Appendix

Table S1. Independent Variable

Independent Variable	Reasoning	Method
Concentration of Hydrogen Peroxide (0.0%, 0.5%, 1.5%, 2.0%, 2.5%, 3.0%)	To determine the effect on the biosorption capacity of hair for zinc ions, since a greater concentration would have a greater effect on the structure and adsorption capacity of the hair.	Hydrogen peroxide solutions of given identified strengths will be used.

Table S2. Dependent Variable

Dependent Variable	Reasoning	Method
Concentration of $Zn(NO_3)_2 \cdot 6H_2O$ solution (mg/L)	To quantify the concentration of the zinc ions before and after the biosorption process, thus revealing the extent of adsorption by the hair.	EDTA titration will be used to determine the solution's concentration.

Table S3. Control Variables

Controls	Reasoning	Method
Hair Source	To ensure consistent experimental conditions by reducing variability due to differences in hair properties.	Hair will be sourced from the same person and area (my head hair).
Hair Length	To minimize variability in hair's physical attributes, which could impact adsorption capacity, as longer hair could potentially have a greater capacity due to a larger surface area	Hair strands will be cut using scissors into lengths between 1-20mm.
Soaking Time	To ensure that hairs of all levels were exposed equally for a reliable comparison of adsorption efficiency.	A fixed soaking time of 24 hrs will be maintained.
pH of Soaking Solution	To prevent pH-induced structural changes that could impact adsorption capacity.	A constant pH of 9 will be maintained by using a pH buffer, as it has been previously determined by Zhang Helan to be the optimal pH level that yields the most significant outcomes.
Mass of Hair	Keeping the amount of hair consistent for accurate assessment of adsorption differences, as a larger amount of hair would adsorb more zinc ions and vice versa.	A standardized amount of hair will be used for the treatment process (hair mass of 5.0g) and the treatment process (hair mass of 0.3g).

Materials:

I. Preparation of Solutions:
- Distilled water
- $Zn(NO_3)_2 \cdot 6H_2O$ (700 mg/L, salt)
- Balance (±0.01g)
- Volumetric flask (1000 ±0.30mL)
- Hydrogen Peroxide (0.0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 3.0%)

II. Human Hair Preparation:
- Deionized water
- Human hair (25 g)
- Hair detergent shampoo (H&S)
- Scissors

III. Treatment of Hair:
- Deionized water
- Balance (±0.01g)
- Filter paper (10x)
- Ammonia buffer solution (pH 10 – 10 mL)

IV. Heavy Metal Ion Biosorption:
- Balance (±0.01g)
- Filter paper (10x)
- Graduated cylinder (25 ±2 cm^3 – 1x)
- Glass rods (5x)
- Test tubes (14x)

V. EDTA Titration:
- Burette (50 ±0.05 cm^3 – 1x)
- 0.01M EDTA solution (100 mL)
- Erlenmeyer flasks (200 ±12.5 cm^3 – 5x)
- Eriochrome Black T (200 mg)
- Analytical grade NaCl (40 ±2g)
- Graduated cylinder (100 ± 0.5 cm^3 – 1x)
- Graduated cylinder (25 ±2 cm^3 – 1x)
- Glass funnel (1x)
- Magnetic stirrer (1x)
- Spatula

Table S4. Safety, Environmental and Ethical concerns

Concern Type	Hazard	Source of Information	Risk or Concerns	Method To Minimize Risk
Safety	Hydrogen Peroxide (H_2O_2)	[8]	It can cause burns on your skin and eyes if it comes into contact with them. Inhalation can irritate the respiratory system and cause difficulty breathing.	Wear protective gear (gloves, goggles, lab coat) and work in a well-ventilated area.
	EDTA	[9]	Ingestion can be extremely dangerous. Direct contact and inhalation can also cause other irritations.	Handle with caution and wear protective gear.
	Celloxan ($Zn(NO_3)_2 \cdot 6H_2O$)	[10]	It can cause dizziness, headaches, and nausea when ingested or inhaled.	Handle with care, avoid ingestion, and ensure proper ventilation.
	Fragile Glass Equipment	-	Breakage can lead to cuts and injuries.	Handle with caution.
Environmental	Celloxan ($Zn(NO_3)_2 \cdot 6H_2O$)	[10]	Water pollutants have high acute toxicity to all lifeforms, especially aquatic organisms.	Proper disposal.
	Hydrogen Peroxide (H_2O_2)	[8]		
Ethical	Human Hair Usage	-	Consent and ethical acquisitions need to be followed and adhered to.	Using my own hair for this study.

References

[8] LabChem [Internet]. EDTA, disodium, dihydrate. 2020 Jul 15; [cited 2023 Aug 13]. Available from: https://www.labchem.com/tools/msds/msds/LC13750.pdf

[9] New Jersey Department of Health [Internet]. Hazardous substance fact sheet. 2016 May [cited 2023 Aug 13]. Available from: https://nj.gov/health/eoh/rtkweb/documents/fs/1015.pdf

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