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APPENDIX

Appendix

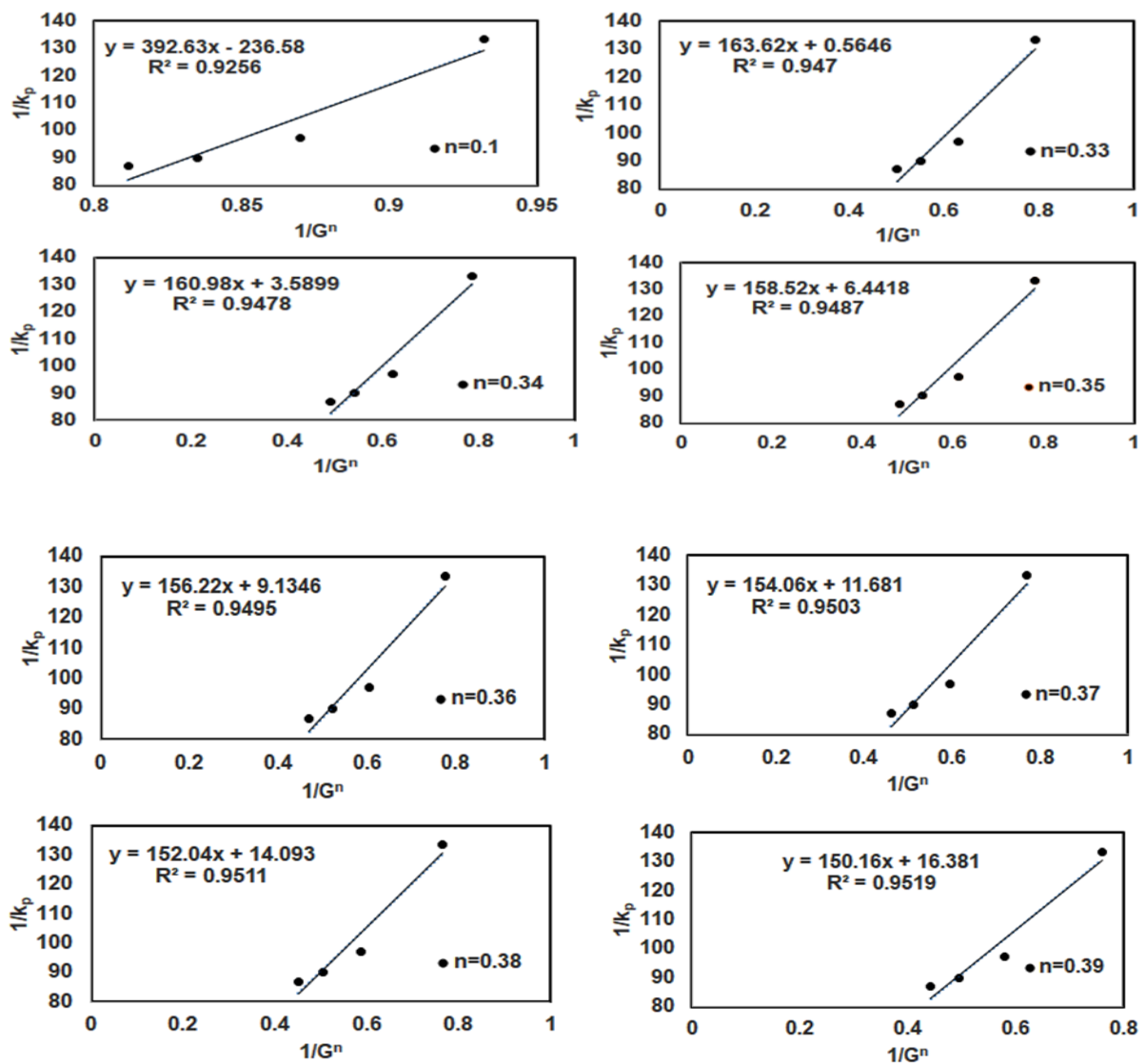
Sequence of *Bacillus flexus* GS1 IIT(BHU) (MK850444.1).

