***TEST EQUIPMENT DATA PACKAGE***

***Kathy Duquesnay***

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*10202 Memorial Dr.*

*Houston, TX 77024*

***The Effects of Microgravity and Light Wavelength on Plant Growth in an Ardulab***

*TEDP Completion Date: Feb. 2, 2014*

***IMPORTANT THINGS TO NOTE:***

***Avoid permanent magnets if possible***

***Avoid Shaterable materials if possible (e.g. class) However there are ways to secure these items, just be sure Mentor and NanoRacks are aware so that they can be packaged appropriately.***

***Avoid pressure vessels***

***Avoid substances with toxicity higher than 2 on MSDS’s***

***CHANGE RECORD***

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***QUICK REFERENCE DATA SHEET***

*Team Name: Duchesne Academy 8th Grade*

*Principal Investigator: Kathy Duquesnay*

*Contact Information: kathy.duquesnay@duchesne.org*

*Experiment Title: The Effects of Microgravity and Light Wavelength on Plant Growth in an Ardulab*

*Work Breakdown Structure (WBS):*

*Flight Date(s): May 1st, 2014*

*Overall Assembly Weight (lbs): 17.5 oz*

*Assembly Dimensions (L x W x H): 10cm x 10cm x 10cm*

*Equipment Orientation Requests in reference to NanoRack:*

*Proposed Mounting to NanoRack: Just the USB connections*

*Does Experiment need to be located next to fan on NanoRack: (Yes or No) NO.*

*Power Requirement (Voltage 9and Current Required): USB Connection*

*Camera or Video Requested? (Yes or No): No*

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***BASIC MISSION OBJECTIVE:***

*Technology demonstration, research, Proof of concept?*

This experiment will test the effect of combinations of red and blue wavelengths of electromagnetic radiation on a small fast growing plant such as pea or broccoli shoots. We can start these plants from seeds and they will be placed in a 10 cubic centimeter Ardulab and grown in a microgravity environment.

This experiment will be important so that plants with high nutrition can be effectively and rapidly grown on the ISS and on future long duration flight. We propose to identify the combination red and blue LEDs that will induce the most rapid growth.

***EXPERIMENT BACKGROUND***

*Why is this experiment relevant?  What questions will it answer? Include NASA supporting org. and programs and research history.*

The selection process for a nutritional, rapidly growing plant that could be easily grown from seeds led us to three vegetables commonly eaten as shoots. In their early stages of life, peas, popcorn shoots, and bamboo could be used as test subjects to observe the speed of growth under different wavelengths of light. Pea shoots contain high amounts of Vitamin A, B, C, E, calcium, chlorophyll, iron, magnesium, niacin, phosphorus, potassium, amino acids, and protein up to 25%. In additional to their nutritional values, they are also low in sodium, fat, and sugar. They can be harvested after only two to four weeks of growth, and have a seed shelf life of four to five years. Popcorn shoots also contain Vitamin A, B, C, E, calcium, chlorophyll, iron, lecithin, magnesium, pantothenic acid, phosphorus, potassium, trace elements, and around 30% protein. However, popcorn seeds only take between eight to twelve days to sprout. In addition to pea and popcorn shoots, bamboo shoots are also highly beneficial. Studies show that bamboo can prevent the production of cancerous cells, improve appetite and digestion, aid weight loss, and treat hypertension and hyperglycemia. The main nutrients include high levels of protein, amino acids, healthy fats and sugars, salt, and water contents.

We are planning to use a combination of red and blue LED lights. According to our research, a mixture of red and blue lights provides the optimal wavelength to induce favorable plant growth.

Professor Allen Barker at University of Massachusetts Amherst stated that 450 and 650 nanometers are required for photosynthesis, and red light has wavelengths between 622 and 780 nm. Blue light has between 455 to 492 nm, and violet light has between 390 and 455 nm. Also between 650 and 730 nm wavelengths allow the plant to flower by influencing the phytochrome plant pigment.

NASA has used white, green, and red lights in the past; this is one of the reasons we have decided on these colors. Red LED lights have been proven by NASA to cause the plants to have a “higher concentration of anthocyanin, an antioxidant that can combat some of the effects of cosmic radiation” (LED Lights Used in Plant Growth Experiments for Deep Space Missions). Another NASA study concluded that green lights are also beneficial to plants. NASA believes the light is important because of the positive effects, like an increase of antioxidants, can have on the plants.

A space experiment called VEGGIE, short for plant growing system about the size of a microwave oven, to be sent onto the ISS on Dec. 9 2013. The experiment called for red and blue LED lights for photosynthesis to take place and to make experiments. LED lights are being used because of their long lifetime.

From October 2009 to September 2010, scientists grew a garden of thale cress on ISS in an experiment called ADSVAC, which tested the Advanced Astroculture Plant Growth Chamber.  Scientists genetically modified these plants to under how stress in a zero gravity environment was affecting the plants. When they genetically modified the plants, it allowed them to glow when they were unhappy. This was helpful because it meant they could examine the plant without dissecting it.

        Seeds in space followed the same sprouting pattern and growth stages as the plants here on Earth. Many scientist were concerned that the roots would grow incorrectly because it was thought that gravity had an effect on the downward formation of the roots. After NASA had conducted a successful experiment on the international space station, it is known that gravity is not necessary to growing plants.

In 2010, the ISS was sent plants called Arabidopsis thaliana or Thale Cress. These plants were used to study how plant roots developed in a weightless environment. These plants were grown on a nutrient-rich gel in clear petri plates. These plants showed familiar root growth patterns where roots slant progressively as they branch out. Researchers have always thought that direction of growth was the result of gravity's effects on root tip growth. Others think that in microgravity, other factors take over that enable the plant to direct its roots away from the seed and light-seeking shoot. Those factors could include moisture, nutrients, and light.

A study was done at the University of Wisconsin and at Kennedy Space center growing wheat plants with only red lights. The plants were dying, thin, and very "pale" because of the loss of chlorophyll.  Blue fluorescent lights repaired most of the problems caused by the blue LEDS.  In the September of 2012 NASA ran and experiment monitoring the growth of radish plants versus red leafed lettuce and in different types of lights and light levels. A chlorophyll meter was used to measure the amount of chlorophyll in a plant. Afterwards, the plants were frozen in liquid nitrogen and were pulverized into a new powdery form. The powder would be used to run a new test in which the amount of stored energy in the plant tissue would be measured. The plants were grown in red, blue, white, and green LED lights. Some lights increase nutrients and antioxidant. The lettuce and radishes showed darker red color under the red and blue LED lights, some nutrients found in red leafed lettuce thrived in the red light. Some of these nutrients fight cosmic radiation. Ongoing experiments are currently further investigating the topic.

***EXPERIMENT DESCRIPTION***

*Brief explanation of experiment. Include sketches or AUTOCAD ipt files*

If pea shoots, *Pisurn sativum*, and/or broccoli shoots, *Brassica oleracea*, are exposed to microgravity and different combinations of red and blue light wavelengths, then the plants will demonstrate the most growth on the side with the ratio of three red to one blue super-bright LED light, because red light has the longest wavelength, is bent the least, and moves the slowest, so the plant would be able to absorb the light more effectively.  The other side will have three blue LEDs and one red LED.  The four LEDs will be in cluster on a side opposite the seeds. The seeds will be placed on top of Phytoblend agar with nutrients. This will supply the necessary moisture and growth media required for the pea shoots. Every twelve hours, a photo will be taken on each side. This will be just before the lights begin their cycle in order for us to observe and measure length and growth.  We will measure the growth of the plants on each side by viewing the photographs. The progress of the plant growth will be compared to a grid attached to the sides of the Ardulab. The grid will be marked off in 0.5 centimeter increments. The LEDs and the cameras will be attached to and controlled by the arduino mega microprocessor built into the 1U Ardulab.

