Lab Manager®

HOMOGENIZATION
TECHNOLOGIES
PROS ✓ & CONS ✗

Homogenization is a very common sample preparation technique prior to the analysis of nucleic acids, proteins, cells, pathogens, and many other targets. Technologies for homogenization have developed over time, resulting in a variety of instruments ranging from a basic mortar and pestle, already in use for thousands of years, to modern high pressure and ultrasonic devices.

MORTAR & PESTLE

1

This simple method of homogenization remains common in life sciences applications where they are commonly called tissue grinders. Simple in design, the sample is squeezed between a container (the mortar) and a solid, blunt object (the pestle). These types of homogenizers can be manual or automatic and are often desirable when dealing with cryogenic samples.

APPLICATIONS:
- Tissue homogenization
- Cryogenic homogenization
- Cell isolation

PROS:
- Affordable
- Easy to use
- Minimal maintenance

CONS:
- Low throughput
- Prone to operator error
- Poor reproducibility

✓ ✓ ✓ ✗ ✗ ✗

ROTO-STATOR

2

This versatile homogenization tool uses a rotating metal shaft (the rotor) inside of a stationary metal casing (the stator). Suction is created as the rotor spins, drawing sample into the space between the rotor and the stator. The sample is subjected to high shear forces between the wall of the stator and the rotor. Centrifugal force then forces the sample out through the slots in the stator.
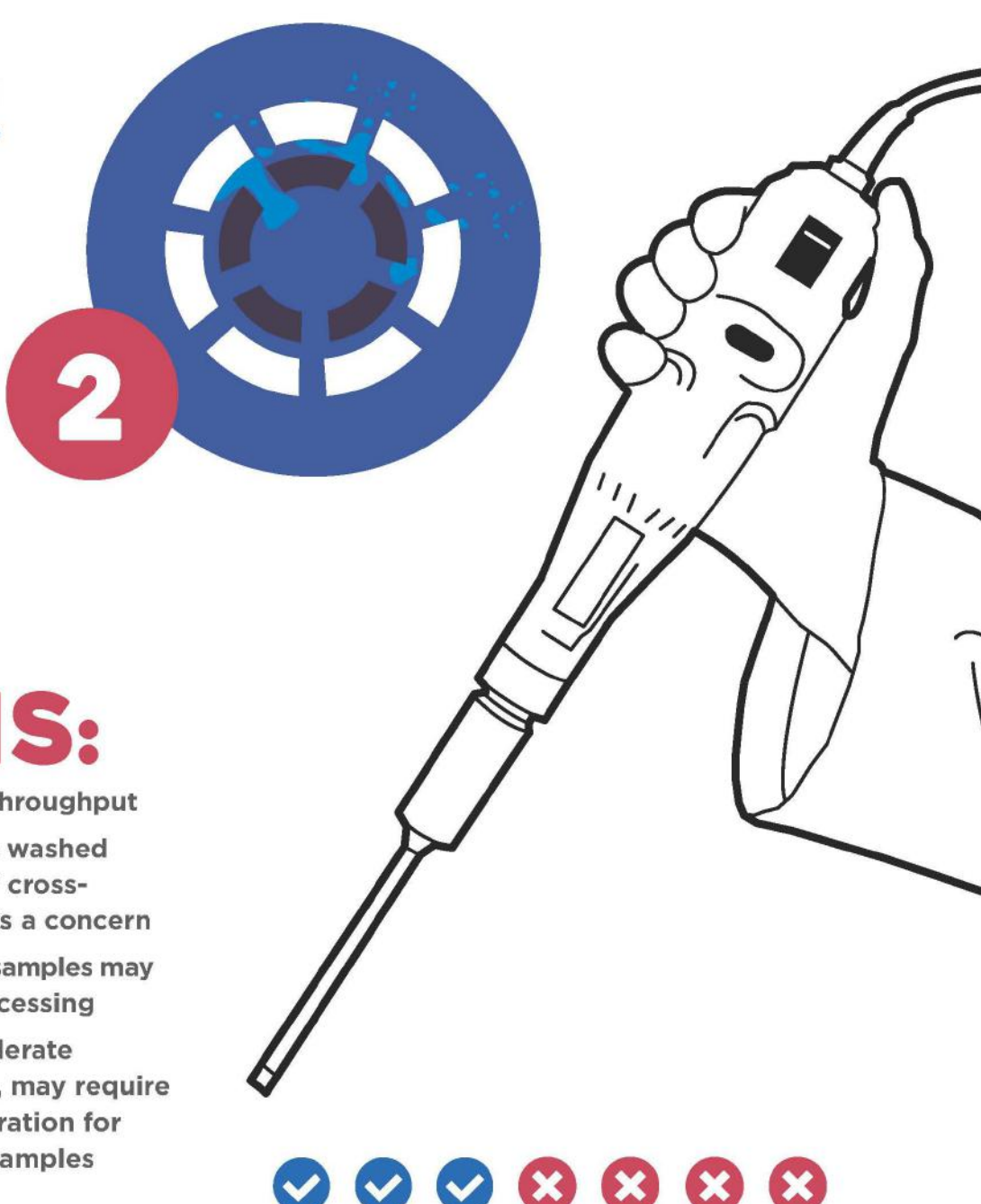
APPLICATIONS:
- Tissue homogenization
- Cell disruption
- Cell isolation
- Organelle extraction
- Particle size reduction
- Emulsification

