MATERIAL SAFETY DATA SHEET
March 18, 1996

I. Identity:
   A. Trade/Common Names: Alkanet, Alkanna.
      Botanical Family: Boraginaceae.
   C. Chemical Family:
      1. 93% - 95% Plant biomass.
      2. 5% - 7% Alkannin: A derivative of 5,8-dihydroxy-1,4-naphthoquinone; Empirical
         Formula: C_{16}H_{16}O_{5}.

II. Physical Data:
   A. Boiling Point: Not applicable.
   B. Melting Point: (1) Biomass: decomposes above 250° C.
      (2) Alkannin: 149° C.
   C. Specific Gravity: approx. 1.1 g./ml.
   D. Vapor Density: Not applicable.
   E. Reactivity in Water: Unreactive.
   F. Solubility: Biomass insoluble in water and usual organic solvents. Alkannin insoluble
      in water; soluble in aqueous alkaline solutions; slightly soluble in selected organic
      solvents (alcohol, acetone, oilseed oils, etc.).
   G. Appearance: Irregular solid with cellulosic layers which break up into thin flakes.
   H. Flash Point: Not known: Above 250° C.
   I. Auto-ignition Temperature: Not applicable.
   J. pH: 7.0 - 7.3.

III. Hazardous Ingredients: None known.

IV. Physical Hazards:
   A. Stability: Stable under dry conditions. Decomposes slowly with microbial growth
      (molds, etc.) after long-term contact with liquid water or in high atmospheric
      moisture.
   B. Incompatibility (Materials to Avoid): No unusual incompatibilities. As with all
      biomass materials, contact with strong oxidizing agents (nitrates, chlorates, oxygen,
      etc.) should be avoided.
   C. Hazardous Decomposition Products: None known.
   D. Hazardous Polymerization: Will not occur.
   E. Unusual Fire and Explosion Hazards: None known.
      1. Fire fighting media: Water, foam, or dry chemical.
      2. Fire fighters should wear self-contained breathing apparatus, to protect from
         potentially hazardous fumes.
MATERIAL SAFETY DATA SHEET:
ALKANET

V. Health Hazards: No toxic effect known from dust inhalation or ingestion.
   A. Threshold Limit Value: None known.
   B. Signs or Symptoms of Exposure: None expected.
   C. Effects of Chronic Overexposure: None known.
   D. Medical Conditions Generally Aggravated by Exposure: None known.
   E. Chemicals Listed as Carcinogen or Potential Carcinogen: No listing.
   F. OSHA Permissible Exposure Limit: None known.
   G. Emergency and First Aid Procedures:
      1. Inhalation: Remove person to fresh air. If breathing difficulty occurs or coughing
         persists, get prompt medical attention.
      2. Eyes: Flood with water.
      3. Skin: Wash with soap and water.
      4. Ingestion: Gastric lavage.

VI. Special Protection Information:
   A. Respiratory Protection: Use dust respirator when handling product.
   B. Ventilation: No special ventilation required.
   C. Protective Gloves: Wear leather or heavy cloth gloves to avoid direct contact of hands
      with product.
   D. Eye Protection: Use safety eyewear.
   E. Waste Disposal Methods: Normal septic type of disposal is recommended, due to ease
      with which microorganisms can grow in the material. pH adjustment is not
      necessary.

VIII. Special Notes:
   A. As with all biomass materials, incomplete combustion may result in the formation of
      volatile toxic compounds. In case of fire, precautions should be taken to avoid
      breathing evolved gases and vapors.
   B. Literature references indicate that this material has long been used as a coloring agent
      in cosmetic preparations. However, this only indicates that it is not immediately
      toxic to the skin. As a reasonable precautionary measure, care should be taken to
      avoid prolonged skin contact.
MATERIAL SAFETY DATA SHEET
November 19, 1996

I. Identity:
   A. Trade/Common Names: Annatto Seeds, Achiote.
   B. Origin: Dried seeds of the tropical tree Bixa orellana.
      Botanical Family: Bixaceae.
   C. Chemical Family:
      1. 93% - 95% Plant biomass.
      2. 5% - 7% Bixin: A monomethyl ester of a long-chain, conjugated poly-unsaturated,
         dibasic carboxylic acid; Empirical Formula: C_{25}H_{30}O_{4}.

