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Standard Operating Procedure

Procedure: Sorvall Legend X1 Centrifuge

Department: Bioeconomy Institute

Building/ Room Number: Biorenewables Research Laboratory (BRL) 1114

Supervisor: Jacqulyn Baughman

Procedure Overview: A Centrifuge is a laboratory product designed to separate components by the generation of relative centrifugal force. It is able to run environmental samples, chemicals, human samples, and other non-human samples. The centrifuge in lab 1114 is a Sorvall Legend X1.

Health and safety information for materials used: This machine operates under high speed. The lid should automatically remain closed while in operation. If the emergency lid release button is pushed or the lid unexpectedly opens, wait for the rotor to stop. Make sure new rotors are compatible with the centrifuge. A full list of compatible rotors is located in the instruction manual. Always disconnect power during maintenance. Be sure the instrument is plugged into grounded outlets.
Spills are possible if the machine is not loaded in a symmetric pattern. Reference the instruction manual for proper loading techniques. Samples that contain bio-oil must be handled properly. Bio-oil is acidic and contains hazardous chemicals (i.e. aromatics, methanol) some which may be carcinogenic. Ensure that room ventilation is adequate before handling bio-oil. Chemical resistant gloves should be worn while handling bio-oil and/or other chemicals. Safety glasses and closed toe shoes are required. Spills should be cleaned immediately. Bio-oil is to be stored in the refrigerator.

Hazard Control Measures:

- Safety glasses
- Lab coat
- Nitrile gloves
- Closed toe shoes

Waste Disposal Procedures: Bio-oil should be disposed in a EH&S designated waste satellite container. Make sure to put the waste in its own container within the EH&S secondary container.

Decontamination Procedures: Any foreign objects can be removed from the centrifuge cavity while wear gloves. The cavity can also be wiped out with a towel and neutral solvent. Never use caustic cleaning agents such as soap suds, phosphoric acid, bleaching solutions or scrubbing power.

Spill Containment and cleanup procedures: Bio oil spills can be cleaned up with paper towels and general cleaning solution. In the case of a large spill, a spill kit should be used. Other chemicals may require different forms of removal.

Using substances requiring special procedures: No

Written By: Matt Schul and Gabriel Domingues **Date:** 5/27/2014

Approved By: Patrick Hall **Date:** 6/03/2014

Detailed procedures, operating instructions, maintenance, and emergency contact information list is attached.

Equipment Description

The Sorvall Legend X1 is capable of running from 300 to 15200 rpm , but is dependent on the rotor equipped. There are no temperature settings. A lid on top of the machine automatically opens when the control panel button is pressed. Inside is the main cavity of the centrifuge with a four arm rotor in the center. The power switch is located on the back of the machine. The operation is run entirely from the control panel on the front of the machine. Buttons are used to control start/stop, lid, speed, acceleration, and programming. On the left side near the front there is an emergency lid open button.

Pre-Analysis Checklist

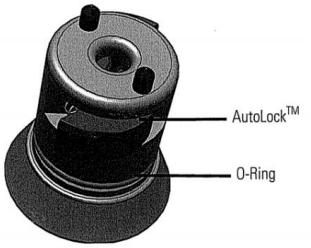
1. Make sure you have your required safety equipment of glasses, closed toe shoes, gloves, and laboratory coat.
2. Check the machine for any previous samples left inside.
3. Remove any dust or other foreign objects from the centrifuge cavity with a towel or cloth.

Equipment Operation

Rotor installation

1. Turn the machine on using the power switch on the back.
2. Open 

the lid and make sure the chamber is clean of dust, foreign, material, or residue.
3. The centrifuge is equipped with an AutoLock locking system so no bolting is required. Check that the AutoLock O-ring is undamaged.



4. Place the rotor over the centrifuge spindle and let it slide down the centrifuge spindle. The rotor clicks automatically in to place.
5.Lift up gently on the rotor to make sure it is properly installed. If the rotor can be pulled up, then it must be reclamped to the centrifuge spindle.

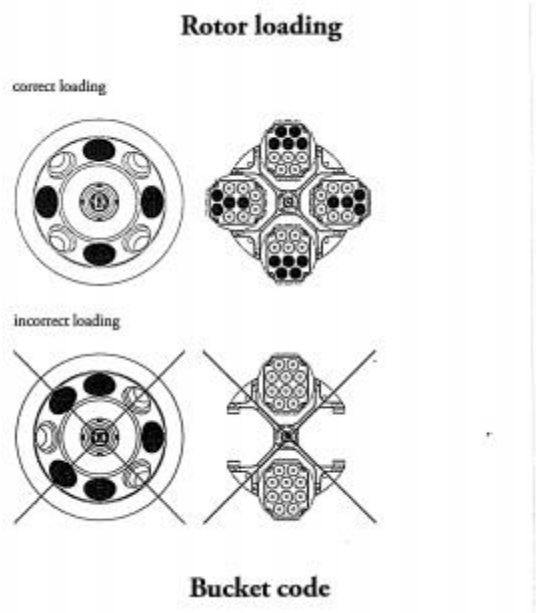
Rotor removal

1. Open 

the lid of the centrifuge.
2. Locate the AutoLock release button located on top of the rotor in the center.
3. Gently press and lift until the rotor slides off the spindle.

