

Cytotoxicity evaluation of L-Arginine and L-Hydroxyproline in lipophilic emulsion gels: Safe formulations for skincare applications.

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Abstract

Background

L-Arginine and L-Hydroxyproline are amino acids known for their anti-inflammatory and anti-aging benefits, making them promising ingredients for cosmetic products. Lipophilic emulsion gels, which allow for localized and non-invasive delivery, present a viable formulation approach, but their safety and efficacy in skincare applications require further evaluation.

Aim

This study aimed to determine the cytotoxicity of L-Arginine and L-Hydroxyproline in lipophilic emulsion gels and identify optimal concentrations for their safe and effective use in cosmetics.

Methodology

The emulsion gels were designed as two-phase systems. The gel phase incorporated Carbomer 940, while the emulsion phase included almond oil, essential oils, and amino acids. Cytotoxicity was analyzed using MTT assays performed on HaCaT cells in 0.200 mL growth medium after 24 hours. Additionally, the pH of the formulations was measured to ensure compatibility with skin, targeting the recommended range of 4.5–7.0.

Results

The cytotoxicity analysis determined that the safe concentrations were 3.0×10^{-7} mg/mL for L-Hydroxyproline and 2.0×10^{-7} mg/mL for L-Arginine, with cell viability exceeding 80% at these levels. The pH of the formulations (5.35 for L-Hydroxyproline and 7.20 for L-Arginine) was deemed appropriate for cosmetic use. To further minimize the risk of skin irritation, it is suggested that amino acid concentrations be adjusted to a range of 1.0×10^{-7} to 2.0×10^{-7} mg/mL.

Conclusion

This study confirms that L-arginine and L-hydroxyproline can be safely incorporated into emulsion gel formulations when used within specified concentration limits. This offers a new strategy for developing skincare products with anti-aging and anti-inflammatory properties. Future research should explore long-term effects, enhance ingredient permeation, and assess clinical efficacy.