II. Physical Data:
   A. Boiling Point: Not applicable.
   B. Melting Point: (1) Biomass: decomposes above 250° C.
      (2) Bixin: 173° C.
   C. Specific Gravity: approx. 1.2 g./ml.
   D. Vapor Density: Not applicable.
   E. Reactivity in Water: Unreactive.
   F. Solubility: Biomass insoluble in water and usual organic solvents. Bixin insoluble
      in water; soluble in aqueous alkaline solutions; slightly soluble in selected organic
      solvents (alcohol, acetone, oilseed oils, etc.).
   G. Appearance: Deep reddish granules, about 3 mm. average size.
   H. Flash Point: Not known: Above 250° C.
   I. Auto-ignition Temperature: Not applicable.
   J. pH: 6.8 - 7.0.

III. Hazardous Ingredients: None known. This product has not been classified as a health
     hazard.

IV. Physical Hazards:
   A. Stability: Stable under dry conditions. Decomposes slowly with microbial growth
      (molds, etc.) after long-term contact with liquid water or in high atmospheric
      moisture.
   B. Incompatibility (Materials to Avoid): No unusual incompatibilities. As with all
      biomass materials, contact with strong oxidizing agents (nitrates, chlorates, oxygen,
      etc.) should be avoided.
   C. Hazardous Decomposition Products: None known.
   D. Hazardous Polymerization: Will not occur.
   E. Unusual Fire and Explosion Hazards: None known.
      1. Fire fighting media: Water, foam, carbon dioxide, or dry chemical.
      2. Fire fighters should wear self-contained breathing apparatus, to protect from
         potentially hazardous fumes.
V. Health Hazards: No toxic effect known from dust inhalation or ingestion.
   A. Threshold Limit Value: None known.
   B. Signs or Symptoms of Exposure: None expected.
   C. Effects of Chronic Overexposure: None known.
   D. Medical Conditions Generally Aggravated by Exposure: None known.
   E. Chemicals Listed as Carcinogen or Potential Carcinogen: No listing.
   F. OSHA Permissible Exposure Limit: None known.
   G. Emergency and First Aid Procedures:
      1. Inhalation: Remove person to fresh air. If breathing difficulty occurs or coughing
         persists, get prompt medical attention.
      2. Eyes: Flood with water.
      3. Skin: Remove contaminated clothing. Wash with mild soap and water.
      4. Ingestion: Gastric lavage.

VI. Special Protection Information:
   A. Respiratory Protection: Use dust respirator when handling product.
   B. Ventilation: No special ventilation required.
   C. Protective Gloves: Wear leather or heavy cloth gloves to avoid direct contact of hands
      with product.
   D. Eye Protection: Use safety eyewear.
   E. Waste Disposal Methods: Normal septic type of disposal is recommended, due to ease
      with which microorganisms can grow in the material. pH adjustment is not
      necessary.

VIII. Special Notes:
   A. Incomplete combustion may result in the formation of dense, acrid smoke, containing
      volatile toxic compounds. In case of fire, precautions should be taken to avoid
      breathing any evolved smoke, gases, or vapors.
   B. Literature references indicate that extracts of this material have long been used as
      coloring agents in foods and cosmetic preparations. However, as a reasonable
      precautionary measure, care should be taken to avoid prolonged skin contact.
MATERIAL SAFETY DATA SHEET
March 19, 1996

I. Identity:
A. Trade/Common Names: Brazilwood, Pernambuco Wood.
B. Origin: Heartwood of the tree Caesalpinia echinata.
   Botanical Family: Leguminosae.
C. Chemical Family:
   1. 88% - 94% Plant biomass.
   2. 6% - 12% Brasiliin and Brasilein.

II. Physical Data:
A. Boiling Point: (1) Biomass: Not applicable.
   (2) Brasiliin: Decomposes above 275° C.
   Brasilein: Decomposes above 230° C.
B. Melting Point: (1) Biomass: Decomposes above 250° C.
   (2) Brasiliin: 290° C.
   Brasilein: Softens 130 - 140° C.
C. Specific Gravity: >1.15 g./ml. when air is removed from biomass.
D. Vapor Density: Not applicable.
E. Reactivity in Water: Unreactive.
F. Solubility: Biomass insoluble in water and usual organic solvents. Brasiliin and brasilein
   are slightly soluble in neutral water; both are soluble in aqueous alkaline solutions;
   both are very soluble in usual organic solvents.
G. Appearance: An orangish-red wood when freshly cut; surfaces turn darker and deeper
   in color when exposed to air and moisture.
H. Flash Point: Not known: Above 300° C.
I. Auto-ignition Temperature: Not applicable.
J. pH: 7.2 - 7.6.