***OPERATIONAL SCENARIO***

***A.****High Level Summary of Payload Operations, general overview*

The Ardulab should be at +4 degrees Celsius until it reaches the ISS. It then needs to be destowed and be plugged into the nanoracks immediately after the destowage. It should run for thirty days and once destowed, at the end of the 30days it should be kept at +4 degrees C until returned to Earth on Space X5.

***B.****Specific constraints for payload (ie. Activation requirements, temperature requirements to/on/from ISS, orientation requirements during transport to ISS)*

The ardulab should be at +4 degrees Celsius until it reaches the ISS. It then needs to be destowed and be plugged into the nanoracks immediately after the destowage. It must run for thirty days and once destowed, at the end of the 30days it should be kept at +4 degrees C until returned to Earth on Space X5.

The orientation requirements during transport to the ISS are as follows: Orient the Ardulab with the Arduino Mega board on the back wall and the USB connection pointing to the right.

We would like the same orientation when it is returned to Earth.

***C.****How long does the experiment need to operate for? Does the experiment require any crew interaction?*

The experiment will operate for the full thirty days in flight. It will not require any crew interaction.

***D.****Will payload need to be returned or disposed of once ops complete*

The payload will need to be returned on Space X 5 so that we can make additional observations and recover the SD card.

***E.****What kind of data needs to be collected during the mission and will ground operations be required (ie. Downlinking to NanoRacks mission control?)*

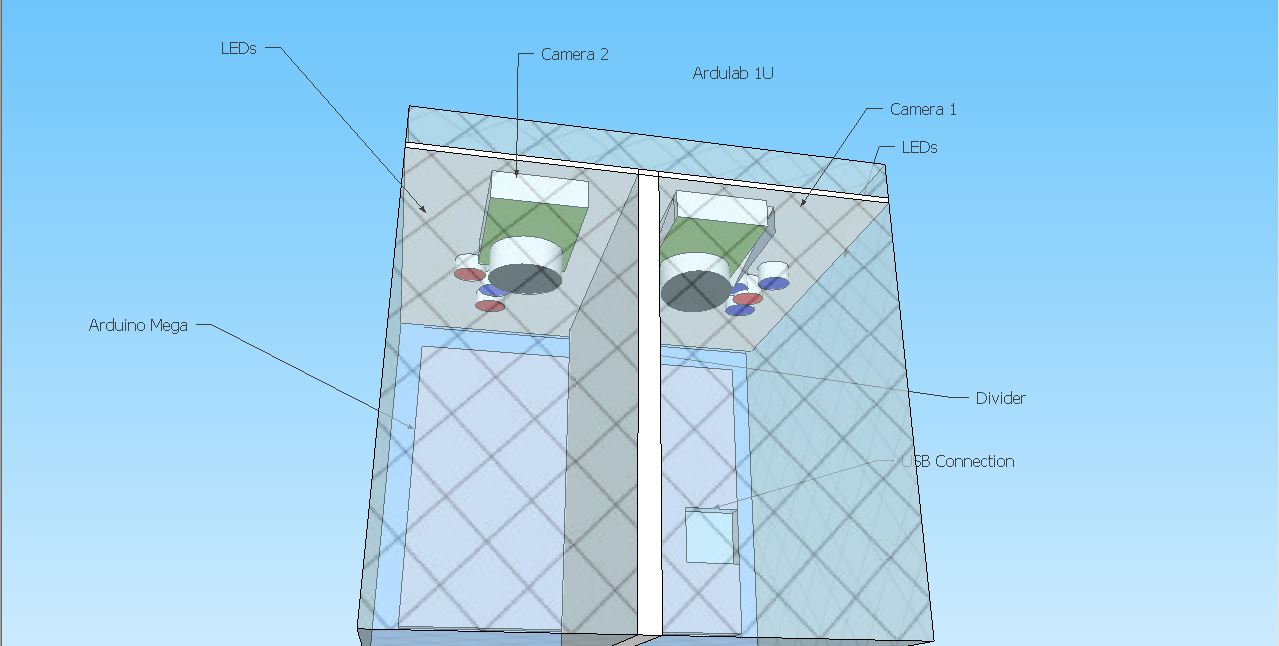
Two photographs will be taken twice a day, 60 photographs in all. These will be saved on the SD card that Nanoracks will downlink to Infinity Aerospace to be sent to us.

***EQUIPMENT DESCRIPTION***

*A.     Ground-Based and Flight Equipment (if there is no difference just reference the flight Equipment.  Please make excel spreadsheet for all categories of the equipment.)*

There is difference in the equipment.

1. *Pictures- See table below*

**

*b.      Descriptions of each piece of equipment*-

The only equipment will be the 1 U Ardulab. See spreadsheet below for the equipment within the Ardulab

