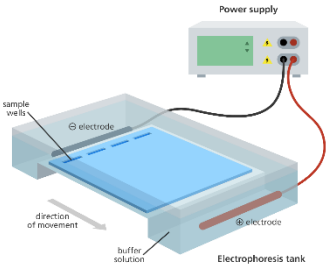
ELECTROPHORESIS

Electrophoresis is a technique which uses electrical energy to separate molecules such as proteins or nucleic acids by their size, structure and electrical charge. The work may pose potential electrical, thermal, chemical, biological and radiological hazards. These guidelines must be considered to ensure the safe operation of electrophoresis units. The development of procedures and adhering to equipment manufacturer's instructions for use and maintenance is also required.



Hazards

Electrical and Thermal

- Electrophoresis units operate at currents which have the potential to cause an electrical shock if not properly handled. Currents as low as 5 milliamperes can result in strong involuntary reactions which could lead to injuries.
- Thermal hazards exist when preparing liquified gels.

Chemical, Biological and Radiological

- The materials used may pose a health risk to the operator, bystander or have an environmental impact. The use of potentially hazardous materials requires a careful review to understand the hazards; development of work, emergency and disposal procedures; and training for those using the materials.

General Safe Work Practices

Setup and Preparation

- Obtain and review Safety Data Sheets for all hazardous materials.
- Develop emergency response procedures and ensure they are accurate. Ensure the on/off button is readily accessible and does not require you to reach over the unit.
- Identify required Personal Protective Equipment and ensure it is available.
- Place the equipment away from ignitable materials (such as flammable solvents, absorbents, paper products and other combustibles) and in an area where it or the operator will not be accidently bumped into by other personnel.
- Ensure there is adequate clearance around the power supply to provide adequate cooling. Do not block vents.

- Utilize ground fault circuit interrupters (GFCIs) for the power supply. Plug-In GFCI's can be used where outlets are not already protected. The GFCI will "sense" the difference in the amount of electricity flowing into the circuit to that flowing out, even in amounts of current as small as 4 or 5 milliamps. The GFCI reacts quickly (less than one-tenth of a second) to trip or shut off the circuit. Contact Facilities or EHS for guidance.
- Install "Danger—High Voltage" labels to well inform users of the shock hazard.
- All wires, connectors and connected apparatus must be appropriately rated. Consider connectors with retractable safety sleeves if available for the supply voltage. See illustration above.
- Keep equipment clear of unintentional grounding points and conductors (e.g., sinks or other water sources, metal plates, jewelry, aluminum foil, pipes or other electrical/metal equipment). Non-conducting benches and floors (and/or rubber mats) are recommended.

Prior to Each Use

With the Unit Unplugged and Off:

- Check and maintain apparatus regularly and replaced units when needed.
    - Inspect power cords and leads for frayed, cracked or dried out cords; exposed copper wire at the connectors (caused by pulling on the wire instead of the jack when trying to remove the jack); and corroded or loose-fitting connectors which may cause electrical arcing between the plugs, resulting in fire or irreversible results. Discard and replace all cords that do not pass the inspection.
    - Inspect gaskets on vertical electrophoresis chambers to ensure they are not leaking. If leaks are found, contact the manufacturer for replacement gaskets.
    - Inspect the electrophoresis chamber for buffer leaks caused by crazing or cracks in the plastic. Loss of buffer can lead to electrical arcing and fires.
    - Inspect well electrodes periodically.
    - Inspect the safety guards where applicable to ensure proper function.
- Ensure that leads/connectors are fully seated.
- Ensure all safety and control labels are in place and legible.
- If applicable, test the GFCI outlet to verify operation.

Rules for Use

- Identify, obtain and inspect all the required Personal Protective Equipment needed prior to beginning work.
- Turn the power off before connecting the electrical leads.
- Connect one lead at a time, using one hand only.
- Ensure that hands are dry while connecting leads.
- Keep the apparatus away from sinks or other water sources.
- Turn off power before opening lid or reaching inside chamber.
- Do not override safety devices.
- Follow all safety procedures for the use of chemicals, disposal and cleanup. Use all required Personal Protective Equipment.
- Exercise caution when heating to liquefy gels. Wear insulated gloves when handling heated gels.
- Avoid running equipment unattended or overnight. Develop detailed procedures in cases where the equipment is left in operation unattended.

Resources and References

- https://ehs.yale.edu/training
- http://www.labmanager.com/lab-health-and-safety/2010/05/electrophoresis-safety-tips#.WwALXe4vxdh
- https://ehs.unl.edu/sop/s-electrophoresis_safety.pdf
- https://ehs.berkeley.edu/sites/default/files/lines-of-services/workplace-safety/04electro.pdf
- http://bridgeslab.sph.umich.edu/protocols/index.php/SOP_-_Electrophoresis