Figure 1: Lipophilic emulsion gel formulation

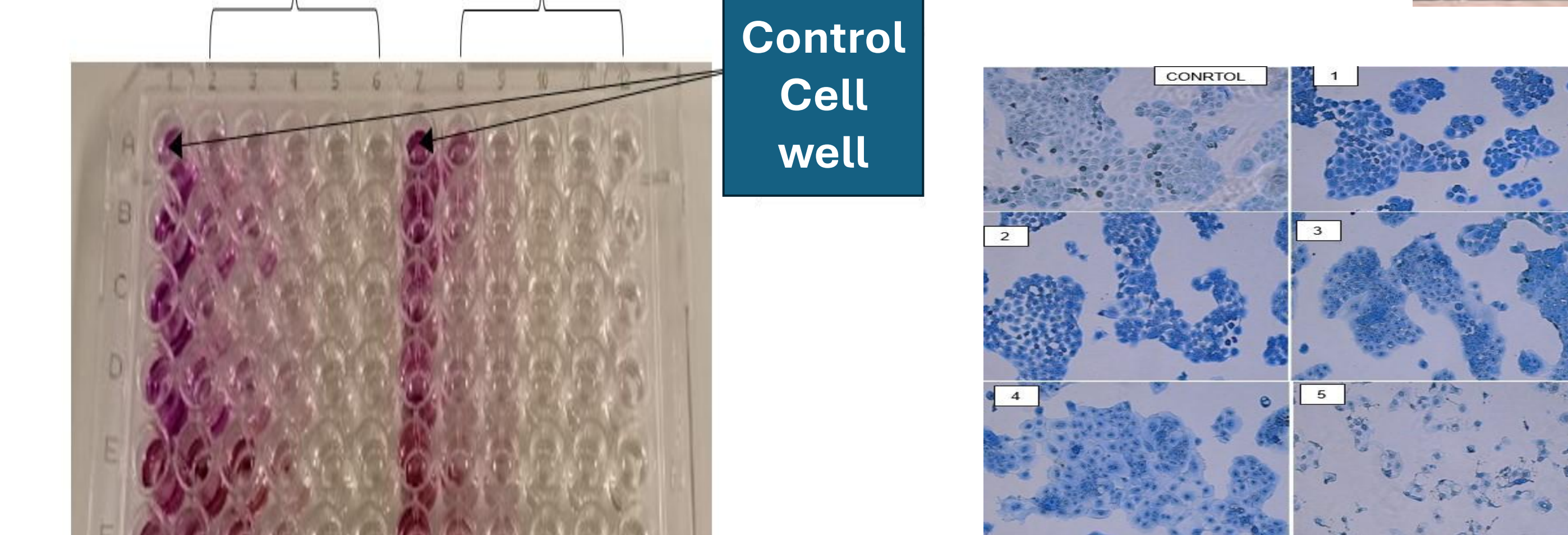


Figure 2: Cell Culture at different concentrations; 0.05-0.0005 mg/mL

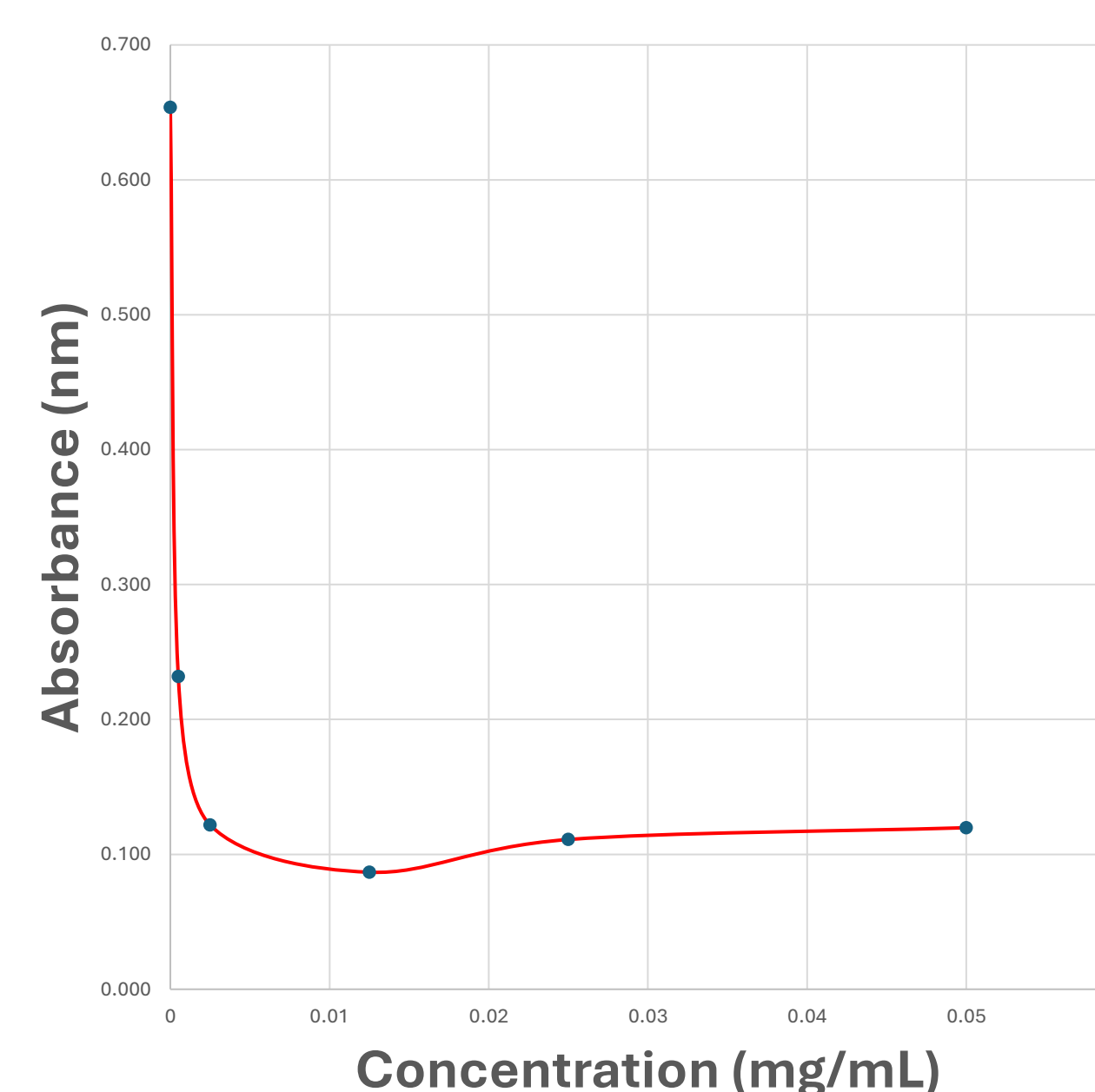


