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# **Growth optimization of *Pseudomonas* L521 for bioremediation of caffeine contaminated environment**

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# Introduction

- Caffeine as a white crystalline alkaloid of xanthine that is bitter, odourless and amorphous in its pure form. At high concentration caffeine is toxic to saprophytic organisms that are concerned in important biotransformation in the environment, which causes disorder in environmental stability (Gibson *et al.*, 2009; Ibrahim *et al.*, 2015b)
- This growth optimization focuses on obtaining suitable parameters at which the caffeine-degrading bacterium can best function in degrading caffeine so that it can be used in bioremediation of caffeine contaminated environments without the use of chemicals.

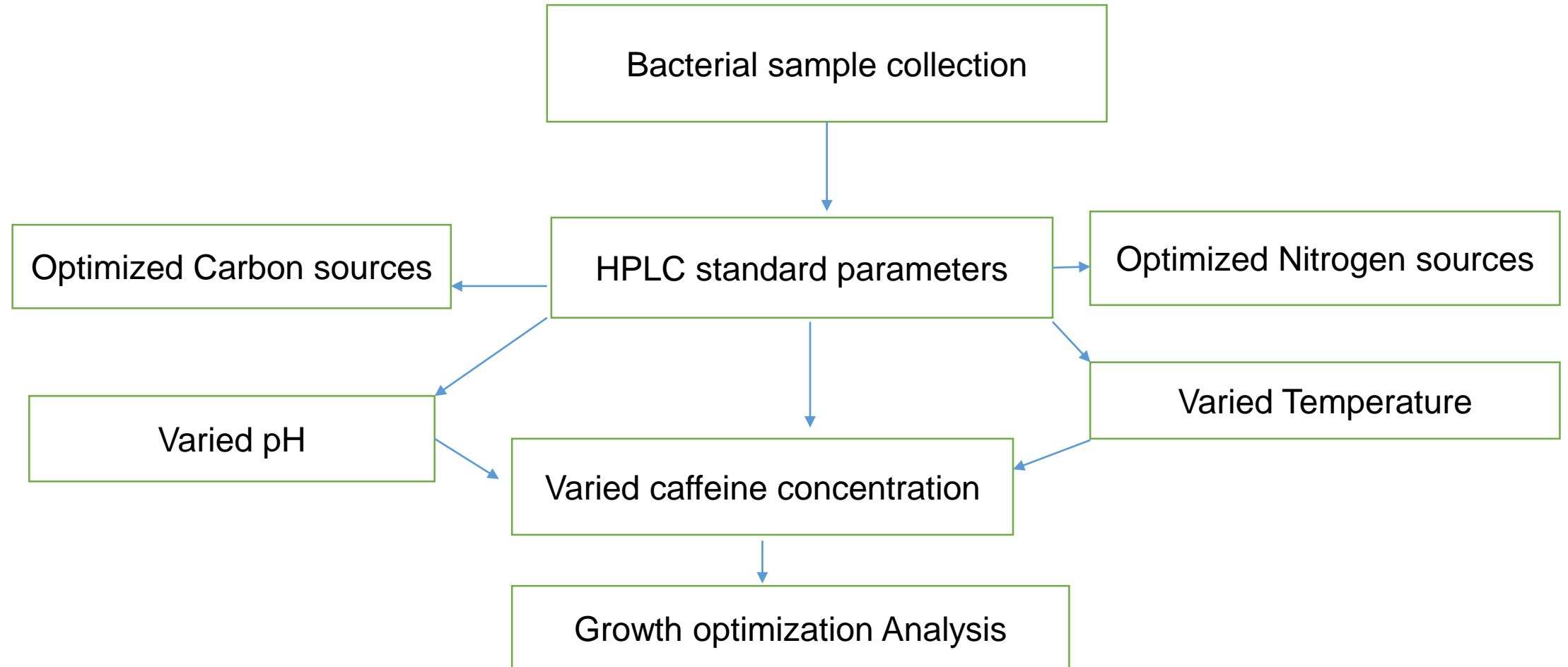
# Objectives

- To study the growth of *Pseudomonas sp.* in the presence of various carbon and nitrogen sources.
- To study the growth and biodegradability of *Pseudomonas sp.* at varied pH and temperature.
- To study the effect of different caffeine concentrations on the growth of *Pseudomonas sp.*