III. Hazardous Ingredients: None known...

IV. Physical Hazards:
A. Stability: Stable under dry conditions. Decomposes slowly with microbial growth
   (molds, etc.) after long-term contact with liquid water or in high atmospheric
   moisture.
B. Incompatibility (Materials to Avoid): No unusual incompatibilities. As with all
   biomass materials, contact with strong oxidizing agents (nitrates, chlorates, oxygen,
   etc.) should be avoided.
C. Hazardous Decomposition Products: None known.
D. Hazardous Polymerization: Will not occur.
IV. Physical Hazards—cont.:
   E. Unusual Fire and Explosion Hazards: None known.
      1. Fire fighting media: Water, foam, carbon dioxide, or dry chemical.
      2. Fire fighters should wear self-contained breathing apparatus, to protect from
         potentially hazardous fumes.

V. Health Hazards: No toxic effect known from dust inhalation or ingestion.
   A. Threshold Limit Value: None known.
   B. Signs or Symptoms of Exposure: None expected.
   C. Effects of Chronic Exposure: None known.
   D. Medical Conditions Generally Aggravated by Exposure: None known.
   E. Chemicals Listed as Carcinogen or Potential Carcinogen: No listing.
   F. OSHA Permissible Exposure Limit: None known.

G. Emergency and First Aid Procedures:
   1. Inhalation: Remove person to fresh air. If breathing difficulty occurs or coughing
      persists, get prompt medical attention.
   2. Eyes: Flood with water.
   3. Skin: Wash with soap and water.
   4. Ingestion: Gastric lavage.

VI. Special Protection Information:
   A. Respiratory Protection: Use dust respirator when handling product.
   B. Ventilation: No special ventilation required.
   C. Protective Gloves: Wear leather or rubber-covered cloth gloves to avoid direct contact
      of hands with product.
   D. Eye Protection: Use safety eyewear.
   E. Waste Disposal Methods: Normal septic type of disposal is recommended, due to ease
      with which microorganisms can grow in the material. pH adjustment is not
      necessary.

VIII. Special Notes:
   A. As with all biomass materials, incomplete combustion may result in the formation of
      volatile toxic compounds. In case of fire, precautions should be taken to avoid
      breathing evolved gases and vapors.
   B. Literature references indicate that this material has long been used as a dye for textile
      fibers and as an ingredient in cosmetics. However, as a reasonable precautionary measure, care should be taken to avoid breathing dust and to avoid
      prolonged skin contact.
MATERIAL SAFETY DATA SHEET
October 30, 1995

I. Identity:

A. Trade/Common Names: Cochineal, Gray Cochineal.


C. Chemical Family:
   1. Approximately 95% Biomass.
   2. Approximately 5% Carminic Acid: Glycoside of a hydroxylated anthraquinonecarboxylic acid; Empirical formula: C_{22}H_{20}O_{13}.

II. Physical Data:

A. Boiling Point: Not applicable.

B. Melting Point: (1) Biomass: Decomposes above 250° C.
   (2) Carminic Acid: 136° C with decomp.

C. Specific Gravity: Approx. 1.2 g./ml.

D. Vapor Density: Not applicable.

E. Reactivity in Water: Unreactive.

F. Solubility: Biomass insoluble in water. Carminic acid soluble in water and alcohols.

G. Appearance: Gray granular solid, with a slight characteristic odor.

H. Flash Point: Not known.

I. Autoignition Temperature: Not applicable.

J. pH: 6.5 - 7.1.

III. Hazardous Ingredients: None known.

IV. Physical Hazards:

A. Stability: Stable under dry conditions. Decomposes with microbial growth (molds) after long-term contact with liquid water or in high atmospheric moisture.

B. Incompatibility (Materials to Avoid): None known.

C. Hazardous Decomposition/Products: None known.

D. Hazardous Polymerization: Will not occur.

E. Unusual Fire and Explosion Hazards: None known.
V. Health Hazards: No toxic effect known from dust inhalation or ingestion.
   A. Threshold limit value: Not known.
   B. Signs or symptoms of exposure: None expected.
   C. Effects of Chronic Overexposure: None known.
   D. Medical Conditions Generally Aggravated by Exposure: None known.
   E. Chemical Listed as Carcinogen or Potential Carcinogen: No listing.
   F. OSHA Permissible Exposure Limit: None known.
   G. Emergency and First Aid Procedures:
      1. Inhalation: Remove person to fresh air. If breathing difficulty occurs or coughing persists, get prompt medical attention.
      2. Eyes: Flood with water.
      3. Skin: Wash with soap and water.
      4. Ingestion: Gastric lavage.