Figure 4: Absorbance Vs Concentration of L-Hydroxyproline; 0.05-0.0005 mg/mL.

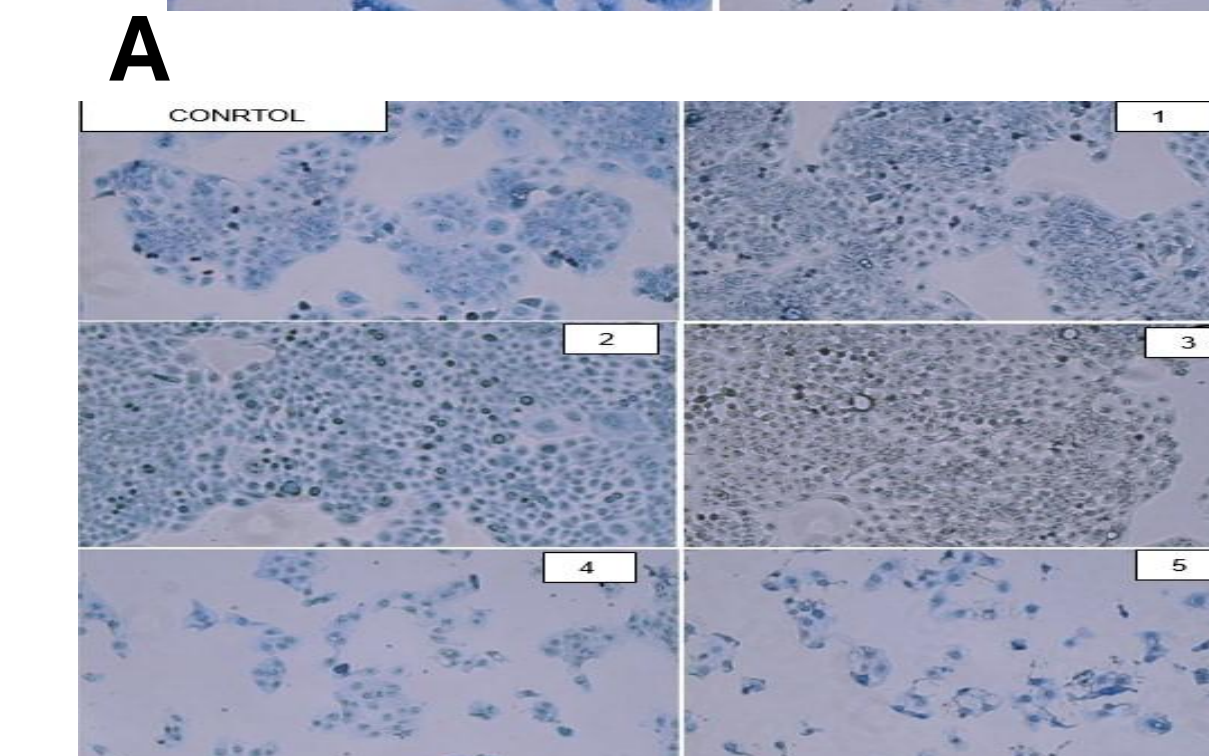


Figure 3: Stained HaCaT with L-Hydroxyproline (A) and L-Arginine (B) gel formulations.