# Methodology

- **Sample collection and maintenance;** *Pseudomonas* strain L521 was collected from Biological Science Department Nigerian Defence Academy, Kaduna and cultivated in a Caffeine Liquid Media (CLM). The bacterial strain was incubated on a rotary shaker incubator at 150rpm and 28 °C for 48 hrs to obtain a starter culture. The isolates were maintained and subcultured every 2 weeks in the caffeine agar medium.
- **Growth Analysis;** Caffeine degradation for the isolate was estimated by HPLC equipment.
- **Growth optimization;** Several parameters such as different concentration of caffeine, carbon source, nitrogen source, pH, and temperature were optimised in order to make sure that the caffeine degradation was successfully carried out for *Pseudomonas* strain

# Experimental Setting



# Results and Discussion

Figures

## Figures

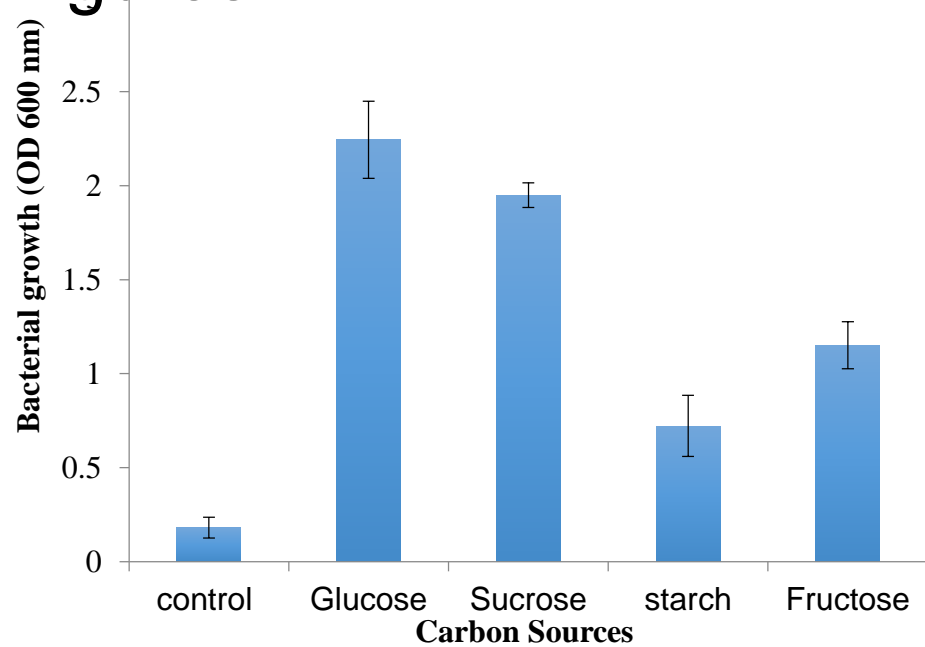


Figure 1: The effect of different carbon sources on bacterial growth and caffeine degradation of *Pseudomonas sp.* with initial caffeine concentration of 0.3 g/L, 5 g/L of carbon source and 0.4 g/L of ammonium chloride.

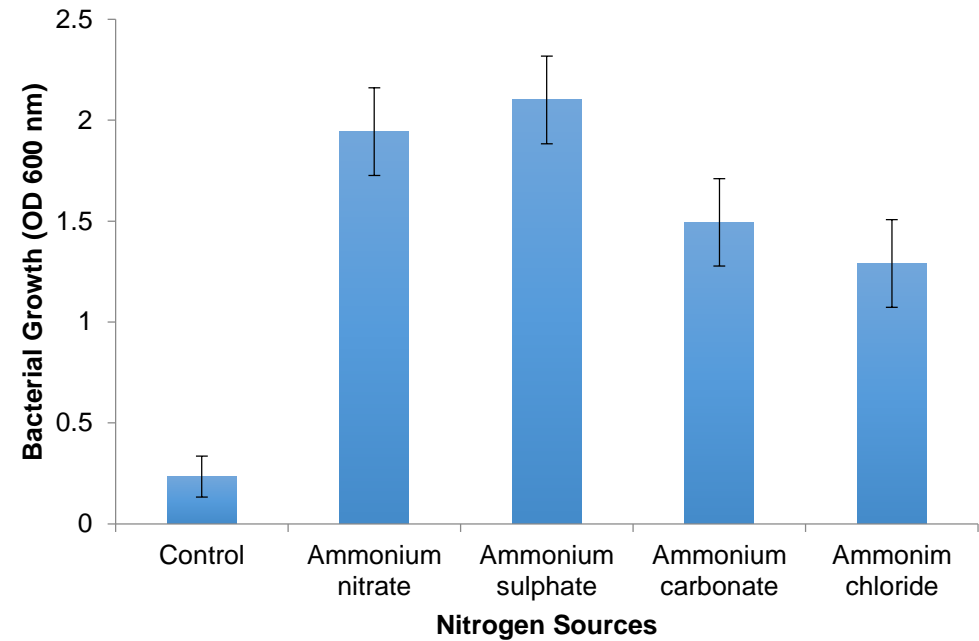


Figure 2: The effect of different nitrogen sources on bacterial growth and caffeine degradation of *Pseudomonas sp.* with initial caffeine concentration of 0.3 g/L, 0.4 g/L of nitrogen source and 5 g/L of sucrose.