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Item | part no. | # | description | dimensions | wt |  | picture |
| Camera | Pid:1386 | 2 | Adafruit Miniature TTL Serial JPEG Camera with NTSC Video to take photos | 20mmx28mm |  | Miniature TTL Serial JPEG Camera with NTSC Video |
| Red Superbright LEDs | COM-00528 | 4 | Sparkfun LEDs to provide light for the plants to grow 9,000mcd brightness | 5 mm |  | https://dlnmh9ip6v2uc.cloudfront.net/images/products/5/2/8/08285-01.jpg | https://dlnmh9ip6v2uc.cloudfront.net/images/products/5/2/8/08285-01.jpg |
| Blue super bright LEDs | COM-00529 | 4 | Standard size - T1 3/4 5mm 2.4 V forward drop Max current 20mA | 5mm |  |  |  | |  |
| jumper wires | PRT-08431 |  | Sparkfun Jumper Wires Premium 6" M/M |  |  | https://dlnmh9ip6v2uc.cloudfront.net/images/products/8/4/3/1/JumperWire-Male-01-L_i_ma.jpg | https://dlnmh9ip6v2uc.cloudfront.net/images/products/8/4/3/1/JumperWire-Male-01-L_i_ma.jpg |
| solder |  |  |  |  |  |  |
| resistors |  | 8 | 100 Ω, 120 Ω, 220 Ω, 3300 Ω, 1000 Ω (2) , 1500 Ω ( 2) |  |  |  |
| Acrylonitrile Butadiene Styrene (ABS) |  | 2 | White plastic boards dividing & supporting the cameras | 10 cm x 10cm |  | C:\Users\Kathy & Mark\AppData\Local\Temp\yblotsog.tmp\photo.JPG | C:\Users\Kathy & Mark\AppData\Local\Temp\yblotsog.tmp\photo.JPGhttp://www.caissonlabs.com/use_images/product_images/A037-2.5KG.jpghttps://encrypted-tbn1.gstatic.com/shopping?q=tbn:ANd9GcSS77CpCqYiKOSgdvfBbjd4WMT-MNj5u-O0FhAfwq2WZU9wOzHB33wY0sxUPpLFp4eApydKH9ca&usqp=CAE |
| Phytoblend agar w/nutrients |  |  | growth media for the seeds | 70 mL |  | http://www.caissonlabs.com/use_images/product_images/A037-2.5KG.jpg |
| 3m mounting tape |  | 2 | Natural rubber adhesive | 20 mm x 28mm x 5mll |  | https://encrypted-tbn1.gstatic.com/shopping?q=tbn:ANd9GcSS77CpCqYiKOSgdvfBbjd4WMT-MNj5u-O0FhAfwq2WZU9wOzHB33wY0sxUPpLFp4eApydKH9ca&usqp=CAE |
| lexan polycarbonate sheet | 31-GE-XL-1 | 2 | thin plastic shelf to support the cameras | 20 mmx 28mm |  | 10 in. x 8 in. Polycarbonate Sheet | 10 in. x 8 in. Polycarbonate Sheet |
| Krazyglue All Purpose |  |  |  |  | 1g | http://www.krazyglue.com/images/products/catalog/KG866.gif |
| pea seeds, *Pisurn sativum* |  | 6 | Quick growing food source |  |  | C:\Users\Kathy & Mark\AppData\Local\Temp\3fd5tqkw.tmp\photo.JPG |
| broccoli seeds |  | 6 | quick growing food source |  |  | C:\Users\Kathy & Mark\AppData\Local\Temp\74t7o4lb.tmp\photo.JPG |
| containers to hold the phytoblencd & seeds |  | 2 | 02-911-870 Available on GSA/VA Contract for Federal Government customers only.  Bottle, Dropping; Fisherbrand; Polyethylene; Low-density; With tip and cap; 2 oz. (60mL); 24mm-410 screw cap size top cut off to hold 45 mL | 50 mL | 53g each w/ the phytoblend | 02-911-870 | 02-911-870   |  | | --- | |  | |
| Ardulab & Arduino Mega 2560 |  |  | The infinity Aerospace container and microcontroller for our entire experiment |  | 398 g w/cameras, wires, ABS boards |  | |  | | --- | |  | |

*c.       Dimensions-*

Ten centimeters by ten centimeters by ten centimeters

*d.      Mass*-

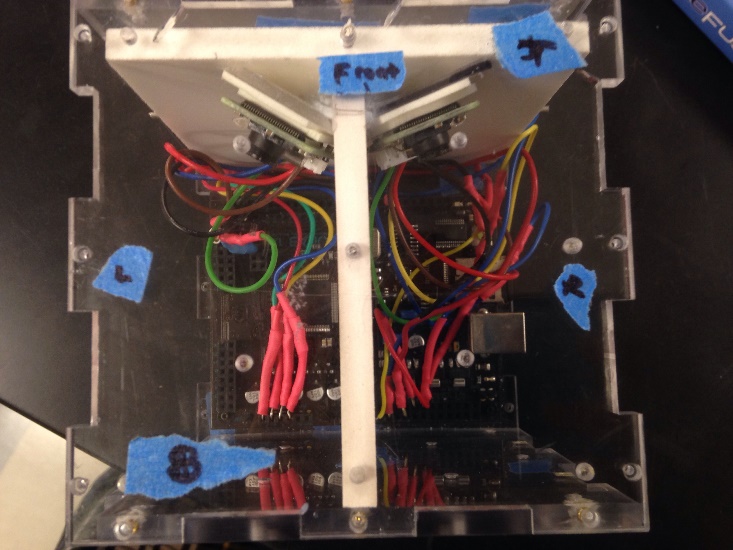
Approximately 600 grams (496 g) 17.5 oz

*e.       Hardware Class (different classes based on toxicity of material)*

Class 1, secure hardware

*B.     Equipment Layout for Take-off, in Flight, and Landing (some of this information provided by NanoRacks.  Equipment may be stowed in flight stowage bag during liftoff and landing.  Show how the ardulab should be interfacing the NanoRack with orientation.  Diagrams are helpful.*

When facing the Ardulab the Arduino Mega microprocessor should be on the back wall with the USB connection on the lower right hand side. This should be the orientation for both take-off and landing.





*C.     Special Handling/Special Hazards/Special Requirements*

*Crew handling during mission?  Will crew be handling toxic materials?*

No special handling needed.  The crew will not be handling toxic materials

*D.      Bio/Chemical Contents :*

*Complete JSC form 27472 if applicable and provide MSDS .  Avoid substances with toxicity higher than a 2 on MSDS form.*

See MSDS Sheets below.

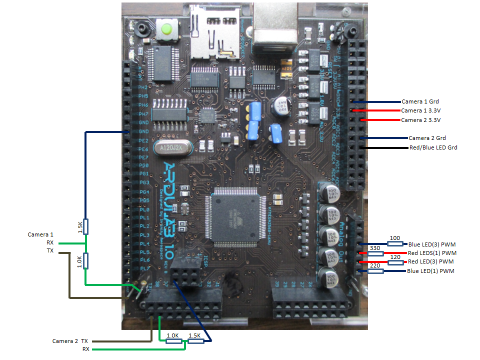
*E.      Inventory of In-flight Items*

*Any extra materials that will need to be stowed outside of the ardulab? If you have items that are going to be operated by the crew outside of the module provide a sketch or enough details to create a drawing.  Photographs are great if available.*

Nothing will be stowed outside of the ardulab.

***ELECTRICAL ANALYSIS***

*A.     Schematic drawing with all current and voltage draws*



*B.     Load Table*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Trail** | **3 Blue LED (Amps)** | **3 Red LED (Amps)** | **1 Blue LED (Amps)** | **1 Red LED (Amps)** | **Cam.1 (Amps)** | **Cam.2 (Amps)** | **SD (Amps)** |
| **1** | **0.088** | **0.083** | **0.075** | **0.08** | **0.08** | **0.09** | **0.08** |
| **2** | **0.095** | **0.095** | **0.093** | **0.099** | **0.09** | **0.089** | **0.07** |
| **3** | **0.1** | **0.097** | **0.097** | **0.101** | **0.1** | **0.095** | **0.077** |
| **4** | **0.096** | **0.097** | **0.099** | **0.1** | **0.09** | **0.093** | **0.081** |
| **Avg Amp Draw** | **0.09475** | **0.093** | **0.091** | **0.095** | **0.09** | **0.09175** | **0.077** |
|  |  |  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **ArduLab** |  |  |
| **Trails** | **Nothing Plugged In (Min)** | **Nothing Plugged In (Max)** |
| **1** | **0.077** | **0.1** |
| **2** | **0.088** | **0.109** |
| **3** | **0.095** | **0.112** |
| **4** | **0.093** | **0.113** |
| **Avg Amp Draw** | **0.08825** | **0.1085** |

*C.     Stored Energy*

None

*D.     Electrical Kill Switch* *How will experiment be turned off in event of an emergency?*

Just remove the Ardulab from its Nanoracks USB connection.

*E.      Loss of Electrical Power (Fail-Safe)*

None. It will not operate without the USB connection.

*F.       TRY TO DESIGN without Batteries and just use the NanoRacks platform with USB power.  If Batteries cannot be avoided, please include the following information and specifications:*

No batteries are going to be used.