PROS:
- Quick and efficient for single samples
- Multiple probes provide wide range of available volumes
- Available in laboratory, pilot, and industrial scale

CONS:
- Generally, low throughput
- Probes must be washed between uses if cross-contamination is a concern
- Hard or fibrous samples may require pre-processing
- Generate a moderate amount of heat, may require special consideration for heat-sensitive samples

✓ ✓ ✓ ✗ ✗ ✗ ✗

BEAD MILL

3

Bead mill homogenizers use beads of a desired size to homogenize samples. As the sample is rapidly agitated in a closed tube, collisions between the sample and the beads and between the beads and the wall reduce the particle size and homogenize the sample. Beads are available in different sizes, densities, and shapes depending on the type of sample you are using and your application.
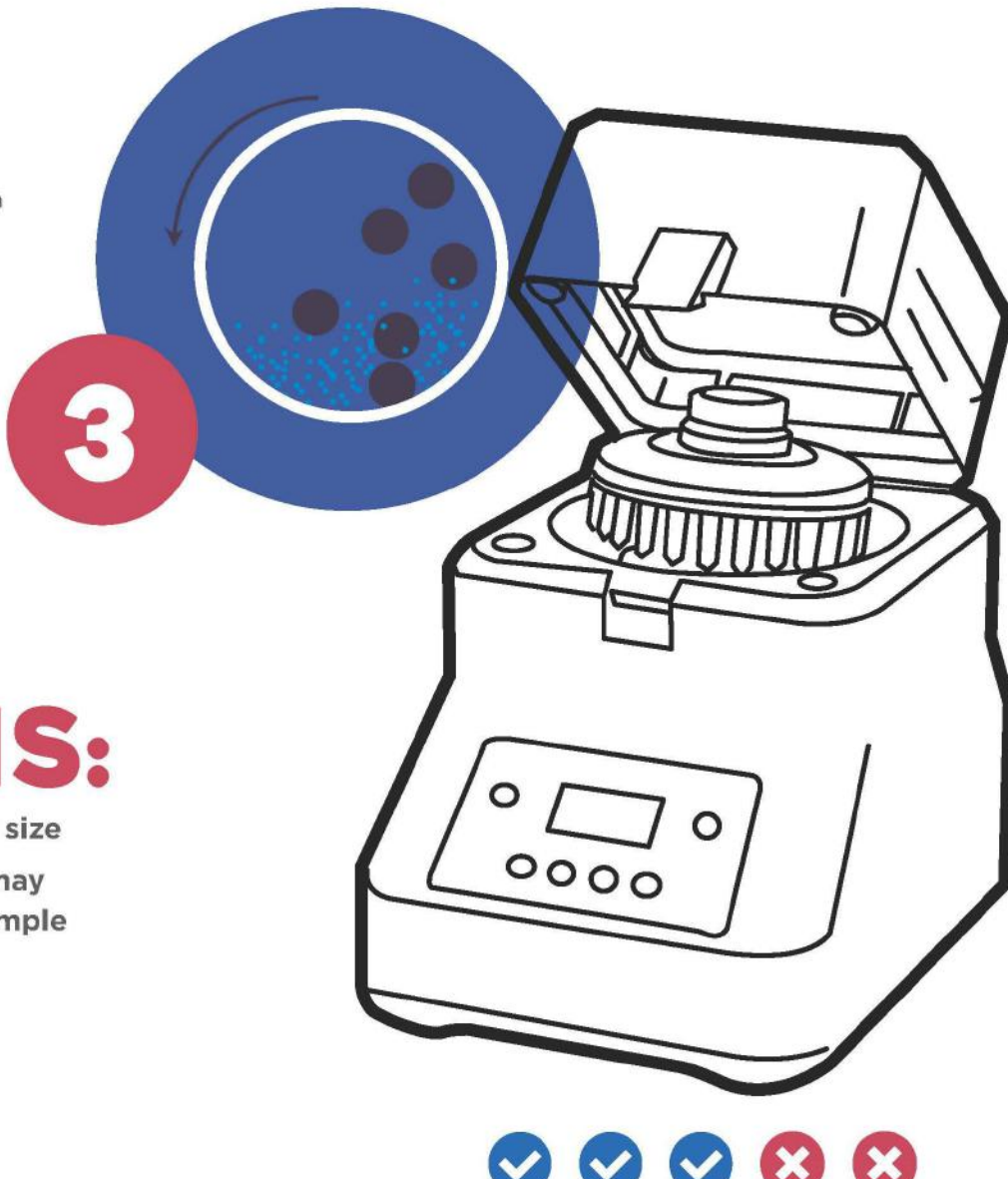
APPLICATIONS:
- Tissue homogenization
- Cell disruption
- Cell isolation
- Organelle extraction
- Particle size reduction

PROS:
- Minimal cross-contamination
- Suitable for hazardous or infectious materials
- Can process several samples at once

CONS:
- Limited sample size
- Bead material may contaminate sample

✓ ✓ ✓ ✗ ✗

HIGH PRESSURE

4

High pressure homogenizers are most commonly used for creating emulsions where large volumes are being processed. They function by forcing a primarily liquid sample through a valve with very narrow slits. The sample is subjected to extremely high shear and cavitation.

APPLICATIONS:
- Cell disruption
- Organelle extraction
- Emulsification

PROS:
- Able to process large volumes of liquid sample
- High reproducibility
- No materials deposited in the sample
- Can achieve very small (sub-micron) particle sizes

CONS:
- Expensive, only cost-effective for large volume processing
- Large and heavy equipment
- Require cleaning to prevent cross-contamination

