Ingestion: No hazards known or suspected.

Chronic Hazards: No known chronic hazards. Not listed by OSHA, NTP or IARC as a carcinogen.

### VII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use NIOSH approved dust mask or respirator where dust occurs.

Gloves: Plastic, rubber or cotton.

Eye Protection: Safety glasses, or chemical goggles.

Other Protective Equipment: N.A.

Personal Hygiene: Avoid breathing dust.

Engineering Control: Use with adequate ventilation.

### VIII. SUBSTANCES FOR WHICH STANDARDS HAVE BEEN SET

OSHA Permissible Exposure Limit or ACGIH Threshold Limit: Value have not been established.

Recommended Ceiling Limit: 15 mg/m<sup>3</sup> Total dust. 5 mg/m<sup>3</sup> Respirable fraction.

Exposure Analysis Methods: Respirable sampler or Midget impinger see: J. Am. Ind. Hyg. Assoc., 28:554 (1967)

### IX. ADDITIONAL INFORMATION

Contact: Ted H. Eyde  
GSA Resources, Inc.  
Box 509  
Cortaro, Arizona 85652  
Telephone (602) 744-8845  
FAX (602) 744-7770

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**Resources Inc.**

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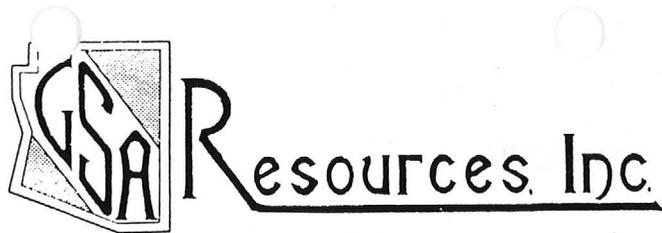
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**ZEOLITE AMMONIA EXCHANGE CAPACITY  
AMMONIA SPECIFIC ION ELECTRODE METHOD  
GSA RESOURCES CABSORB AND COMPETITIVE PRODUCTS**

Sample	Ammonia meq/g
Teague Minerals Zeofil	1.00
<b>GSA Resources CABSORB Sodium</b>	<b>2.20</b>
Magic Mountain XTRASORB	0.21
Japanese Clinoptilolite	1.56
Texas-Arizona crude	1.20
Serra Company coarse	1.20
Serra Company fine	1.20

**WESTINGHOUSE OIL & WATER ABSORPTION  
GSA RESOURCES CABSORB AND COMPETITIVE PRODUCTS**

Sample	Oil Absorption	Water Absorption
Teague Minerals Zeofil	18.7%	69.4%
<b>GSA Resources CABSORB Sodium</b>	<b>97.0%</b>	<b>107.0%</b>
Magic Mountain XTRASORB	16.4%	30.5%
Japanese Clinoptilolite	20.8%	39.1%



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**CABSORB-ZS500A  
(CABSORB SODIUM)**

Anhydrous Sodium Aluminosilicate  
Natural Herschelite-Sodium Chabazite (CHA)  
(Zeolite Powder and Granules)

**TYPICAL PROPERTIES**

Form	Powder or Granules
Color	Dark Brown (Dry Brightness 40)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	520.95 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 513kg/m <sup>3</sup> (32 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 3% by weight
pH of 1% Dispersion	8.5
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g
Sorption Capacity	Greater than 15 wt.% H <sub>2</sub> O at 10% R.H.

## TYPICAL CHEMICAL ANALYSIS

(Anhydrous Basis)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>Dominant Cation</u>
68.10	18.59	2.84	0.27	0.75	8.32	1.12	Na

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

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Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution  $AgNO_3$ ,  $Pb(NO_3)_2$ ,  $CoSO_4$  and a 0.025 mg/ml solution of  $CuSO_4$  at the initial pH indicated for each solution.