*a.       Schematics of entire unit must include the batteries (if batteries are rechargeable, include the schematics of the battery charging circuits).*

*b.      Protection circuit*

*i.      Manufacturer, details, and model number*

*ii.      Schematics*

*iii.      Voltage and current cutoff levels*

*c.        Battery type and configuration*

*d.      Battery manufacturer*

*e.       Battery history*

*i.      Testing history, including reports*

*ii.      Previous NASA use, if any.*

*iii.      Lot and cell Data*

*f.        Specifications on any active thermal system (N/A if no heater internal to Module experiment.)*

No heater involved.

***INSTITUTIONAL REVIEW BOARD***

*Only for human or vertebrate animal test subjects.*

***HAZARD ANALYSIS***

***A.****General Hazard Identification Checklist*

[*http://jsc-aircraft-ops.jsc.nasa.gov/Reduced\_Gravity/docs/NS-STO-CH01.pdf*](http://jsc-aircraft-ops.jsc.nasa.gov/Reduced_Gravity/docs/NS-STO-CH01.pdf)

***TOOL REQUIREMENTS***

*A.     Additional Tools that will be required in flight for crew monitoring of the project.*

None needed

***PHOTO REQUIREMENTS***

*A.     Camera/Video required?  How often during mission required?*

None needed the cameras are inside the ardulab.

*B.     Downlink Requirements*

The SD card needs to be read by Nanoracks at the same time daily then downlinked by Infinity Aerospace 3 times a week.

*C.     Still/Video Photographer Special Requests*

None needed the cameras are inside the ardulab.

***HAZARDOUS MATERIAL***

*List any hazardous material being used and it hazard number associated with it.  Include MSDS sheet for that material in section below.*

***MATERIAL SAFETY DATA SHEETS (MSDS)***

Phytoblend agar, Lexan plastic, and Krazy glue

***Material Safety Data Sheet***

I Material & Company Identification

Product Name: **Phytoblend**

Catalog Number: PTP01

Company: Caisson Laboratories

Address: 1740 Research Park Way, North Logan, UT 84341

Telephone: 435.755.7615   Fax: 435.755.7617

Emergency Contact: CHEMTREC 800.424.9300 (703.527.3887)

II Composition / Information on Ingredients

General Information:

Component:  CAS#: 9002-18-0

% by Weight:

III Hazards Identification

Overview: Health Rating: 0 - None

Flammability Rating: 1 - Slight

Reactivity Rating: 0 - None

Route of Exposure

Oral: Not expected to be a health hazard.

Inhalation: If inhaled, move to fresh air. If breathing becomes difficult, call a physician.

Dermal: Not expected to be a health hazard.

Eye: In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by

separating the eyelids with fingers. Call a physician.

Suitable Extinguishing Media: Use any means suitable for extinguishing surrounding fire.

Special Protective Equipment for fire fighters: Use protective clothing and breathing equipment appropriate for the surrounding fire.

Additional Information: Not considered to be a fire hazard. Not considered to be an explosion hazard.

VI Accidental Release Measures

General Information: Ventilate area of leak or spill. Wear appropriate personal protective equipment. Spills: Sweep up and containerize

for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal.

VII Handling and Storage

Handling:

Storage: General storage, keep in a tightly closed container, stored in a cool, dry, ventilated area

Temperature: 15 to 30° C   Light Sensitive: False

Incompatibles: Strong oxidizers.

Hazardous Decomposition Products: Carbon dioxide and carbon monoxide may form when heated to decomposition.

Stable under ordinary conditions of use and storage.

XI Toxicological Information

General Information:

Acute Toxicity: Complete toxicological properties have yet to be determined.

Chronic Toxicity: Complete toxicological properties have yet to be determined.

Carcinogenicity: Investigated as a tumorigen.

OSHA Permissible Exposure Limits: No exposure limits established by OSHA or ACGIH

XII Ecological Information

General Information:

XIII Disposal Considerations

General Information:

Disposal of Product: Observe all federal, state and local environmental regulations.

Disposal of Packaging: Rinse and dispose according to federal, state and local environmental regulations.

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Material Safety Data Sheet

XIV Transport Information

Proper Shipping Name: CHEMICALS, N.O.S (NON-REGULATED)

XV Regulatory Information

General Information:

TSCA:

SARA 313:

XVI Other Information

General Information: The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Caisson Laboratories, Inc. Shall not be held liable for any damage resulting from handling or from contact with the above product.

GE Plastics Material Safety Data Sheet

**LEXAN**

103-112

Print Date: 04-04-2002

Revision Date: 10/03/01

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Material Safety Data Sheet

SECTION

1:

PRODUCT

AND

COMPANY

IDENTIFICATION

General Electric Co.

GE Plastics Canada, Ltd.

One Plastics Ave.

2300 Meadowvale Blvd.

Pittsfield, MA 01201

Mississauga, ONT L5N 5P2

Visit GE Plastics on the Web at WWW.GEPLASTICS.COM

PHONE NUMBERS

Emergency Medical (24 HOUR)

800/447-4545

Emergency Transportation/CHEMTREC (24 HOUR)

800/424-9300

Other Emergency Information (24 HOUR)

812/831-7701

Non-Emergency Information :

For Resin Products

413/448-5800

For Structured Products

413/448-5400

PRODUCT IDENTIFICATION

PRODUCT IDENTIFIER:

LEXAN

103-112

Polycarbonate Polymer

PRODUCT DESCRIPTION:

Synthetic thermoplastic polymer.

PRODUCT USE:

May be used to produce molded or extruded articles or as a component of other

industrial products.

SECTION

2:

COMPOSITION/INFORMATION

ON

INGREDIENTS

Components listed below are physical or health hazards as defined in the Hazard Communication Standard. The quantities

represent typical or average values for the materials shown. Additional compositional data are provided in Section 15,

REGULATORY INFORMATION, subject to supplier notification requirements.

Component Name

%

CAS Number

OSHA PEL

ACGIH TWA

GE Recommended

Exp. Limits

This product does not contain any reportable hazardous materials.

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SECTION

3:

HAZARDS

IDENTIFICATION

EMERGENCY OVERVIEW:

Pellets with slight or no odor.

Spilled material may create slipping hazard.

Can burn in a fire creating dense toxic smoke.

Molten plastic can cause severe thermal burns.

Fumes produced during melt processing may cause eye, skin, and respiratory tract irritation. Severe over-exposure may result in nausea, headache, chills, and fever.

Secondary operations, such as grinding, sanding, or sawing can produce dust which may present an explosion or

respiratory hazard.

HMIS Ratings: Health = 0; Flammability = 1; Reactivity = 0; PPE = B

POTENTIAL HEALTH EFFECTS

INGESTION:

No hazard in normal industrial use.

SKIN ABSORPTION:

No absorption hazard in normal industrial use.

EYE CONTACT:

Can cause mechanical irritation if dusts are generated.

SKIN CONTACT:

Unlikely to cause irritation even on repeated contact.

CHRONIC / CARCINOGENICITY

NTP:

Not Tested.

OSHA:

Not Regulated.

IARC:

Not Listed.