VI. Special Protection Information:
   A. Respiratory Protection: Use dust respirator when handling product.
   B. Ventilation: No special ventilation required.
   C. Protective Gloves: Wear leather or heavy cloth gloves to avoid direct contact of hands with product.
   D. Eye Protection: Wear safety glasses.

VII. Special Precautions and Spill/Leak Procedures:
   A. Precautions in Handling and Storage: Store away from oxidizing agents (bleach, elevated temperatures, etc.)
   B. Other Precautions: Store in a dry place. Avoid excessive heat. Avoid excessive atmospheric humidity.
   C. Steps to be Taken if Material is Released or Spilled: Avoid inhalation of dust. Use gloves when handling.
   D. Waste Disposal Methods: Normal septic type of disposal is recommended, due to the ease with which microorganisms can grow in the media. pH adjustment is not necessary.

VIII. Special Notes:
   A. Unground material may contain a small number of cactus thorns, incidental to harvesting methods; leather or similar gloves should be used when handling directly, to avoid injury to hands by thorn points.
   B. Literature references indicate that this material is not immediately toxic to the skin. However, as a reasonable precautionary measure, care should be taken to avoid prolonged skin contact.
# MATERIAL SAFETY DATA SHEET

## SECTION I

**EMERGENCY TELEPHONE NO.**

916 - 920-8658

**CHEMICAL NAME AND SYNONYMS**

A mixture of Tannic Acid, Gallic Acid, Catechin, & Catechin Derivatives.

**TRADE NAME AND SYNONYMS**

Cutech Extract, Catechu Extract, Katna Tannin

**CHEMICAL FAMILY**

Flavonoids, Flavonol Dehydration Products: Polyhydroxy Aromatic Carbon.

**FORMULA**

Catechin: C_{15}H_{14}O_{6}

Tannic Acid: C_{14}H_{10}O_{9}

## SECTION II - HAZARDOUS INGREDIENTS

<table>
<thead>
<tr>
<th>Pigments, Preservatives, &amp; Solvents</th>
<th>% TLV (Units)</th>
<th>Alloys and Metallic Coatings</th>
<th>% TLV (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIGMENTS</td>
<td><strong>NONE</strong></td>
<td>BASE METAL</td>
<td><strong>NONE</strong></td>
</tr>
<tr>
<td>CATALYST</td>
<td></td>
<td>ALLOYS</td>
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<tr>
<td>VEHICLE</td>
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<td>METALLIC COATINGS</td>
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<tr>
<td>SOLVENTS</td>
<td></td>
<td>FILLER METAL</td>
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<td>ADDITIVES</td>
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<td>OTHERS</td>
<td></td>
</tr>
<tr>
<td>OTHERS</td>
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<td>HAZARDOUS MIXTURES OF OTHER LIQUIDS SOLIDS, OR GASES</td>
<td>% TLV (Units)</td>
</tr>
</tbody>
</table>

**NONE**

## SECTION III - PHYSICAL DATA

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling Point (°F)</td>
<td><strong>Not Applicable</strong></td>
</tr>
<tr>
<td>Vapour Pressure (mm Hg)</td>
<td><strong>Not Volatile</strong></td>
</tr>
<tr>
<td>Vapour Density (Air = 1)</td>
<td><strong>Not Volatile</strong></td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Very Soluble at 100°C</td>
</tr>
<tr>
<td>Appearance and Odor</td>
<td>Dark Brown Resinous Solid with slight characteristic Phenent Odor</td>
</tr>
</tbody>
</table>

## SECTION IV - FIRE AND EXPLOSION HAZARD DATA

**Flash Point (Method Used)**

None to 250°C, Flammable Limits: No Data

**Extinguishing Media**

Water, Foam, CO₂, or Dry Chemical

**Special Fire Fighting Procedures**

Firefighters should wear self-contained breathing apparatus, to protect from potentially toxic fumes.