# Results and Discussion

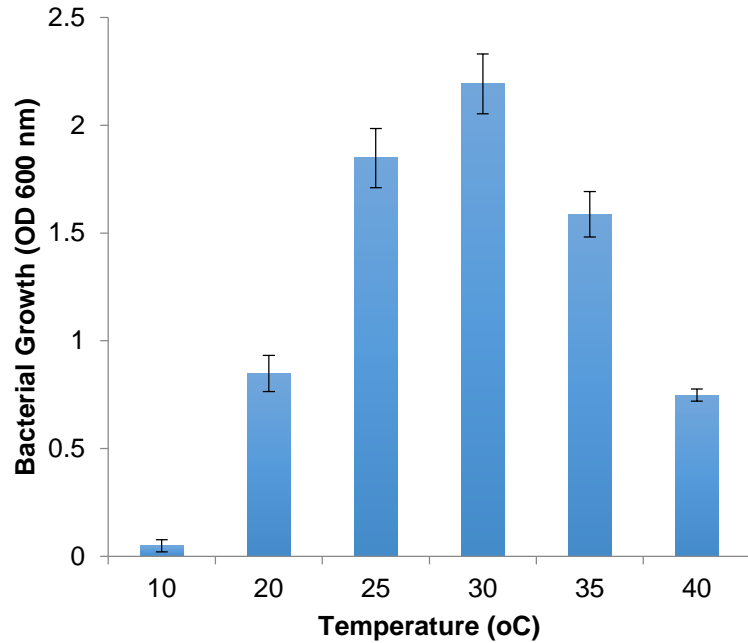


Figure 3: Effect of various temperatures on bacterial growth by *Pseudomonas sp.* with initial caffeine concentration of 0.3 g/L, 5 g/L of sucrose and 0.4 g/L of ammonium sulphate.

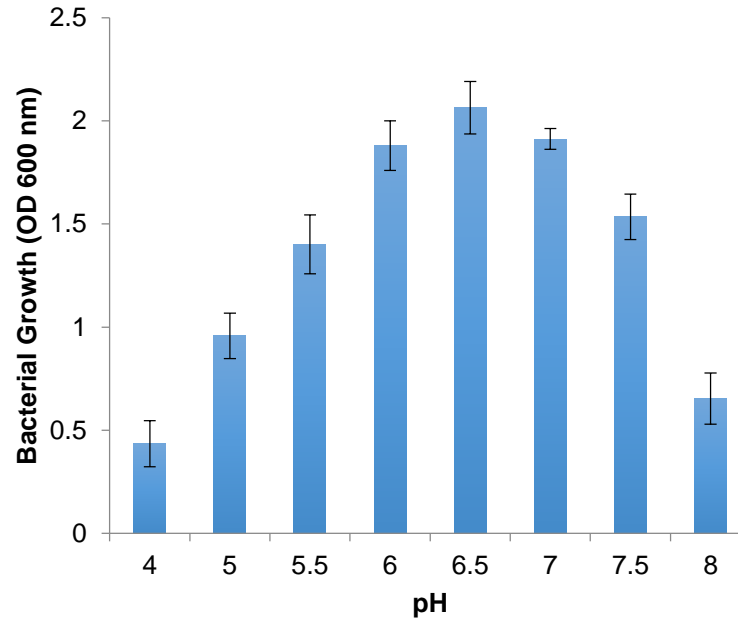


Figure 4: Effect of various pH on bacterial growth by *Pseudomonas sp.* with initial caffeine concentration of 0.3 g/L, 5 g/L of sucrose and 0.4 g/L of ammonium chloride.