NOTE: OSHA, IARC and/or NTP have listed carbon black and heavy metals, present in some colorants, as carcinogens. If these colorants are present in this product, they are shown in SECTION 2. These colorants are essentially bound to the plastic matrix and are unlikely to contribute to workplace exposure under recommended processing conditions. Processing fumes may cause irritation to the eyes, skin, and respiratory tract. In cases of severe exposure, nausea and headache can also occur.

Grease-like processing fume condensates on ventilation ductwork, molds, and other surfaces can cause irritation and injury to skin.

MEDICAL RESTRICTIONS: There are no known human health effects aggravated by exposure to this product. However, certain sensitive individuals and individuals with respiratory impairments may be affected by exposure to components in the processing vapors.

SECTION

4:

FIRST

AID

MEASURES

EYES:

Immediately flush eyes with plenty of water. Get medical attention if irritation develops or persists. After initial flushing, remove any contact lenses.

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GE Plastics

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SKIN:

Wash with soap and water. Get medical attention if irritation develops or persists. For hot

product, immediately immerse in or flush affected area with large amounts of cold water to

dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.

INGESTION:

No hazard in normal industrial use. Do not induce vomiting. Seek medical attention if symptoms develop.

INHALATION:

No specific treatment is necessary since this material is not likely to be hazardous by inhalation.

PROCESSING

FUMES:

Processing fumes inhalation may be irritating to the respiratory tract. If symptoms are experienced remove victim from the source of contamination or move victim to fresh air and obtain medical advice.

SECTION

5:

FIRE

FIGHTING

MEASURES

FIRE FIGHTING:

Do not enter fire area without proper protection including self-contained breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products.

EXTINGUISHING MEDIA:

Water spray and foam. Carbon dioxide and dry chemical are not recommended because their lack of cooling capacity may permit re-ignition.

CONDITIONS OF FLAMMABILITY:

Requires a continuous flame source to ignite.

AUTOIGNITION TEMPERATURE:

630 C (1166 F), estimated

EXPLOSION DATA:

Material not sensitive to mechanical impact but is sensitive to static discharge under dust cloud conditions.

HAZARDOUS COMBUSTION PRODUCTS:

Intense heat, smoke, carbon dioxide, carbon monoxide, hydrocarbon fragments

SECTION

6:

ACCIDENTAL

RELEASE

MEASURES

GENERAL:

Gather and store in a closed container pending a waste disposal evaluation.

Allow molten material to solidify before disposal.

SECTION

7:

HANDLING

AND

STORAGE

HANDLING:

Follow recommendations on label and in processing guide. Prevent contact with skin and eyes. Use good industrial hygiene practices. Provide adequate ventilation. Secondary operations such as grinding, sanding, or sawing may produce a dust explosion hazard. Use aggressive housekeeping activities to prevent dust accumulation: employ bonding, grounding, venting, and explosion relief provisions in accordance with accepted engineering practices.

STORAGE:

Store in a cool dry place. Avoid excessive heat and ignition sources.

SECTION

8:

EXPOSURE

CONTROLS/PERSONAL

PROTECTION

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ENGINEERING CONTROLS:

A continuous supply of fresh air to the workplace together with removal of processing fumes through exhaust systems is recommended. Processing fume condensate may be a fire hazard and toxic; remove periodically from exhaust hoods, ductwork, and other surfaces using appropriate personal protection.

Local ventilation requirements must be determined to limit exposure to processing fumes in the workplace.

PERSONAL PROTECTION

EYE/FACE:

Wear safety glasses with side shields or chemical goggles. In addition, use full-face shield when cleaning processing fume condensates from hoods, ducts, and other surfaces.

SKIN:

When handling pellets or powder, avoid prolonged or repeated contact with skin. Wear long pants, long sleeves, well insulated gloves, and a face shield during melt processing. Appropriate clothing - including chemical resistant gloves - should be worn to prevent contact with processing fumes condensate.

RESPIRATORY:

When using this product at elevated temperatures, implement engineering systems, administrative controls, or a respiratory protection program (including a respirator approved for protection from organic vapors, acid gases, and particulate matter) if processing fumes are not adequately controlled or operators experience symptoms of overexposure. If dust or powder are produced from secondary operations such as sawing or grinding, use a respirator approved for protection from dust.

SECTION

9:

PHYSICAL

AND

CHEMICAL

PROPERTIES

PHYSICAL STATE:

Solid

ODOR AND APPEARANCE:

Plastic pellet with slight odor.

MELTING POINT:

This product does not exhibit a sharp melting point but softens gradually over a wide range of temperatures.

VAPOR PRESSURE (mmHg):

Negligible.

SPECIFIC GRAVITY (WATER = 1):

>1

WATER SOLUBILITY:

Insoluble.

% VOLATILES:

Negligible

EVAPORATION RATE:

Negligible.

OCTANOL/WATER PARTITION

COEFFCIENT:

Not established

SECTION

10:

STABILITY

AND

REACTIVITY

STABILITY:

Stable

REACTIVITY:

Not reactive under recommended conditions of handling, storage, processing, and use.

CONDITIONS TO AVOID:

Do not exceed melt temperature recommendations in product literature.

In order to avoid autoignition/hazardous decomposition of hot thick

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masses of plastic, purgings should be collected in small, flat, shapes or thin strands to allow for rapid cooling. Quench in water. Do not allow product to remain in barrel at elevated temperatures for extended periods of time: purge with a general purpose resin. (See Section 8 for respiratory protection advice.)

HAZARDOUS DECOMPOSITION

PRODUCTS

Processing fumes evolved at recommended processing conditions may include trace levels of the following materials: phenols, alkylphenols,

diarylcarbonate, tetrahydrofuran (THF)

SECTION

11:

TOXICOLOGICAL

INFORMATION

ACUTE HEALTH HAZARDS

ACUTE ORAL:

Oral LD50 Rat >5 g/kg Oral toxicity is estimated from tests on similar materials.

EYE CONTACT:

Product not considered primary eye irritant. When similar products, in finely divided form, were placed into the eyes of rabbits, slight transient redness or discharge occurred. This is consistent with the expected slightly abrasive nature of the resin particles.

SKIN CONTACT:

Product not considered primary skin irritant. Draize Skin Primary Irritation

Score (rabbit) for similar products, in finely divided form, for a 24-hour exposure is 0. Not expected to be a skin sensitizer based on results of Modified

Buehler Guinea Pig Sensitization Test from similar products.Dermal LD50 (rabbit) > 2g/kg, estimated.

SUBCHRONIC HEALTH HAZARDS

SUBCHRONIC TOXICITY:

No data available.

CHRONIC HEALTH HAZARDS

CARCINOGENIC

NTP:

Not Tested.

OSHA:

Not Regulated.

IARC:

Not Listed.

SECTION

12:

ECOLOGICAL

INFORMATION

GENERAL:

This material is not expected to be harmful to the ecology.

SECTION

13:

DISPOSAL

INFORMATION

WASTE DISPOSAL:

Recycling is encouraged. Landfill or incinerate in accordance with federal, state and local requirements. Collected processing fume condensates and incinerator ash should be tested to determine waste classification.

POSSIBLE EPA WASTE CODES:

No data.

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SECTION

14:

TRANSPORTATION

INFORMATION

REGULATORY STATUS:

Not Regulated.

SECTION

15:

REGULATORY

INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA):

This product is in compliance with all rules and orders of

TSCA.

WHMIS PRODUCT CLASSIFICATION:

Not a controlled product.