**Unusual Fire and Explosion Hazards**

None - Moderately Flammable, No Explosion

**Hazard in Granular Resin Form**

(Continued on reverse side)
SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE  
Not Established.

EFFECTS OF OVEREXPOSURE  
None Expected.

EMERGENCY AND FIRST AID PROCEDURES

Eyes - Flush with water. See a physician if irritation persists.

SECTION VI - REACTIVITY DATA

STABILITY  
Unstable  
Stable  

CONDITIONS TO AVOID

INCOMPATIBILITY (Materials to avoid)  
Strong Oxidizing Agents.

HAZARDOUS DECOMPOSITION PRODUCTS  
Incomplete Combustion may produce carbon monoxide.

HAZARDOUS POLYMERIZATION

MAY OCCUR  
WILL NOT OCCUR  

CONDITIONS TO AVOID

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Sweep up - Flush area with water.

WASTE DISPOSAL METHOD  
No special requirements. Disposal should be in accordance with existing governmental and environmental control regulations.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

NIOSH - Approved mask for nuisance dusts, if ground to powder.

VENTILATION  
Local exhaust  
Yes - for dusts  
Special -

MECHANICAL (General)  
Other -

PROTECTIVE GLOVES  
Leather or thick plastic, eye protection goggles or safety glasses.

OTHER PROTECTIVE EQUIPMENT  
None required.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING  
Wear gloves when handling to avoid cutting hands on sharp edges of resin.

OTHER PRECAUTIONS  
Store in a clean dry place.

January 7, 1994  Roger W. Wolfe
MATERIAL SAFETY DATA SHEET
NATURAL INDIGO
August, 2002

I. Identity:
A. Trade/Common Names: Natural Indigo, Natural Indigo Blue, Vat Blue 1.
B. Origin: Extract of leaves and stems of the plant Indigofera tinctoria.
   Botanical Family: Leguminosae.
C. Chemical Family:
   1. 50% - 75% Plant biomass.
   2. 25% - 50% Indigotin: a complex organic heterocyclic compound: Empirical Formula:
      C_{16}H_{10}O_{2}N_{2}.

II. Physical Data:
A. Boiling Point: (1) Biomass: Not applicable.
   (2) Indigotin: Sublimes.
B. Melting Point: (1) Biomass: Decomposes above 250° C.
   (2) Indigotin: 390 - 392° C.
C. Specific Gravity: >1.2 g./ml.
D. Vapor Density: Not applicable.
E. Reactivity in Water: Unreactive.
F. Solubility: Biomass insoluble in water and all common organic solvents.
   Indigotin insoluble in water and all common organic solvents.
G. Appearance: Dark blue solid with a hard but somewhat chalky texture.
H. Flash Point: Not known: Above 275° C.
I. Auto-ignition Temperature: Not applicable.
J. pH: 7.1 - 7.5.

III. Hazardous Ingredients: None known.

IV. Physical Hazards:
A. Stability: Stable under dry conditions. Decomposes slowly with microbial growth
   (molds, etc.) after long-term contact with liquid water or in high atmospheric
   moisture.
B. Incompatibility (Materials to Avoid): No unusual incompatibilities. As with all
   biomass materials, contact with strong oxidizing agents (nitrates, chlorates, oxygen,
   etc.) should be avoided.
C. Hazardous Decomposition Products: None known.
D. Hazardous Polymerization: Will not occur.
E. Unusual Fire and Explosion Hazards: None known.
   1. Fire fighting media: Water, foam, or dry chemical.
   2. Fire fighters should wear self-contained breathing apparatus, to protect from
      potentially hazardous fumes.
V. Health Hazards: No toxic effect known from dust inhalation or ingestion.
   A. Threshold Limit Value: None known.
   B. Signs or Symptoms of Exposure: None expected.
   C. Effects of Chronic Exposure: None known.
   D. Medical Conditions Generally Aggravated by Exposure: None known.
   E. Chemicals Listed as Carcinogen or Potential Carcinogen: No listing.
   F. OSHA Permissible Exposure Limit: None known.
   G. Emergency and First Aid Procedures:
      1. Inhalation: Remove person to fresh air. If breathing difficulty occurs or coughing
         persists, get prompt medical attention.
      2. Eyes: Flood with water.
      3. Skin: Wash with soap and water.
      4. Ingestion: Gastric lavage.