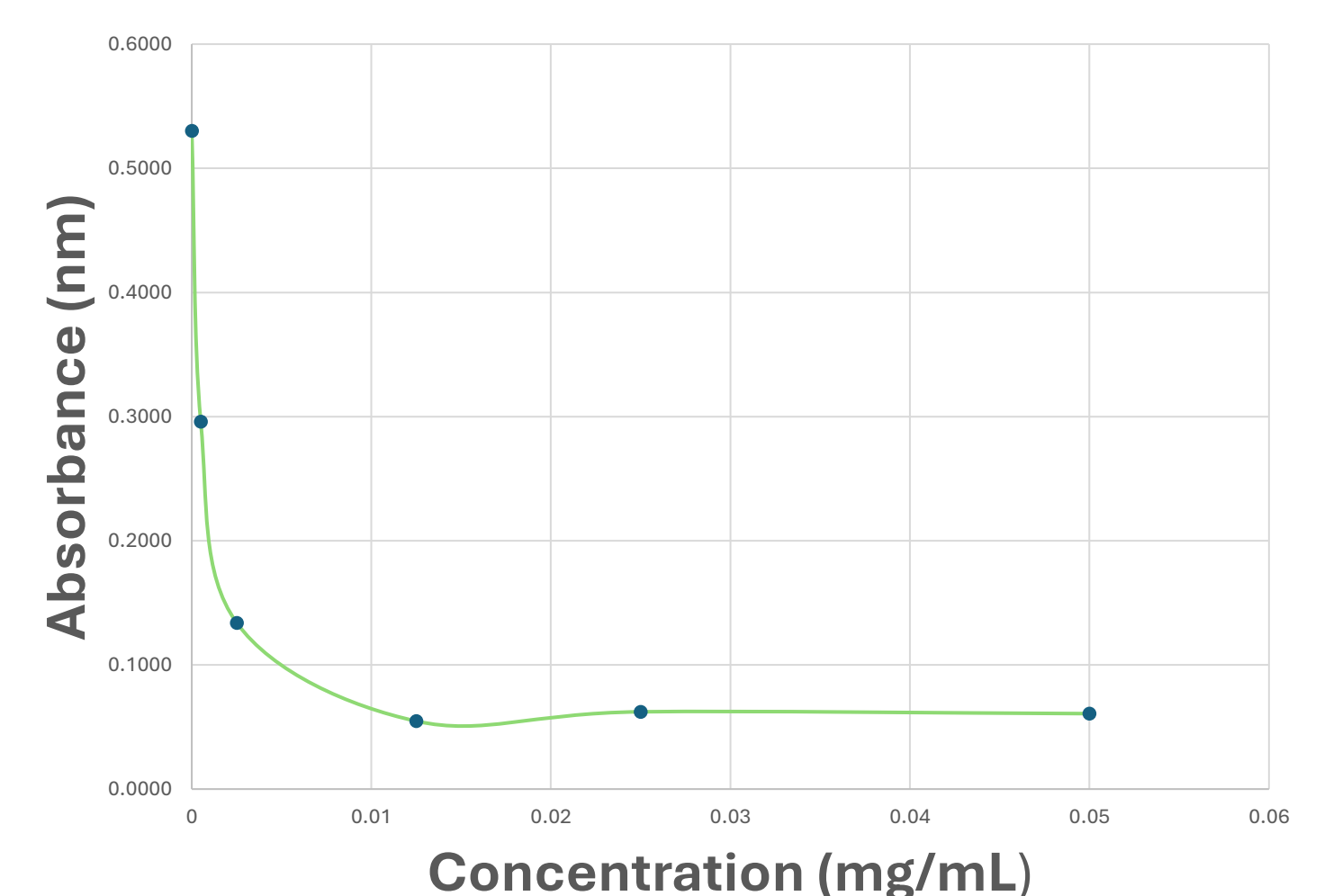


Figure 5: Absorbance Vs Concentration of L-Arginine; 0.05-0.0005 mg/mL.