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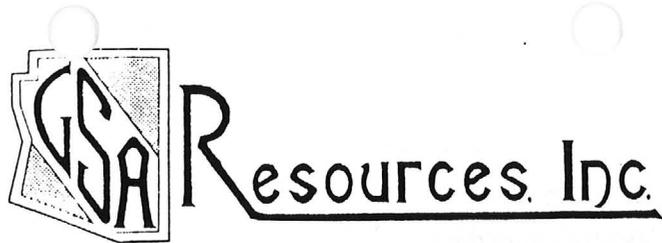
<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite

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## CABSORB-ZC400H

Hydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light yellowish brown (Dry Brightness 56)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 80%
Density	1.62 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.353 cm <sup>3</sup> /g
Surface Area	354 m <sup>2</sup> /g
Crystal Void Volume	N.D.
Packing Density	Approx. 536kg/m <sup>3</sup> (33 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 15% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	1.90 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
56.5	11.4	3.43	3.96	N.D.	2.15	1.20	N.D.	Ca

---

## EXCHANGE SELECTIVITIES

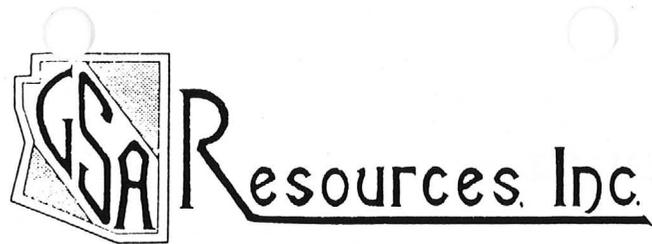
$\text{Ti}^+ > \text{Cs}^+ > \text{K}^+ > \text{Ag}^+ > \text{Rb}^+ > \text{NH}_4^+ > \text{Pb}^{2+} > \text{Na}^+ = \text{Ba}^{2+} > \text{Sr}^{2+} > \text{Ca}^{2+} > \text{Li}^+$

---

## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite
Herschelite	

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## CABSORB-ZC500A

Anhydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)  
(Zeolite Powder and Granules)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Dark yellowish Brown (Dry Brightness 48)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Surface Area	462.20 m <sup>2</sup> /g
Total Pore Volume	.468 cm <sup>3</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 513kg/m <sup>3</sup> (32 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 3% by weight
pH of 1% Dispersion	8.5
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g
Sorption Capacity	Greater than 15 wt. % H <sub>2</sub> O at 10% R.H.

## TYPICAL CHEMICAL ANALYSIS

(Anhydrous Basis)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>TiO<sub>2</sub></u>	<u>Dominant Cation</u>
69.50	16.60	4.33	4.49	0.89	2.40	1.32	0.47	Ca

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34	Hershelite
Linde Ion Sieve IE 95	TSM 300	
Linde Ion Sieve IE 96	2 K - 14	
Linde D	2 YT - 6	
Linde R	Acadialite	
LZ 218	Haydenite	
MAPO 44	Seebachite	
MAPO 47	Willhendersonite	
Hershelite		

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**Resources Inc.**

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## CABSORB-ZC500H

Hydrous Calcium Sodium Aluminosilicate  
Natural Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light yellowish-Brown (Dry Brightness 50)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	462.20 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 577kg/m <sup>3</sup> (36 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 15% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
55.3	13.2	3.40	3.25	0.98	2.85	1.15	19.1	Ca

---

## EXCHANGE SELECTIVITIES

$TI^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial Mitial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34	Herschelite
Linde Ion Sieve IE 95	TSM 300	
Linde Ion Sieve IE 96	2 K - 14	
Linde D	2 YT - 6	
Linde R	Acadialite	
LZ 218	Haydenite	
MAPO 44	Seebachite	
MAPO 47	Willhendersonite	
	Herschelite	

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**CABSORB SC1502A  
(CABSORB TAM)  
Magnesium Calcium Aluminosilicate  
Thermally activated Smectite (Bentonite)  
Bentonite Powder and Granules**

Typical Properties

Form	Powder or Granules
Color	Gray
Smectite Content	+ 90%
Layer Spacing	15.5 Angstroms
Surface Area	97m <sup>2</sup> /g
Packing Density	993Kg/m <sup>3</sup> (62lbs/ft <sup>3</sup> )
Moisture as Packaged	Less than 2% by weight
pH of 1% Dispersion	8.0
Ion Exchange Capacity	125meq/100g. major exchange cation Ca