VI. Special Protection Information:
   A. Respiratory Protection: Use dust respirator when handling product.
   B. Ventilation: No special ventilation required.
   C. Protective Gloves: Wear leather or rubber-covered cloth gloves to avoid direct contact
      of hands with product.
   D. Eye Protection: Use safety eyewear.
   E. Waste Disposal Methods: Normal septic type of disposal is recommended, due to ease
      with which microorganisms can grow in the material. pH adjustment is not
      necessary.

VIII. Special Notes:
   A. As with all biomass materials, incomplete combustion may result in the formation of
      volatile toxic compounds. In case of fire, precautions should be taken to avoid
      breathing evolved gases and vapors.
   B. Literature references indicate that this material has long been used as a dye for textile
      fibers. However, as a reasonable precautionary measure, care should be taken to
      avoid breathing dust and to avoid prolonged skin contact.
SECTION 4 - PHYSICAL DATA cont'd

Specific Gravity: Not applicable

Bulk Density: ca 35 lbs/ft³

Solubility: Insoluble in water, ether, alcohol and dilute acids.

Physical Appearance and Odor: Dark blue powder with a coppery luster.

SECTION 5 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: None to 250°C

Flammable Limits: Not applicable

Extinguishing Media: Water, carbon dioxide or dry chemical.

Special Fire Fighting Procedures & Equipment: Respiratory protection against combustion products.

Unusual Fire & Explosion Hazards: Indigo Powder, like most finely ground powders, can present an explosion hazard. It is recommended that dust control equipment and material transport systems for handling Indigo Powder should be designed to eliminate this hazard. The following design features should be considered: non-sparking equipment; explosion relief vents; explosion suppression equipment; elimination of oxygen from the system; electrical bonding and grounding of all conductive equipment parts.


SECTION 6 - REACTIVITY DATA

Stability: At Ambient temperatures: stable.

At elevated temperatures: stable to 250°C

Conditions to avoid: All sources of ignition or spark. (See Section 5)

Incompatibility (Materials to Avoid): Acid, strong oxidizers.

Hazardous polymerization will occur under the following conditions: Will not occur.

SECTION 7 - SPILL OR LEAK PROCEDURES

Steps To Be Taken If Material Is Spilled or Released:

Clean up spills and dust accumulation promptly. See Sections 8, 9, 10, 11. Sweep and pick up for disposal. Hose area down with water.

On Highway: Call Chembrec 1-800-424-9300. Local environmental agency should be notified. Within Manufacturing Area: Contact Environmental Control Department.

Disposal Methods: Deposit material in a separate, labeled, leak-proof container and take to an approved treatment, storage, or disposal facility.

SECTION 8 - HEALTH HAZARD DATA

SECTION 8 - HEALTH HAZARD DATA cont'd

Toxicity and Sensitivity Data:
Ingestion Oral \(\text{LD}_{50}\): In Rat \(>5000\) mg/kg
Absorption Dermal: Rat: \(50\%\) absorbed @ 3 mg/kg
\(38\% @ 30 + 300\) mg/kg
Irritation: Skin RBT: On scale of 8 (Draize): 0.0
Eye RBT: On scale of 110 (Draize): 0.0-2.0
Inhalation Rat: 760 mg/m\(^3\) x 4 h: mortality 0/10

Carcinogenicity: This material is not listed as a carcinogen by OSHA, NTP, IARC.

Primary Route(s) of Entry: Inhalation, eyes, skin.

<table>
<thead>
<tr>
<th>Permissible Exposure Limits:</th>
<th>OSHA (3/89)</th>
<th>ACGIH TLV (1988-89)</th>
<th>Buffalo Color Limit Values (TWA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigo</td>
<td>Not listed</td>
<td>Not listed</td>
<td>5.0 mg/m(^3)</td>
</tr>
<tr>
<td>As nuisance dust total</td>
<td>15 mg/m(^3)</td>
<td>10 mg/m(^3) TWA</td>
<td>---</td>
</tr>
</tbody>
</table>

Signs and Symptoms of Exposure (Progressive):
Inhalation: Sneezing, mucous flow, coughing.
Skin/eyes: Skin coloring, eye irritation, tearing.
Ingestion: Possible nausea.
Discolors skin but no permanent adverse effects. Will penetrate skin slowly.
Sodium sulfate content may add to eye irritation. No toxic effect known from dust inhalation or ingestion.

Medical Conditions which may be aggravated by exposure: Inhalation of Indigo Powder dust may aggravate pre-existing pulmonary conditions.