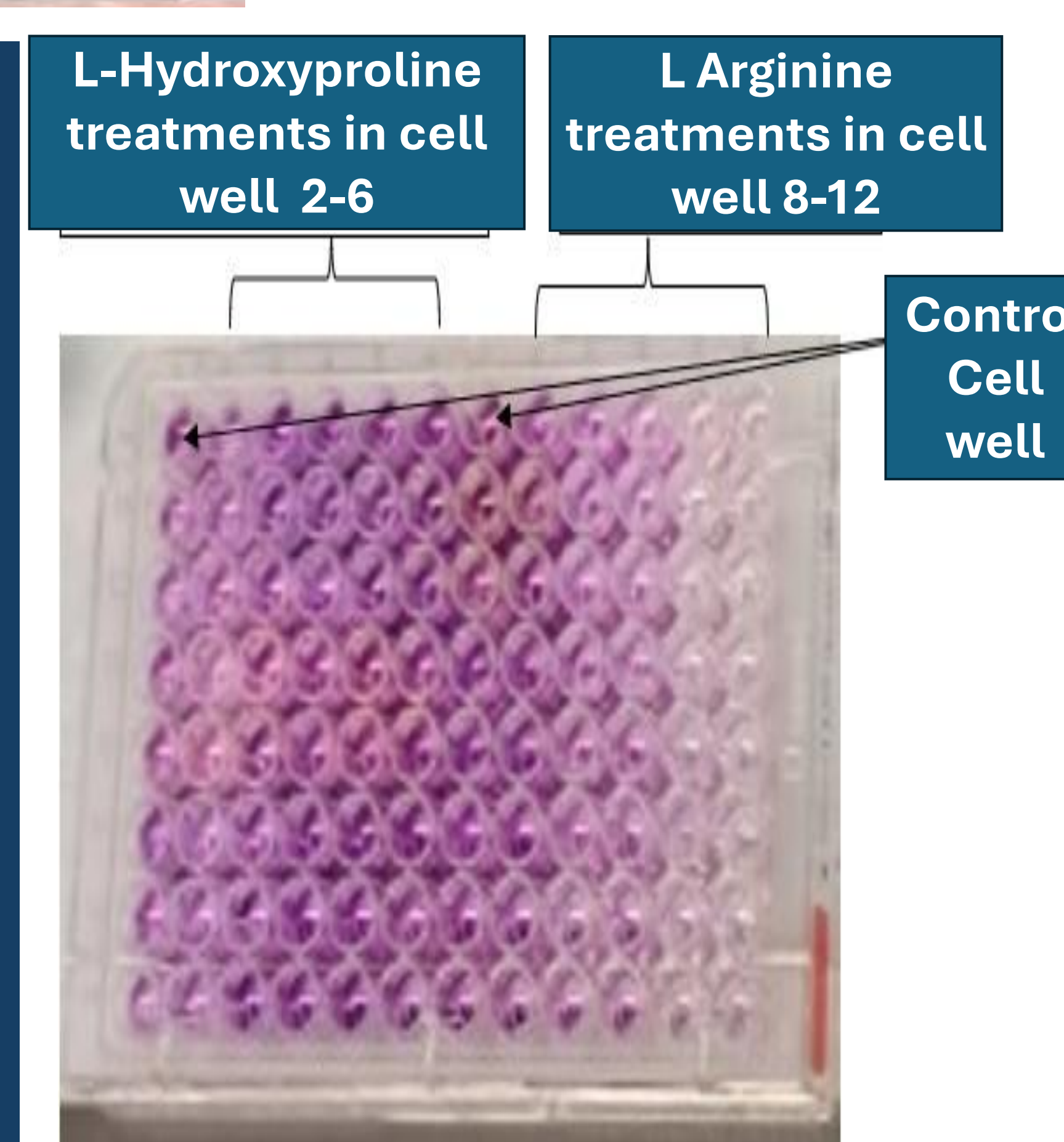


Figure 6: Cell Culture at lower concentrations; 1.0×10^{-7} - 8.0×10^{-7} mg/mL

