Electric Skin Project – Ethanolamine Wash Solution Protocol

Objective

This protocol describes the preparation of a 500 mL ethanolamine wash solution used for cleaning and stabilizing protein nanowires. The solution helps neutralize acidity, remove residual growth medium, and maintain nanowire integrity during the purification process.

Background

Ethanolamine (2-aminoethanol) is a mild alkaline compound that serves as both a solvent and buffer. Combined with acetic acid (vinegar) and water, it produces a stable environment (pH approximately 10.5 to 10.7) for washing nanowires. A small amount of Triton X-100 is added to help remove lipid or membrane residues without denaturing the protein structures. This wash is used after nanowire harvesting to clean and stabilize the samples prior to conductivity testing.

Materials and Equipment

Ethanolamine (2-aminoethanol) Distilled white vinegar (5 percent acetic acid) Distilled water Triton X-100 solution Graduated cylinders and glass beakers Blender or stir plate (for mixing) Microcentrifuge tubes or small glass vials (for measuring, mixing, and aliquoting)

Procedure

Prepare the ethanolamine wash base (500 mL total):

Measure and combine the following components:
• 400 mL distilled white vinegar (5 percent acetic acid)
• 442 mL distilled water
• 18.1 mL ethanolamine
Mix thoroughly until uniform.

Adjust pH:

Check the pH using a calibrated pH meter and adjust to approximately 10.5 using small additions of ethanolamine or vinegar as needed.

Add Triton X-100:

Add 353 microliters of Triton X-100 per 100 mL of ethanolamine used. For example, if using 300 mL ethanolamine, add 1059 microliters of Triton X-100 slowly while stirring or blending to ensure even distribution.

Dilute samples as needed:

Add 200 mL ethanolamine for each 353 microliters of Triton X-100 added earlier to maintain consistency. Some samples may not require extra Triton depending on residue content.

Store:

Dispense the final solution into microcentrifuge tubes or small vials for use during washing steps. These tubes are used for accurate measurement and short-term handling rather than long-term storage.

Observations

The solution appears clear and slightly viscous with a mild vinegar odor. After pH adjustment, it stabilizes around 10.5 to 10.7. The combination of acetic acid and ethanolamine creates a balanced ionic environment suitable for washing nanowires without degradation.

Rationale and Notes

This wash solution helps remove residual growth media and cell debris, while maintaining nanowire stability in a gentle alkaline environment. Triton X-100 assists in removing membrane fragments without denaturing the proteins when used at low concentration. Use fresh aliquots for each wash to prevent contamination. Buffer strength and pH may require fine-tuning based on experimental conditions.

Next Step

With the ethanolamine wash solution prepared, the next phase involves culturing Geobacter sulfurreducens and harvesting the protein nanowires for subsequent cleaning and conductivity testing.