If any components in this product are SARA 313 listed as reportable, they are shown below. The quantities listed for elements represent typical or average values for compounds containing the element.

Component

CAS Number

%

No SARA 313-listed chemicals in this product.

If any components in this product are known to the State of California to cause cancer and/or are reproductive hazards, they are listed below:

Component

Reason Listed

CAS Number

%

SECTION

16:

OTHER

INFORMATION

Prepared by: Product Stewardship

® AVP, COLORXPRESS, CYCOLAC, CYCOLOY, ENDURAN, GELON, GELOY, GEMAX, GTX, LEXAN,

LEXGUARD, LOMOD, MAGIX, NORYL, NORYL GTX, NORYL PPX, POLYMERLAND, PPX, PREVEX, SOLLX,

SUPEC, ULTEM, VALOX, VISUALFX, XENOY, XYLEX and CYTRA are registered or pending trademarks of the

General Electric Co.

DISCLAIMER: This Material Safety Data Sheet [MSDS] information is provided based on the Hazard Communication

Regulations for your region or country and for the use of the persons required to receive this information under those

regulations. The information is neither designed nor recommended for any other use or for use by any other person,

including for compliance with other laws. GE does not warrant the suitability for use of this MSDS for any other material or product not specifically identified herein. GE does not warrant the accuracy or authenticity of this MSDS unless it has been obtained directly from GE, or posted or viewed on a GE website. Modification of this MSDS, unless specifically authorized by GE, is strictly prohibited. This MSDS is based on information, that is believed to be reliable, but may be subject to change as new information becomes available. Because it is not possible to anticipate all conditions of use, additional safety precautions may be required. Since the use of this material is not under General Electric Company’s control, each user is responsible for making its own determination as to the safe and proper handling of this material in its own particular use of this material. GENERAL ELECTRIC COMPANY MAKES NO REPRESENTATION OR WARRANTY, EITHER

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Each user should read and understand this information and incorporate it into individual site safety programs as required by applicable hazard communication standards and regulations.

ABBREVIATIONS:

ACGIH: American Conference of Governmental Industrial Hygienists

CAS: Chemical Abstracts Service

CFR: Code of Federal Regulations

CPR: Cardiopulmonary Resuscitation

EPA: Environmental Protection Agency

HMIS: Hazardous Material Identification System (National Paint and Coatings Association)

IARC: International Agency for Research on Cancer

OSHA: Occupational Health and Safety Administration (U.S.)

NTP: National Toxicology Program

PEL: Permissible Exposure Limit

PPE: Personal Protective Equipment

SARA 313: Superfund Amendments and Reauthorization Act, Section 313

TLV: Threshold Limit Value

TSCA: Toxic Substance Control Act

WHMIS: Workplace Hazardous Materials Information System (Canada

**Material Safety Data Sheet**

**1. Chemical Product and Company Identification**

DESCRIPTION: KRAZY GLUE ALL PURPOSE

PRODUCT TYPE: CYANOACRYLATE ADHESIVE

APPLICATION: KG-583, KG-585, KG-517

         **Manufacturer/Supplier Information**

MSDS Prepared by:

Elmer's Products, Inc. Emergency Phone Number

1 Easton Oval Poison Control Center

Columbus, OH 43219 888-516-2502

For additional health, safety or regulatory information, call 888-435-6377

Call 1-800-848-9400 to place an order or request additional MSDSs.

**2. Composition, Information on Ingredients**

The ingredients listed below have been associated with one or more

immediate and/or delayed(\*) health hazards. Risk of damage and effects

depends upon duration and level of exposure. BEFORE USING, HANDLING, OR

EXPOSURE TO THESE INGREDIENTS, READ AND UNDERSTAND THE MSDS.

% by weight

7085-85-0 Ethyl 2-Cyanoacrylate

**3. Hazards Identification**

**3.1 Emergency Overview**

Appearance Colorless liquid

Odor Irritating

CAUTION!

COMBUSTIBLE

May become unstable at high temperatures or may react with water.

May be harmful if inhaled. May cause irritation of nose, throat and

lungs.

Bonds skin instantly. Causes skin irritation.

Bonds eyelids instantly. Causes eye irritation.

         **HMIS Rating**

HEALTH = 2 (moderate)

FLAMMABILITY = 2 (moderate)

REACTIVITY = 1 (slight)

**3.2 Potential Health Effects**

         **Immediate Hazards**

INGESTION: No hazards known to company.

INHALATION: May be harmful if inhaled. Liquid or vapor may cause

irritation of nose, throat and lungs.

SKIN: Bonds skin instantly. Causes irritation.

EYES: Bonds eyelids instantly. Causes irritation.

         **Delayed Hazards**

None of the components present in this product at concentrations equal

to or greater than 0.1% have been listed by NTP, classified by IARC,

nor regulated by OSHA as a carcinogen.

**4. First Aid Measures**

INGESTION: If accidentally swallowed, dilute by drinking large

quantities of water. Immediately contact poison control

center or hospital emergency room for any other

additional treatment directions.

INHALATION: If inhaled, remove to fresh air. If not breathing,

give artificial respiration, preferably mouth-to-mouth.

Call a physician.

SKIN: If skin bonding occurs, soak in nail polish remover

or acetone and carefully peel or roll skin apart (do not

pull).

EYES: If eye contact occurs, hold eyelid open and rinse

thoroughly but gently with only water for 15 minutes and

GET MEDICAL ATTENTION. Do not use any solvents to

flush the eye and its surroundings. Liquid glue will

sting eye temporarily. Solidified glue may irritate eye

like a grain of sand and should be treated by an eye

doctor.

**5. Fire Fighting Measures**

Autoignition Temperature 485 deg C

Upper/Lower Flammable Limits Not available

Up/Lower Explosive Limits, % by Vol Not available

Flash Point 83 deg C (CC)

COMBUSTIBLE.

Keep away from heat and flame.

In case of fire, use water spray, dry chemical, foam or CO2. Use

water to keep fire-exposed containers cool.

**6. Accidental Release Measures**

Eliminate all ignition sources. Soak up with absorbent material and

remove to a chemical disposal area. Prevent entry into natural bodies

of water.

**7. Handling and Storage**

**7.1 Handling**

Handle in accordance with good industrial hygiene and safety

practices. These practices include avoiding unnecessary exposure and

removal of the material from eyes, skin and clothing.

Wash thoroughly after handling. Always use appropriate Personal

Protective Equipment (PPE).

INHALATION: Avoid breathing vapor. Use with adequate

ventilation.

SKIN: Avoid contact with skin and clothing.

EYES: Avoid contact with eyes.

**7.2 Storage**

Keep away from amines.

Store in cool, dry area away from sun and heat.

Keep containers tightly closed.

Exposure to small amounts of moisture, even moisture in air, causes

polymerization and renders the product unusable.

Keep away from heat, sparks, flame and other ignition sources.

**8. Exposure Controls/Personal Protection**

**8.1 Exposure Controls**

ENGINEERING CONTROLS: The following exposure control techniques maybe used to effectively minimize employee exposure: local exhaust

ventilation, enclosed system design, process isolation and remote

control in combination with appropriate use of personal protective

equipment and prudent work practices. These techniques may not

necessarily address all issues pertaining to your operations. We,

therefore, recommend that you consult with experts of your choice to

determine whether or not your programs are adequate.