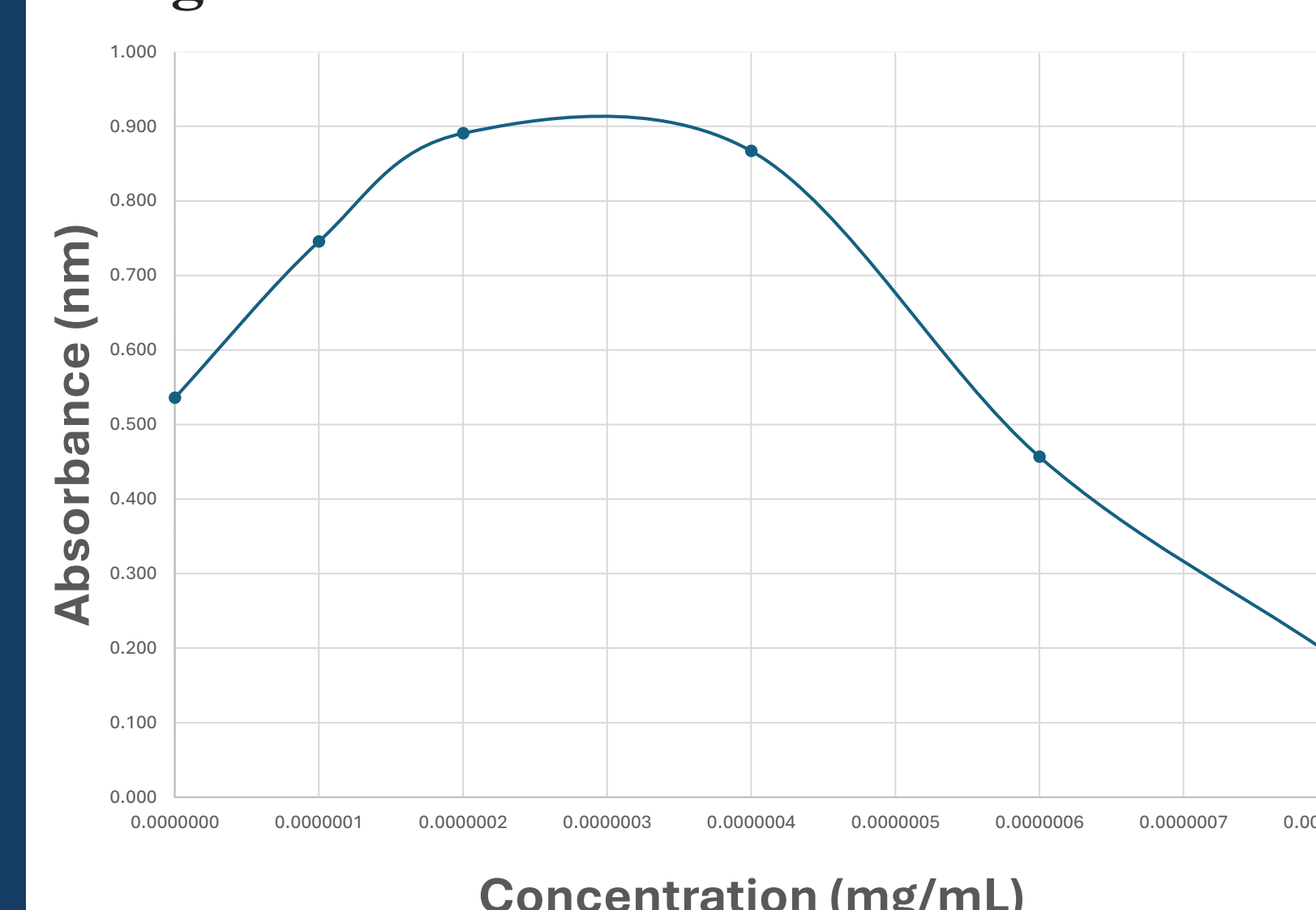


Figure 8: Absorbance Vs Concentration of L-Hydroxyproline 1.0×10^{-7} - 8.0×10^{-7} mg/mL .