SECTION 9 - EMERGENCY AND FIRST AID

Inhalation: Remove person to fresh air. If breathing difficulty occurs, or coughing persists, get prompt medical attention.

Skin/Eye Contact: Flush eyes with plenty of water for at least 15 min. If irritation persists get medical attention. Wash skin thoroughly with soap and warm water to remove and use emollients if needed.

Ingestion: If person is conscious, give water, induce vomiting. Get medical attention.

SECTION 10 - SPECIAL PROTECTION INFORMATION

Respiratory Protection: Dust respirator when handling product.

Eye Protection: Safety glasses with cup side shields. Full face shield if there is any possibility of splashing or eye contact.

Protective Clothing: Appropriate, clean clothing to prevent skin contact including long sleeved shirt, buttoned at wrist, and impervious gloves. Remove contaminated clothing and shoes immediately. Wash contaminated clothing before reuse.

Ventilation: Adequate general and local ventilation should be provided in powder handling areas to keep concentration of dust below exposure limit values. (See Section 8)

Personal Hygiene: Shower at end of each work shift.
MATERIAL SAFETY DATA SHEET
March 19, 1996

I. Identity:
   A. Trade/Common Names: Madder Root, Dyer's Madder.
   B. Origin: Dried roots of the perennial plant Rubia tinctorum; also roots of related species, such as Rubia cordifolia.
      Botanical Family: Rubiaceae.
   C. Chemical Family:
      1. 96% - 98% Plant biomass.
      2. 2% - 4% Alizarin: α,β-Dihydroxyanthraquinone: Empirical Formula: C_{14}H_{8}O_{4}.

II. Physical Data:
   A. Boiling Point: (1) Biomass: Not applicable.
      (2) Alizarin: 430° C.
   B. Melting Point: (1) Biomass: Decomposes above 250° C.
      (2) Alizarin: 290° C.
   C. Specific Gravity: >1.2 g./ml. when air is removed from biomass.
   D. Vapor Density: Not applicable.
   E. Reactivity in Water: Unreactive.
   F. Solubility: Biomass insoluble in water and usual organic solvents. Alizarin very slightly soluble in neutral water, soluble in aqueous alkaline solutions, very soluble in usual organic solvents.
   G. Appearance: Irregular small cellulosic roots with fibrous and/or pithy texture; light brown to pink color.
   H. Flash Point: Not known: Above 250° C.
   I. Auto-Ignition Temperature: Not applicable.
   J. pH: 7.1 - 7.5.

III. Hazardous Ingredients: None known.

IV. Physical Hazards:
   A. Stability: Stable under dry conditions. Decomposes slowly with microbial growth (molds, etc.) after long-term contact with liquid water or in high atmospheric moisture.
   B. Incompatibility (Materials to Avoid): No unusual incompatibilities. As with all biomass materials, contact with strong oxidizing agents (nitrates, chlorates, oxygen, etc.) should be avoided.
   C. Hazardous Decomposition Products: None known.
   D. Hazardous Polymerization: Will not occur.
   E. Unusual Fire and Explosion Hazards: None known.
      1. Fire fighting media: Water, foam, or dry chemical.
      2. Fire fighters should wear self-contained breathing apparatus, to protect from potentially hazardous fumes.
V. Health Hazards: No toxic effect known from dust inhalation or ingestion.
A. Threshold Limit Value: None known.
B. Signs or Symptoms of Exposure: None expected.
C. Effects of Chronic Exposure: None known.
D. Medical Conditions Generally Aggravated by Exposure: None known.
E. Chemicals Listed as Carcinogen or Potential Carcinogen: No listing.
F. OSHA Permissible Exposure Limit: None known.
G. Emergency and First Aid Procedures:
   1. Inhalation: Remove person to fresh air. If breathing difficulty occurs or coughing persists, get prompt medical attention.
   2. Eyes: Flood with water.
   3. Skin: Wash with soap and water.
   4. Ingestion: Gastric lavage.

VI. Special Protective Information:
A. Respiratory Protection: Use dust respirator when handling product.
B. Ventilation: No special ventilation required.
C. Protective Gloves: Wear leather or rubber-covered cloth gloves to avoid direct contact of hands with product.
D. Eye Protection: Use safety eyewear.
E. Waste Disposal Methods: Normal septic type of disposal is recommended, due to ease with which microorganisms can grow in the material. PH adjustment is not necessary.