✓ ✓ ✓ ✓ ✗ ✗ ✗

ULTRASONIC

5
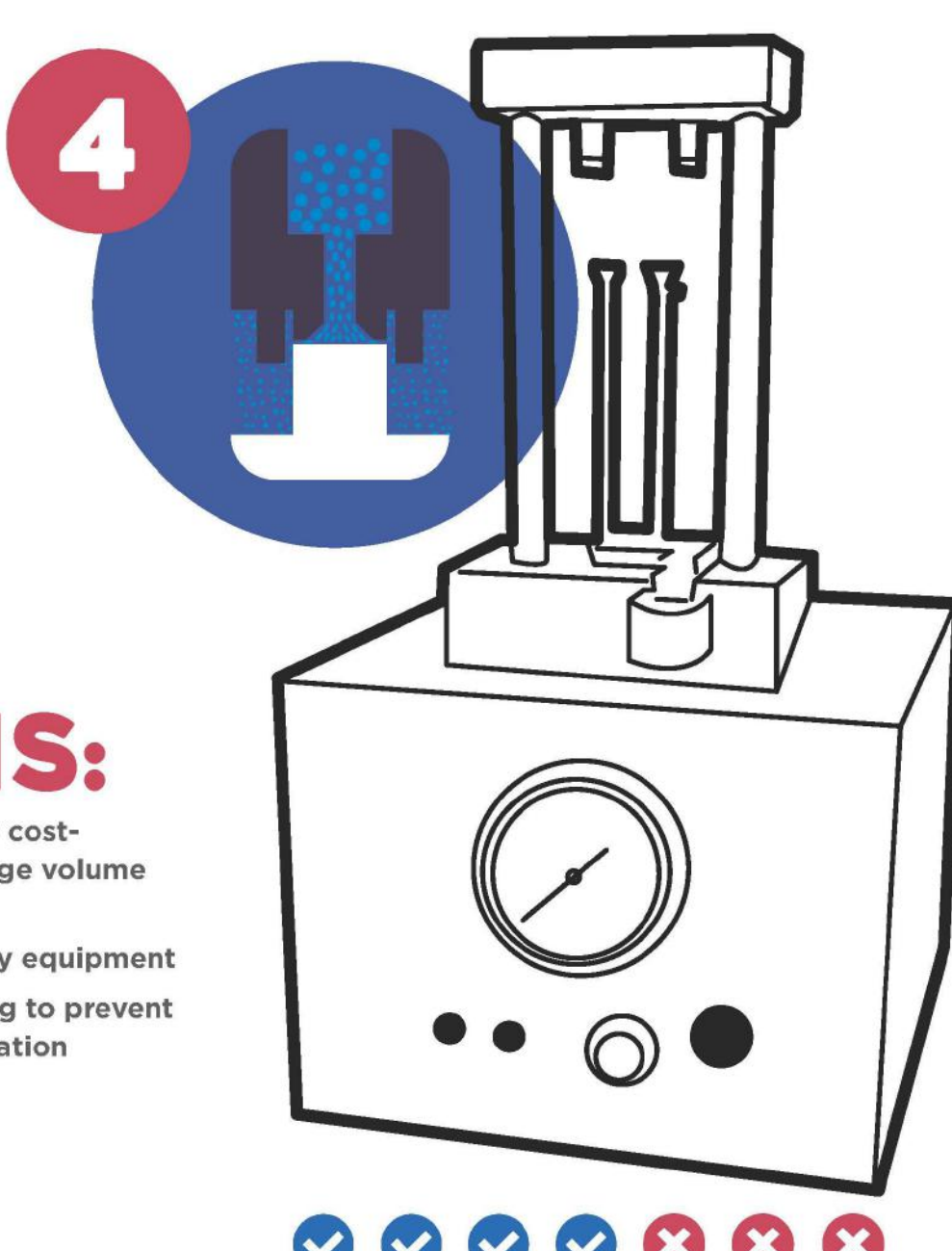
Ultrasonic homogenizers are an excellent choice for many cell disruption and particle size reduction operations. These devices utilize ultrasonic waves to disrupt materials directly through ultrasonic force and via cavitation.
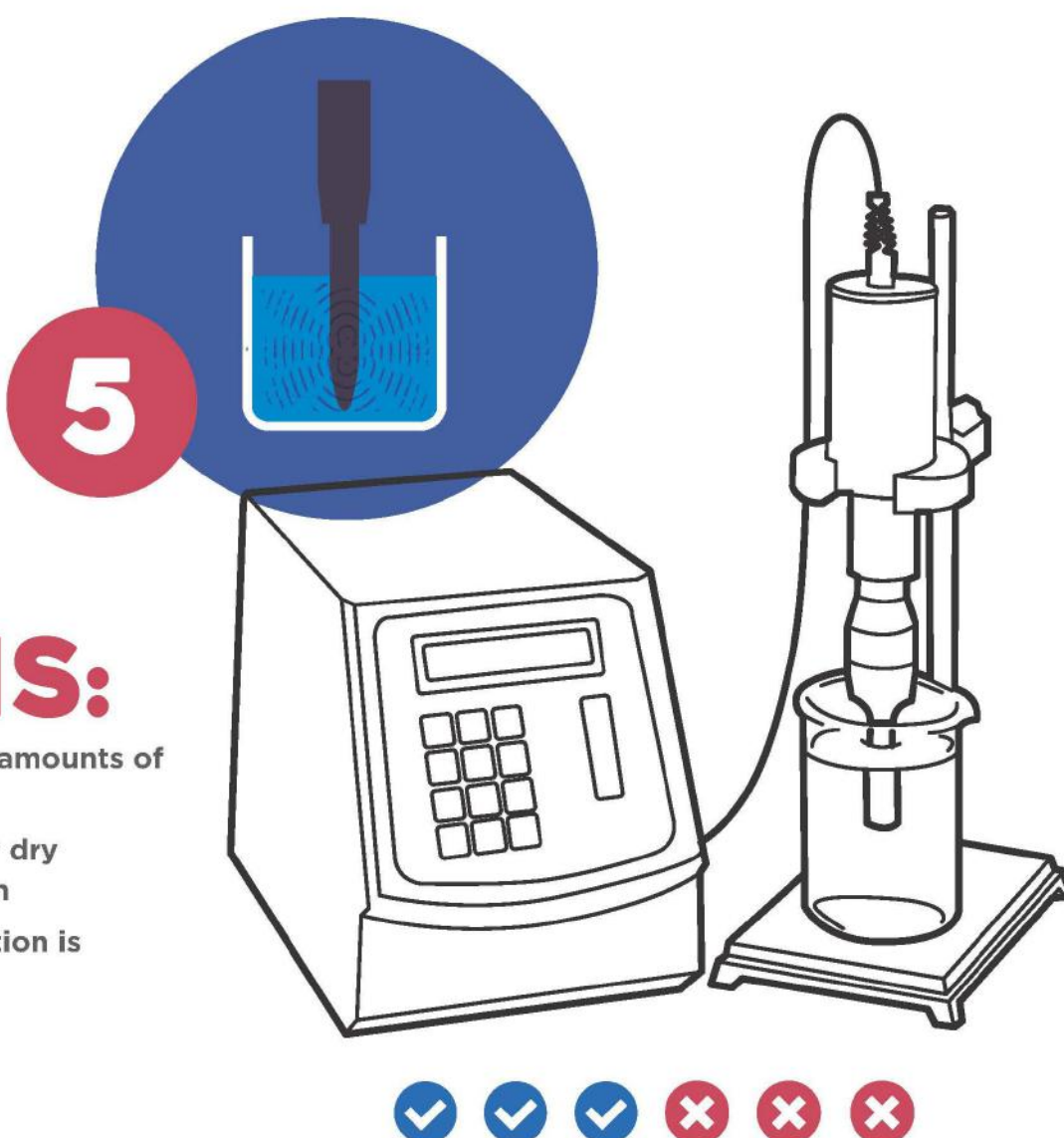
APPLICATIONS:
- Tissue homogenization
- Cell disruption
- Particle size reduction
- Emulsification

PROS:
- Powerful
- Ideal for samples that are mostly liquid or have very small particles
- Works well for applications that require high energy over a small area

CONS:
- Generate large amounts of heat
- Not suitable for dry homogenization
- Hearing protection is recommended

✓ ✓ ✓ ✗ ✗ ✗