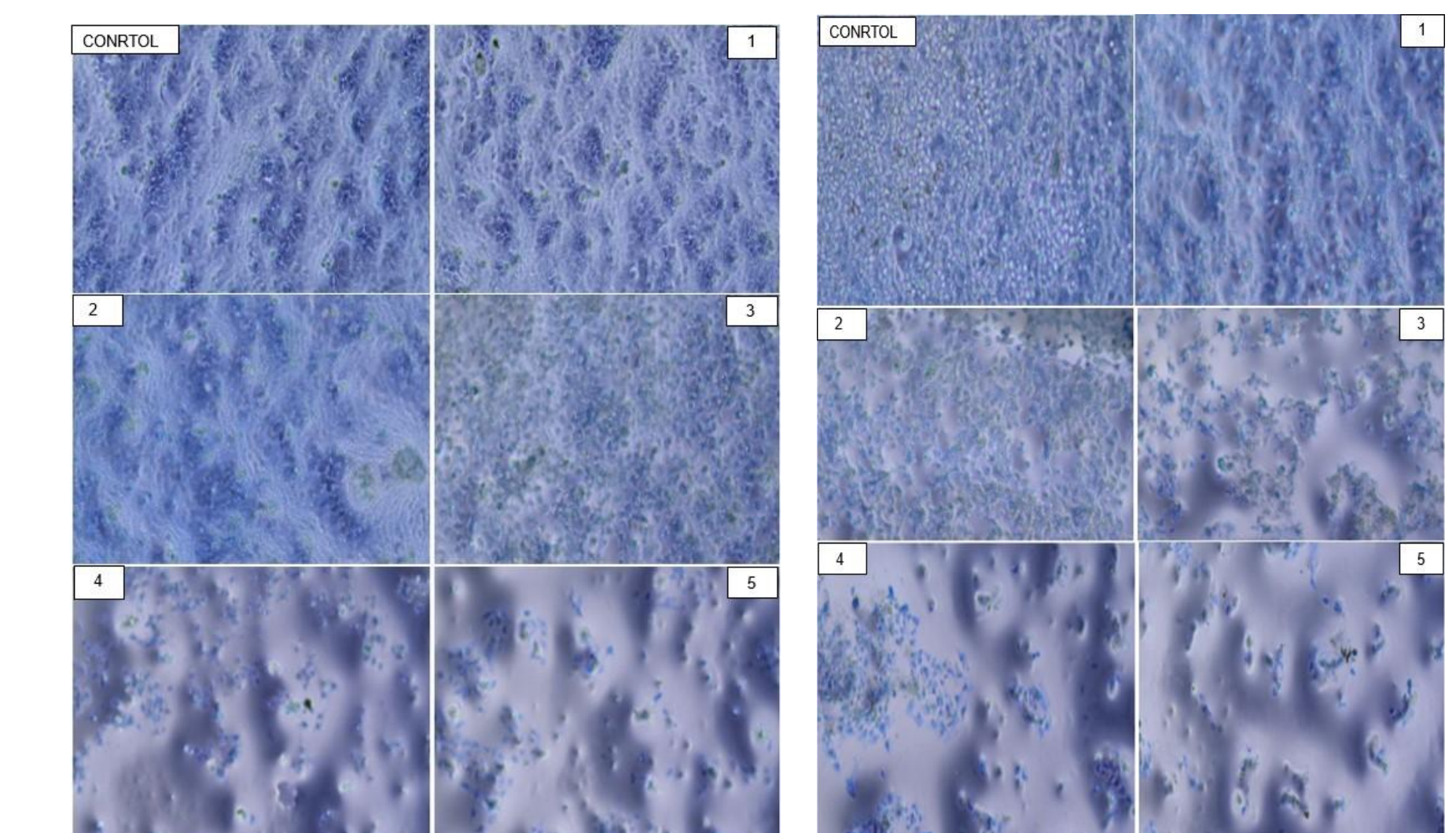


Figure 7: Stained HaCaT with L-Hydroxyproline (A) and L-Arginine (B) lipophilic gel formulations.