VIII. Special Notes:
A. As with all biomass materials, incomplete combustion may result in the formation of volatile toxic compounds. In case of fire, precautions should be taken to avoid breathing evolved gases and vapors.
B. Literature references indicate that this material has long been used as a dye for textile fibers and as an ingredient in pigment lakes. However, as a reasonable precautionary measure, care should be taken to avoid breathing dust and to avoid prolonged skin contact.
MATERIAL SAFETY DATA SHEET
October, 1998

I. Identity:
A. Trade/Common Names: Osage Orange, Hedge Apple, Bow Dock.
B. Origin: Heartwood of the tree *Maclura pomifera*.
   Botanical Family: Moraceae.
C. Chemical Family:
   1. 92% - 94% Plant biomass.
   2. 6% - 8% Soluble isoflavone derivatives:
      Osajin, empirical formula: \( \text{C}_{25}\text{H}_{26}\text{O}_{5} \), and
      Pomiferin, empirical formula: \( \text{C}_{25}\text{H}_{26}\text{O}_{6} \).
      Both compounds are isoflavones substituted by 2 isoprene units.

II. Physical Data:
A. Boiling Point: (1) Biomass: Not applicable.
       (2) Isoflavone derivatives: decompose above 275 C.
B. Melting Point: (1) Biomass: Decomposes above 250 \(^\circ\) C.
       (2) Isoflavone derivatives: approx. 225 \(^\circ\) C.
C. Specific Gravity: >1.2 g./ml. when air is removed from biomass.
D. Vapor Density: Not applicable.
E. Reactivity in Water: Unreactive.
G. Appearance: Close-grained, hard wood, wood shavings, or sawdust. All forms have a pronounced yellow color.
H. Flash Point: Not known: Above 300 \(^\circ\) C.
I. Auto-ignition Temperature: Not applicable.
J. pH: 7.1 - 7.5.

III. Hazardous Ingredients: None known.

IV. Physical Hazards:
   A. Stability: Stable under dry conditions. Decomposes slowly with microbial growth (molds, etc.) after long-term contact with liquid water.
   B. Incompatibility (Materials to Avoid): No unusual incompatibilities. As with all biomass materials, contact with strong oxidizing agents (nitrates, chlorates, oxygen, etc.) should be avoided.
   C. Hazardous Decomposition Products: None known.
   D. Hazardous Polymerization: Will not occur.
MATERIAL SAFETY DATA SHEET:
OSAGE ORANGE

IV. Physical Hazards--cont.:
E. Unusual Fire and Explosion Hazards: None known.
   1. Fire fighting media: Water, foam, carbon dioxide, or dry chemical.
   2. Fire fighters should wear self-contained breathing apparatus, to protect from
      potentially hazardous fumes.

V. Health Hazards: No toxic effect known from dust inhalation or ingestion.
A. Threshold Limit Value: None known.
B. Signs or Symptoms of Exposure: None expected.
C. Effects of Chronic Exposure: None known.
D. Medical Conditions Generally Aggravated by Exposure: None known.
E. Chemicals Listed as Carcinogen or Potential Carcinogen: No listing.
F. OSHA Permissible Exposure Limit: None known.
G. Emergency and First Aid Procedures:
   1. Inhalation: Remove person to fresh air. If breathing difficulty occurs or coughing
      persists, get prompt medical attention.
   2. Eyes: Flood with water.
   3. Skin: Wash with soap and water.
   4. Ingestion: Gastric lavage.

VI. Special Protection Information:
A. Respiratory Protection: Use dust respirator when handling product in sawdust or
   shaving form.
B. Ventilation: No special ventilation required.
C. Protective Gloves: Wear leather or rubber-covered cloth gloves to avoid direct contact
   of hands with product.
D. Eye Protection: Use safety eyewear to avoid getting dust in eyes.
E. Waste Disposal Methods: Normal septic type of disposal is recommended, due to ease
   with which microorganisms can grow in the material. pH adjustment is not
   necessary.

VIII. Special Notes:
A. As with all biomass materials, incomplete combustion may result in the formation of
   volatile toxic compounds. In case of fire, precautions should be taken to avoid
   breathing evolved gases and vapors.
B. Literature references indicate that this material has long been used as a dye for textile
   fibers and as a decorative wood in cabinet making, etc. However, as a reasonable
   precautionary measure, care should be taken to avoid breathing dust and to avoid
   prolonged skin contact.