Typical Chemical Analyses in weight percent after drying at 110°C

Wt. %

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	LOI
61.00	18.10	1.38	2.66	5.84	0.19	0.11	11.67

Adsorption Capacities at 25°C After 2 Hrs. Activation at 175°C

Relative Humidity %

Water Vapor Adsorption wt/%

10

7

20

11

40

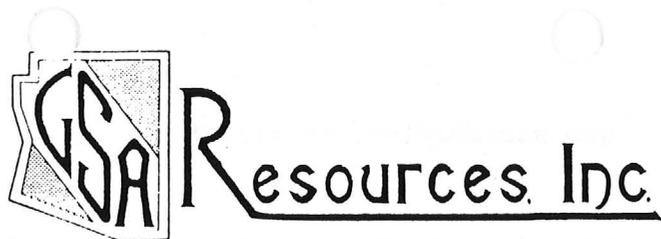
19

60

23

80

29



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## CABSORB-ZS500H (CABSORB SODIUM)

Hydrous Sodium Aluminosilicate  
Natural Herschelite-Sodium Chabazite (CHA)

### TYPICAL PROPERTIES

Form	Powder or Granules
Color	Light Brown (Dry Brightness 43)
Ring Members	8
Crystal Size - Chabazite	Less than 1 micron
Crystallinity	+ 90%
Density	1.73 g/cm <sup>3</sup>
Pore Size	4.1 by 3.7 Angstroms
Effective Pore Diameter	4.3 Angstroms
Cavity Size	11.0 by 6.6 Angstroms
Total Pore Volume	.468 cm <sup>3</sup> /g
Surface Area	520.95 m <sup>2</sup> /g
Crystal Void Volume	.47 cm <sup>3</sup> /cm <sup>3</sup>
Packing Density	Approx. 577kg/m <sup>3</sup> (36 lbs/ft <sup>3</sup> )
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub> Ratio	Approx. 4:1
MOH's Hardness	4-5
Moisture as packaged	Less than 10% by weight
Stability	pH of 3 through 12
Ion Exchange Capacity	2.50 meq/g

## TYPICAL CHEMICAL ANALYSIS

(equilibrated at 20°C. and 40% relative humidity)

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<u>SiO<sub>2</sub></u>	<u>Al<sub>2</sub>O<sub>3</sub></u>	<u>Fe<sub>2</sub>O<sub>3</sub></u>	<u>CaO</u>	<u>MgO</u>	<u>Na<sub>2</sub>O</u>	<u>K<sub>2</sub>O</u>	<u>LOI</u>	<u>Dominant Cation</u>
54.6	14.9	2.28	0.22	0.60	6.67	0.90	19.4	Na

---

## EXCHANGE SELECTIVITIES

$Tl^+ > Cs^+ > K^+ > Ag^+ > Rb^+ > NH_4^+ > Pb^{2+} > Na^+ = Ba^{2+} > Sr^{2+} > Ca^{2+} > Li^+$

## EXCHANGE OF HEAVY METAL IONS

---

Weight Percent of Heavy Metals Retained in anhydrous CABSORB After Ion Exchange from a .10 mg/ml solution AgNO<sub>3</sub>, Pb(NO<sub>3</sub>)<sub>2</sub>, CoSO<sub>4</sub> and a 0.025 mg/ml solution of CuSO<sub>4</sub> at the initial Mitial pH indicated for each solution.

---

<u>Ag</u>		<u>Pb</u>		<u>Cu</u>		<u>Co</u>	
pH	wt%	pH	wt%	pH	wt%	pH	wt%
5.30	21.85	3.80	15.27	3.43	3.17	2.91	2.82

---

## RELATED MATERIALS

Linde AW 500	Sapo 34
Linde Ion Sieve IE 95	TSM 300
Linde Ion Sieve IE 96	2 K - 14
Linde D	2 YT - 6
Linde R	Acadialite
LZ 218	Haydenite
MAPO 44	Seebachite
MAPO 47	Willhendersonite

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