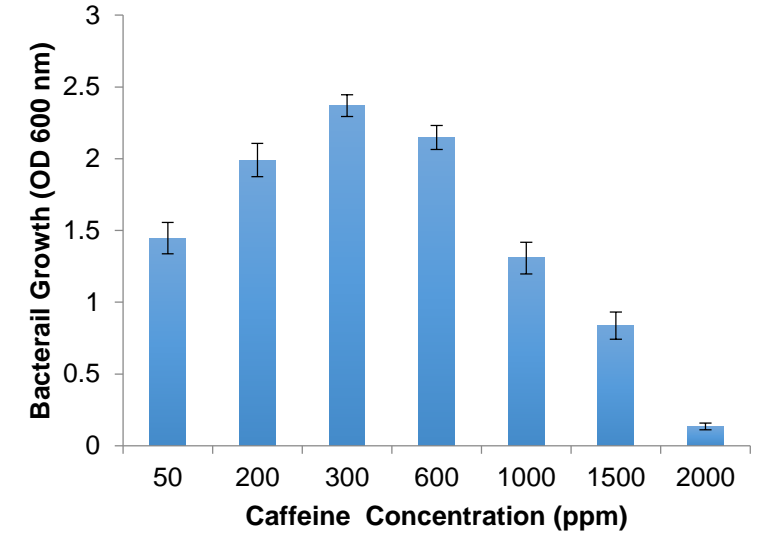


Figure 5: The effect of different caffeine concentrations on bacterial growth and caffeine degradation of *Pseudomonas sp.* with initial caffeine concentration of 0.5 mg/L, 5 g/L of carbon source and 0.4 g/L of ammonium chloride.

# Conclusions & Recommendations

## • CONCLUSION

- The aim of this research was to evaluate biodegradability of *Pseudomonas* L521 on caffeine. The growth optimization studies provides the optimum growth conditions for *Pseudomonas* sp. that can be used to increase the capability of the bacteria in degrading caffeine. *Pseudomonas* sp. grew best at 5g/L glucose, 0.4g/L ammonium sulphate, pH 6.5, 30 °C and 0.3g/L caffeine.

## • RECOMMENDATION

- *Pseudomonas* sp was found to be the best caffeine degrading bacteria from the comparison of the literature and the result in this research.
- Therefore, further studies on cloning the gene, purification and hyper-expression of enzyme and its molecular techniques would be essential.



# References

- Asano, Y., Komeda, T., and Yamada, H. (1993). Microbial production of theobromine from caffeine. *Bioscience, Biotechnology, and Biochemistry*, 57(8): 1286–1289.
- Babu, V. R. S., Patra, S., Thakur, M. S., Karanth, N. G., and Varadaraj, M. C. (2005). Degradation of caffeine by *Pseudomonas alcaligenes* CFR 1708. *Enzyme and Microbial Technology*, 37(6): 617–624.
- Batish, D. R., Singh, H. P., Kaur, M., Kaohli, R. K., and Yadav, S. S. (2008). Caffeine affects adventitious rooting and causes biochemical changes in the hypocotyl cuttings of mung bean (*Phaseolus aureus* Roxo). *Acta Physiologiae Plantarum*, 30(3): 401–405.
- Dash, S. S., and Gummadi, S. N. (2006). Biodegradation of caffeine by *Pseudomonas* sp. NCIM 5235. *Research Journal of Microbiology*, 1: 115–123.
- El-Mched, F., Olama, Z., and Holail, H. (2013). Optimization of the environmental and physiological factors affecting microbial caffeine degradation and its application in caffeinated products. *Basic Research Journal of Microbiology*, 1(2): 17–27.
- Gokulakrishnan, S., and Gummadi, S. N. (2006). Kinetics of cell growth and caffeine utilization by *Pseudomonas* sp. GSC 1182. *Process Biochemistry*, 41(6): 1417–1421.
- Gummadi, S. N., Lionel, A. C., Dash, S. S., and Gokulakrishnan, S. (2007). The effect of glucose on growth and degradation of caffeine by *Pseudomonas* sp. *Research Journal of Microbiology*, 2(4): 327–336.
- Holmgren, P. L., Norden, P., and Ahlner, J. (2004). “Caffeine fatalities — four case reports.” *Forensic Science International*, 139(1): 71–3.
- Ibrahim, S., Shukor M. Y, Syed M. A, Johari, W. L. W and Ahmad, S. A (2015b). Characterisation and growth kinetics studies of caffeine-degrading bacteria. *Annals Microbiology*, 66(1):289-298.
- Lakshmi, V., and Nilanjana, D. (2013b). Biodegradation of Caffeine by *Trichosporon asahii* Isolated from caffeine Contaminated Soil. *Internationnal journal of Engineering Science and Technology (IJEST)*, 1(1): 1–10.

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