Loading the Centrifuge

1. If individual vials are not being used, step2-3 can be skipped. Load the black buckets with the desired sample.
2. Insert the vial holders to all 4 buckets regardless of the number being used for testing. (NOTE: There are different sizes vial holders for different sized vials.)
3. Place vials with contents in a symmetric pattern with empty vials acting as place holders to remain balanced.



4. Place the lids on top of buckets and lock them into place with their handles.
5. Hang the four black buckets on the rotor by sliding them into place

Centrifuge Operation

1. Close centrifuge lid be gently pressing down until the machine engages the lid automatically.
2. Press the acceleration/deceleration button in order to set the acceleration of the machine. Use the numeric pad to set a value between 1 and 9 with 1 being the slowest and nine the fastest acceleration. Press ENTER to confirm

3. Press the acceleration/deacceleration button twice to set the deceleration the same way you did the acceleration. The numeric value now ranges from 1 to 10, 1 being the slowest and 10 the fastest deacceleration. Press ENTER to confirm.
4. Press the SPEED key.

5. The display shows RPM or the RCF value. Press the TOGGLE or arrow keys to switch between RPM and RCF.

6. Enter the desired numeric value using the number pad and press ENTER. Further explanation of the RCF value can be found on page 4-5 of the instruction manual.

Explanation of RCF Value

The relative centrifugal force is given as a multiple of the force of gravity g. It is a unitless numerical value which is used to compare the separation or sedimentation capacity of various devices, since it is independent of the type of device. Only the centrifuging radius and the speed come into play in it:

$$RCF = 11,18 \times \left(\frac{n}{1000}\right)^2 \times r$$

r = centrifuging radius in cm

n = Rotational speed in rpm

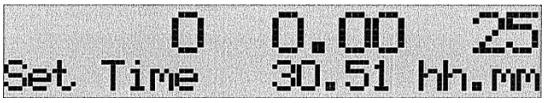
The maximum RCF value is related to the maximum radius of the tube opening.

Remember that this value is reduced depending on the tubes and adapters used.

This can be accounted for in the calculation above if required.

7. Press the TIME key to open the runtime selection. The machine can be run in hh.mm, mm.ss, or hold. (continuous)

8. Enter the time in hh.mm using the numeric pad. Press the TIME key repeatedly to switch over to mm.ss or to hold. (hold has no set time and continuously runs the centrifuge until the user hits STOP)



9. Use the TOGGLE key to set the run time counter start. This controls when your designated time will start counting.(NOTE: When AT START is lit, the running time will be counted right when START is pressed. When AT SPEED is lit, the running time will start once the centrifuge has reached the desired RPM/RCF value)

10. Press the BUCKET key to show the bucket selection of the display.

11. Press the BUCKET key repeatedly until the bucket type being used is displayed. Then press ENTER.

12. The display will show the default bucket radius. Press ENTER to confirm radius or enter a different value with numeric pad. The entry will be confirmed when no buttons are pressed for 5 seconds.

13. Press START  key to start centrifugation. The lid cannot be opened using control panel at this time. (NOTE: if the rotor speed is set higher than its maximum, the message CHECK SET SPEED will display. After reaching 300 RPM, the machine may display IMBALANCE LOAD if it senses an unbalance in the force.)
14. If the time is preset, the machine will automatically come to a stop. You can stop the machine at any time by pressing the red STOP  key.
15. Short term centrifusion can be ran by holding the PULSE  key. It will run at max acceleration and deceleration and any RPM or RCF value will be overwritten. CAUTION! THE PULSE RUNS THE MACHINE'S MAXIMUM SPEED. THE CURRENT ROTOR MAY NOT BE ABLE TO HANDLE THIS.

Saving a Program

1. Enter the parameters using the process from above.
2. Press any of the program store keys for 4 seconds.
3. Only five programs can be assigned at once to the quick keys but up to 99 can be stored. Reference page 4-9 for further programming instructions.

Machine Shutdown

1. Make sure the machine has come to a complete stop.
2. Remove any samples you need
3. Turn off the power by flipping the switch on the back of the machine.

Emergency Contacts
In case of emergency the following people should be contacted:

Jacqulyn Baughman
Lab Supervisor
Cell: (515) 505-9509

Patrick Hall
Research Associate II
Office: 515-294-4984

Marjorie Rover
Lab Manager
Office: (515) 294-2984 Cell: (319) 230-1163

Ryan Smith
BEI Program Coordinator
Office: (515) 294-6244 Cell: (515) 203-1640 Home: (719) 660-2262

Patrick Johnston
Assistant Scientist III
Office: (515) 509-0027 Cell: (515) 509-0027 Home: (319) 231-9140

Dr. Robert Brown
BEI/CSET Director
Office: (515) 294-7934 Cell: (515) 520-1337 Home (515) 460-3434

If the emergency is minor, please contact responsible graduate student or lab supervisor. If there is a serious emergency or life threatening emergency please contact 911 followed immediately by contacting Jacqulyn Baughman and/or Robert Brown. If there is a chemical spill too large to be cleaned using a typical spill kit contact Environmental Health and Safety.

Approved Trainers:
Patrick Hall , Matt Schul, Gabriel Domingues

Training Sign-Off

Trainee	Date	Trainer