PART 1: Curcumin Extraction (Small-Scale)

✅ **Objective:**

Extract curcumin from dried turmeric rhizomes using **ultrasound-assisted extraction (UAE)** or **solvent extraction**, two practical, scalable, and low-cost methods.

🔧 **Materials Needed:**

Item	Description / Notes
Dried turmeric powder	Finely ground for better solvent penetration
Ethanol (95% food grade)	Preferred solvent; methanol or acetone optional
Beaker or glass container (250 mL)	Heat-resistant
Ultrasonic cleaner (optional)	20–40 kHz preferred, or use manual stirring
Stirring rod or magnetic stirrer	Manual or automatic
Coffee filter or fine filter paper	For filtration
Funnel	For pouring and filtering
Scale (grams)	Precision ±0.01 g recommended
Graduated cylinder	For measuring liquids
Evaporation setup (air dry or low heat plate)	To remove solvent
Gloves and safety goggles	Safety first!

🧪 **Step-by-Step Protocol: Ultrasound-Assisted Extraction**

1. **Weigh Sample**:
    - Use 10g of dried turmeric powder.
2. **Prepare Solvent**:
    - Mix ethanol and water in a **70:30 ratio** (v/v).
    - Add 100 mL of this mixture to your turmeric powder (solid:liquid ratio = 1:10).

3. **Ultrasound Treatment**:
    - Place the container in an ultrasonic bath at **35–40°C** for **30 minutes**.
    - If no ultrasonic bath, stir the mixture vigorously for 2–3 hours at room temp.
4. **Filtration**:
    - Filter the solution through filter paper to remove solid residues.
5. **Evaporation**:
    - Let the ethanol evaporate using a low-heat plate (≤50°C) or leave it uncovered for a few days in a well-ventilated space.
    - The orange-yellow residue left behind is **crude curcumin extract**.
6. **Storage**:
    - Store the dried extract in a dark glass container at room temperature.

🧪 PART 2: Nanoemulsion-Based Encapsulation

✅ Objective:

Encapsulate the extracted curcumin in an **oil-in-water (O/W) nanoemulsion** for enhanced solubility and absorption.

🔧 Materials Needed:

Item	Description
Crude curcumin extract	From Part 1
Coconut oil / olive oil	Carrier oil (5–10 mL)
Tween 80	Food-grade emulsifier (Polysorbate 80)
Distilled water	Aqueous phase
Ultrasonic cleaner / immersion blender	To emulsify
Small beaker	100–200 mL
Dropper or syringe	For adding oil to water phase

💉 Step-by-Step Protocol: Nanoemulsion Formation

1. **Dissolve Curcumin in Oil**:
    - Dissolve a small amount (~50 mg) of curcumin extract into 5 mL of coconut or olive oil.
2. **Prepare Aqueous Phase**:
    - Mix 1–2 mL of Tween 80 into 45 mL of distilled water in a beaker.
3. **Create Pre-emulsion**:
    - Slowly **add the curcumin-oil mix into the aqueous phase** while stirring continuously.
4. **Homogenization**:
    - Place the mixture in an **ultrasonic cleaner for 5–10 minutes**.
    - Alternatively, blend it at high speed using an immersion blender for 1 minute.
5. **Observe**:
    - You should get a **slightly milky, stable emulsion**. The smaller the droplet size, the more transparent and stable it will appear.
6. **Storage**:
    - Store the nanoemulsion in the refrigerator for up to 2 weeks in an amber bottle.

📌 Next Steps or Add-ons

Would you like me to help you with any of the following?

- ✅ Printable **lab poster or checklist** of the above steps
- ✅ **Label templates** for your stored extracts and nanoemulsions
- ✅ A **data log template** (Excel) for recording yield, droplet size, observations, etc.
- ✅ Ideas for **tests** (like colorimetry or stability) to evaluate your nanoemulsion

Let me know and we can continue to the next phase!