If airborne contaminants are generated when the material is heated or

handled, sufficient ventilation in volume and air flow patterns should

be provided to keep air contaminant concentration levels below

acceptable criteria.

**8.2 Personal Protection**

Use goggles if contact is likely. Wear impervious gloves as required to prevent skin contact.

**8.3 Exposure Guidelines**

Ethyl 2-Cyanoacrylate 7085-85-0

ACGIH TLV: 0.2 ppm (1 mg/m³) TWA

OSHA PEL: NONE ESTABLISHED

**9. Physical and Chemical Properties**

Percent Volatiles Not determined

pH @ 25 C Not available

Specific Gravity 1.05

Appearance Colorless liquid

Autoignition Temperature 485 deg C

Boiling Point 62 deg C (5 mm Hg)

Vapor Density (Air=1) > 1

Vapor Pressure, mm Hg @ 20 C 0.13 (@ 20 deg C)

Evaporation Rate (Butyl Acetate=1) < 1

Upper/Lower Flammable Limits Not available

Up/Lower Explosive Limits, % by Vol Not available

Flash Point 83 deg C (CC)

Freezing Point < -20 deg C

Odor Irritating

Odor Threshold, ppm Not available

Solubility in Water Negligible

Coefficient of Water/Oil Distrib. Not applicable

**10. Stability and Reactivity**

Normally stable, but may become unstable at high temperatures or may

react with water.

         **Conditions to Avoid:**

Exposure to heat, flame and incompatibles.

         **Incompatibilities:**

Water, alcohols, amines, bases and direct UV.

         **Decomposition products may include:**

Oxides of carbon.

         **Hazardous polymerization:**

Will not occur.

         **Other Hazards:**

None known to company.

**11. Toxicological Information**

See Section 3 Hazards Identification information.

Ethyl 2-Cyanoacrylate 7085-85-0

LC50: Not available

LD50: Not available

**12. Ecological Information**

Not determined.

**13. Disposal Considerations**

Recover free liquid. Absorb residue and dispose of according to

local, state/provincial, and federal requirements.

Empty container: May contain explosive vapors. DO NOT cut, puncture or weld on or nearby.

**14. Transport Information**

**14.1 U.S. Department of Transportation (DOT)**

The data provided in this section is for information only and may not be specific to your package size. You will need to apply the

appropriate regulations to properly classify your shipment for transportation.

Non-Regulated.

**14.2 Canadian Transportation of Dangerous Goods (TDG)**

Non-Regulated.

**15. Regulatory Information (Selected Regulations)**

**15.1 U.S. Federal Regulations**

         **OSHA Hazard Communication Standard 29CFR1910.1200**

This material is a "health hazard" and/or a "physical hazard" as

determined when reviewed according to the requirements of the

Occupational Safety and Health Administration 29 CFR Part 1910.1200

"Hazard Communication" Standard.

         **SARA Title III: Section 311/312**

Fire hazard

Immediate health hazard

         **SARA Title III Section 313 and 40 CFR Part 372**

This product contains the following toxic chemical(s) subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986, and Subpart C-Supplier Notification Requirement of 40 CFR Part 372. None required per SARA TITLE III SECTION 313.

         **TSCA Section 8(b) Inventory**

All reportable chemical substances are listed on the TSCA Inventory.

We rely on certifications of compliance from our suppliers for

chemical substances not manufactured by us.

**15.2 Canadian Regulations**

         **Workplace Hazardous Materials Information System (WHMIS)**

This product has been classified in accordance with the hazard

criteria of the Controlled Products Regulation (CPR) and the MSDS

contains all the information required by the CPR.

CLASS D, DIV 2B

CLASS B, DIV 3

         **Canadian Environmental Protection Act (CEPA)**

All reportable chemical substances are listed on the Domestic

Substances List (DSL) or otherwise comply with CEPA new substance

notification requirements.

         **National Pollutant Release Inventory (NPRI)**

This product contains the following chemical(s) subject to the

reporting requirements of the Canadian Environmental Protection Act (CEPA) subsection 16(1), National Pollutant Release Inventory.

None required.

**16. Other Information**

CL (Cautionary Labeling): Products bearing the CL (Cautionary

Labeling) Seal of The Art & Creative Materials Institute, Inc. (ACMI)are certified to be properly labeled in a program of toxicological evaluation by a medical expert. This program is reviewed by ACMI's Toxicological Advisory Board. These products are certified by ACMI to be labeled in accordance with the chronic hazard labeling

standard, ASTM D-4236 and Federal Law, P.L. 100-695.

         **User's Responsibility**

The OSHA Hazard Communication Standard 29CFR 1910.1200 and the Workplace

Hazardous Materials Information System (WHMIS) require that the information contained on these sheets be made available to your workers. Educate and train your workers regarding OSHA and WHMIS precautions. Instruct your workers to handle this product properly. Consult with appropriate experts to guard against hazards associated with use of this product and its ingredients.

         **Disclaimer**

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE

MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE, except that the product shall conform to contracted specifications, and that the product does not infringe any valid United States or Canadian patent. No claim of any kind shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.

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PREVIOUS ISSUE: 13-JAN-05

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|  |
| --- |
| Version-1, 04-07, 2011 |
| ABS (Acrylonitrile Butadiene Styrene) Material Safety Data Sheet |
| **CHEMICAL PRODUCT/ COMPANY IDENTIFICATION** |
| **Product Identifier**: ABS (Acrylonitrile Butadiene Styrene)  **Product Use**: Filament for FDM™ modeler  **Manufacturer and Address**: Delta Micro Factory Corporation  Rm. E506, Jinyu Intenational, 48 Wangjing West Road, Chaoyang District  Beijing, 100102, P.R.China  **Phone**: +86-10-8477-5323  **Fax**: +86-10-8477-5323 |
| **COMPOSITION/INGREDIENT INFORMATION** |
| **COMPONENT CAS # % OSHA/PEL ACGIH/TLV**  Acrylonitrile/butadiene/styrene resin 009003-56-9 90-100 N/E N/E  May contain the following:  Mineral Oil 008042-47-5 0-2 N/E N/E  Tallow 067701-27-3 0-2 N/E N/E  Wax 000110-30-5 N/E N/E  N/E = not established. ABS is not considered hazardous under the criteria of the Federal  OSHA Hazard Communication Standard 29 CFR § 1910.1200 |
| **HAZARDS IDENTIFICATION** |
| **Emergency Overview**: can burn in fire creating dense toxic smoke. Molten plastic can cause severe thermal burns. Secondary operations, such as grinding, sanding, or sawing, can produce dust which may present a respiratory hazard.  **Chronic/Carcinogenicity:** No relevant information found.  **Melt Processing Health Effects**: Molten plastic can cause severe burns.  **Medical Restrictions**: There are no known human health effects aggravated by exposure to this product. However, certain sensitive individuals and individuals with respiratory impairment may be affected by exposure to components in the processing fumes. |
| **EMERGENCY AND FIRST AID MEASURE** |
| **Inhalation**: No specific intervention is indicated as the compound is not likely to be hazardous by inhalation. Consult a physician if necessary. If exposed to fumes from overheating, move to fresh air. Consult a physician if symptoms persist.  **Skin contact**: The compound is not likely to be hazardous by skin contact, but cleansing the skin after use is advisable. If molten plastic gets on skin, cool the skin in ice water or running water rather than ice if it occurs. Don’t attempt to remove it from the skin in case of tissue damage.  **Eye contact**: Flush eyes with plenty of water for at least 10 minutes immediately. Call a physician.  **Ingestion**: No specific intervention is indicated as compound is not likely to be hazardous by ingestion. If inhaled, move the people to fresh air. Consult a physician |