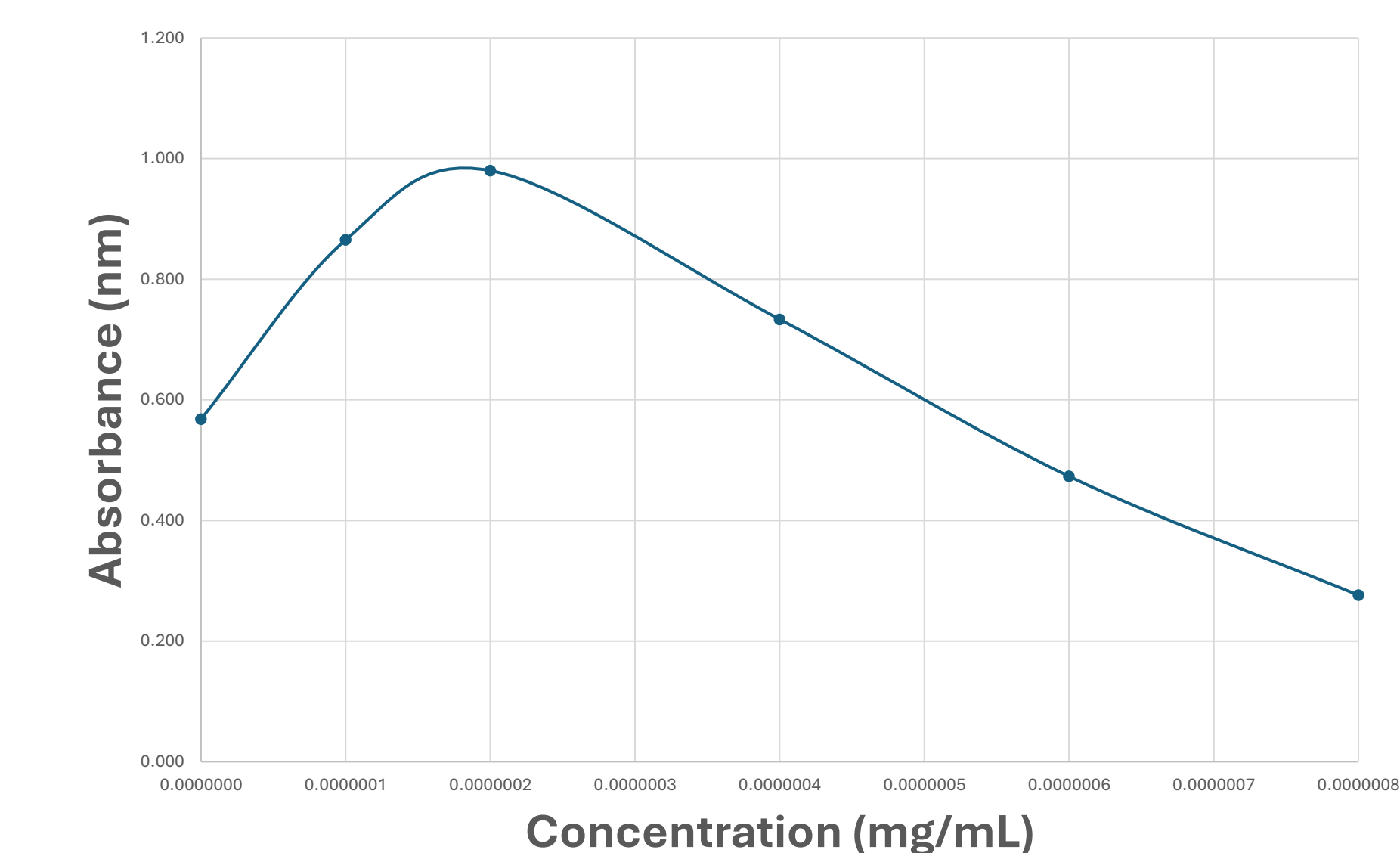


Figure 9: Absorbance Vs Concentration of L-Arginine; 1.0×10^{-7} - 8.0×10^{-7} mg/mL .

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