Revised September 1, 2012

**LOW DENSITY POLYETHYLENE (LDPE)** Page 1 of 3

**MSDS**

**MATERIAL SAFETY DATA SHEET**

**I. PRODUCT IDENTIFICATION**

**PRODUCT NAME:** Low Density Polyethylene (LDPE)

**PHONE NUMBERS:**

PRODUCT INFORMATION: 1-800-667-0999

CHEMTREC: 1-800-424-9300

**II. COMPOSITION/INFORMATION ON INGREDIENTS**

**INGREDIENT NAME CAS NUMBER WEIGHT %**

Polyethylene 9002-88-4 > 99

**III. PHYSICAL AND CHEMICAL PROPERTIES**

**APPEARANCE:** Translucent solid with waxy color

**PERCENT VOLATILES:** N/A

**MELTING POINT:** N/A

**SOLUBILITY IN WATER:** Insoluble

**SPECIFIC GRAVITY:** 0.94 - 97

**IV. STABILITY AND REACTIVITY**

**STABILITY:** Stable

**CONDITIONS TO AVOID:** None Known

**MATERIALS TO AVOID:** Strong oxidizing agents

**V. EXPOSURE CONTROLS/PERSONAL PROTECTION**

**VENTILATION:** Local ventilation in dusty conditions, or if thermal decomposition occurs

**PROTECTIVE EQUIPMENT**

**SKIN:** Gloves and protective garments when handling molten material

**EYE:** Glasses with side shields in dusty conditions

**RESPIRATOR:** NIOSH approved dust respirator recommended. If material is being burned wear an organic res*pirator*

**V. EXPOSURE CONTROLS/PERSONAL PROTECTION - continued**

**EXPOSURE GUIDELINES:**

**INGREDIENT AGENCY VALUE**

Polyethylene ACGIH 10 mg/m3 (total dust)

OSHA 15 mg/m3 (total dust)

5 mg/m3 (respirable dust)

**VI. HEALTH HAZARDS IDENTIFICATION**

**MEDICAL RESTRICTIONS:** None Known

**CHRONIC/CARCINOGENICITY:** NO

**VII. FIRST AID MEASURES**

**SKIN:** If molten material comes in contact with the skin, cool under running water. Do not attempt to remove the molten material from the skin. Get medical attention.

**EYES:** Seek medical attention if constant irritation occurs.

**INHALATION:** Seek medical attention if constant irritation occurs.

**VIII. FIRE FIGHTING MEASURES**

**AUTOIGNITION TEMPERATURE:** N/A

**HAZARDOUS PRODUCTS OF COMBUSTION:** Carbon dioxide, carbon monoxide and aldehydes

**EXTINGUISHING MEDIA:** Water, Foam, Carbon Dioxide, Dry Chemical

**SPECIAL FIRE FIGHTING INSTRUCTIONS/PRECAUTIONS:**

Soak thoroughly with water to cool and prevent re-ignition. The smoke can contain polymer fragments of varying composition, in addition to unidentified toxic and /or irritating compounds.

**IX. ACCIDENTAL RELEASE MEASURES**

**SPILL OR RELEASE**: Sweep up for disposal or reuse

**X. HANDLING AND STORAGE**

**HANDLING:** Wash with soap and water

**STORAGE:** Store in a sprinkler protected warehouse. If a heat source is present keep the area well ventilated

**. EXPOSURE CONTROLS/PERSONAL PROTECTION - continued**

**EXPOSURE GUIDELINES:**

**INGREDIENT AGENCY VALUE**

Polyethylene ACGIH 10 mg/m3 (total dust)

OSHA 15 mg/m3 (total dust)

5 mg/m3 (respirable dust)

**VI. HEALTH HAZARDS IDENTIFICATION**

**MEDICAL RESTRICTIONS:** None Known

**CHRONIC/CARCINOGENICITY:** NO

**VII. FIRST AID MEASURES**

**SKIN:** If molten material comes in contact with the skin, cool under running water. Do not attempt to remove the molten material from the skin. Get medical attention.

**EYES:** Seek medical attention if constant irritation occurs.

**INHALATION:** Seek medical attention if constant irritation occurs.

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**AUTOIGNITION TEMPERATURE:** N/A

**HAZARDOUS PRODUCTS OF COMBUSTION:** Carbon dioxide, carbon monoxide and aldehydes

**EXTINGUISHING MEDIA:** Water, Foam, Carbon Dioxide, Dry Chemical

**SPECIAL FIRE FIGHTING INSTRUCTIONS/PRECAUTIONS:**

Soak thoroughly with water to cool and prevent re-ignition. The smoke can contain polymer fragments of varying composition, in addition to unidentified toxic and /or irritating compounds.

**IX. ACCIDENTAL RELEASE MEASURES**

**SPILL OR RELEASE**: Sweep up for disposal or reuse

**X. HANDLING AND STORAGE**

**HANDLING:** Wash with soap and water

**STORAGE:** Store in a sprinkler protected warehouse. If a heat source is present keep the area well ventilated

**XI. DISPOSAL CONSIDERATIONS**

**DISPOSAL:** Incineration or landfill – dispose of in accordance with Federal, State, Provincial and Local regulations.

**XII. DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES**

The information presented in the Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

***EXPERIMENT PROCEDURES DOCUMENTATION*** *This section is to include procedures for all aspects of the experiment from shipping to KSC to unloading and return to Houston.  Please be specific about all procedures, especially those procedures that need to take place while on the Space Station.   If there are not specific aspects to consider then please put N/A*

*A.     Equipment shipment to KSC-*

Cold stowage protocol

*B.     Ground Operations while at KSC*

Cold stowage protocol

*C.     Loading/Stowing*

Destow

Plug into one of the NanoRacks Frame-1 or 2 Module ports as soon after destowing as possible.

Power up the Frame

*D.     Pre-Flight*

Keep the Ardulab cold- Cold stowage protocol.

*E.      Ascent (Launch)*

Keep in the launch axis orientation as marked on the container with the USB connection on the right side when facing the Ardulab.

*F.      On-Orbit-*

The payload is automated; it will utilize the standard NanoRacks Platform plug-n-play operations for power and data.

Operate for minimum 30 days (+/- week)\*

Downlink data 3 times a week

\*NOTE: This payload can be left in the active Frame and executed as long as needed until standard time to pack for return (i.e. no hard constraint for deactivation time).

*G.     Descent (Return/landing)*

Destow from NanoRacks Platform Frame to pack for return to Earth on Space X5

*H.     Post-Flight*

Return to Duchesne Academy in Houston, TX

*I.        Off-Loading*

*????*

*J.       Emergency/Contingency*

Contact Kathy Duquesnay*.*

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***DEVIATIONS/EXCEPTIONS/WAIVERS***

*Include any waivers or exceptions documentation from CASIS, NanoRacks, or NASA JSC if applicable*

None