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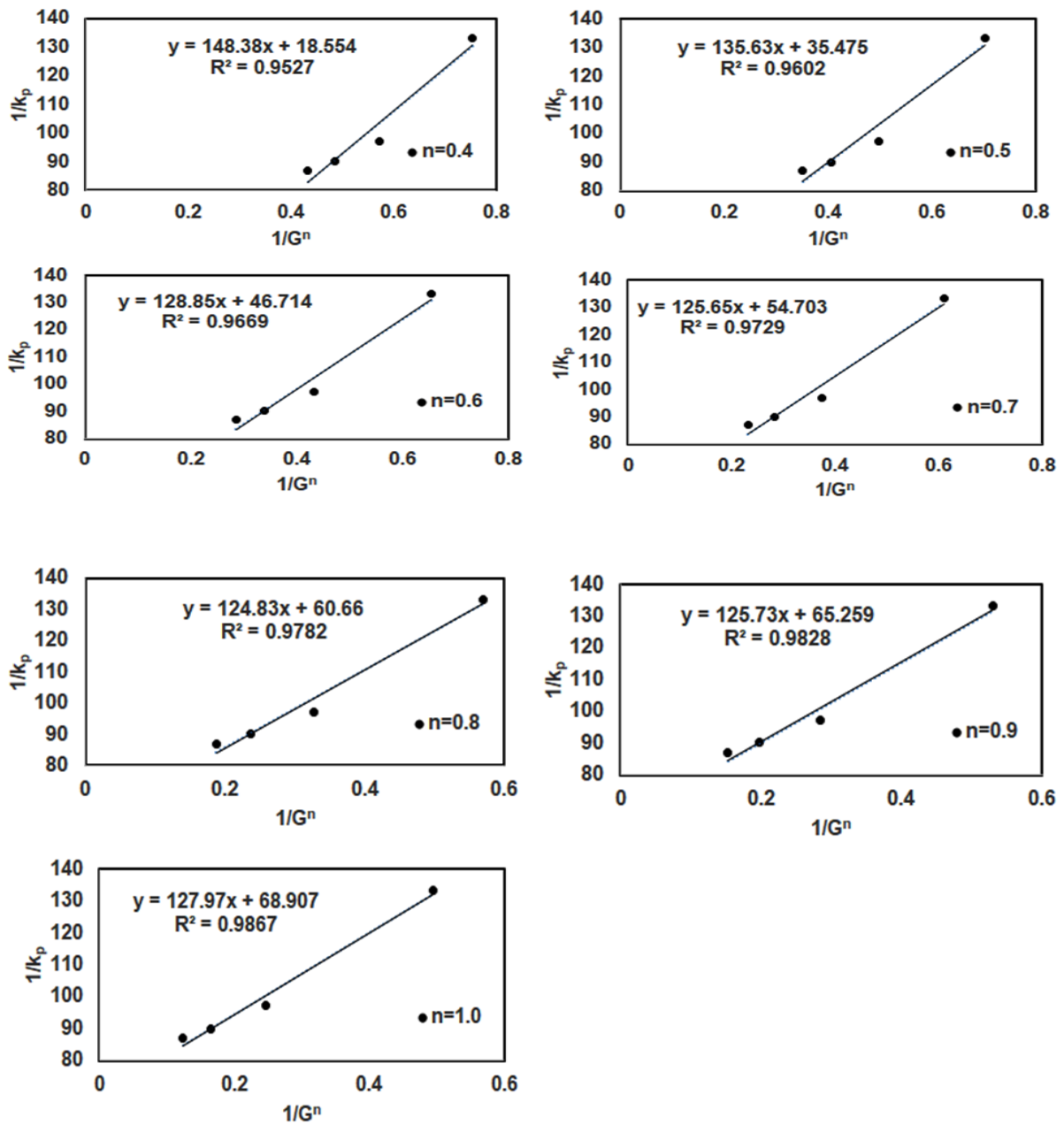


Fig. A.1. Plot between $1/k_p$ vs. $1/G^n$ for $n=0.1, 0.33, 0.34, 0.35, 0.36, 0.37, 0.38, 0.39, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0$ ($R^2 > 0.94$).

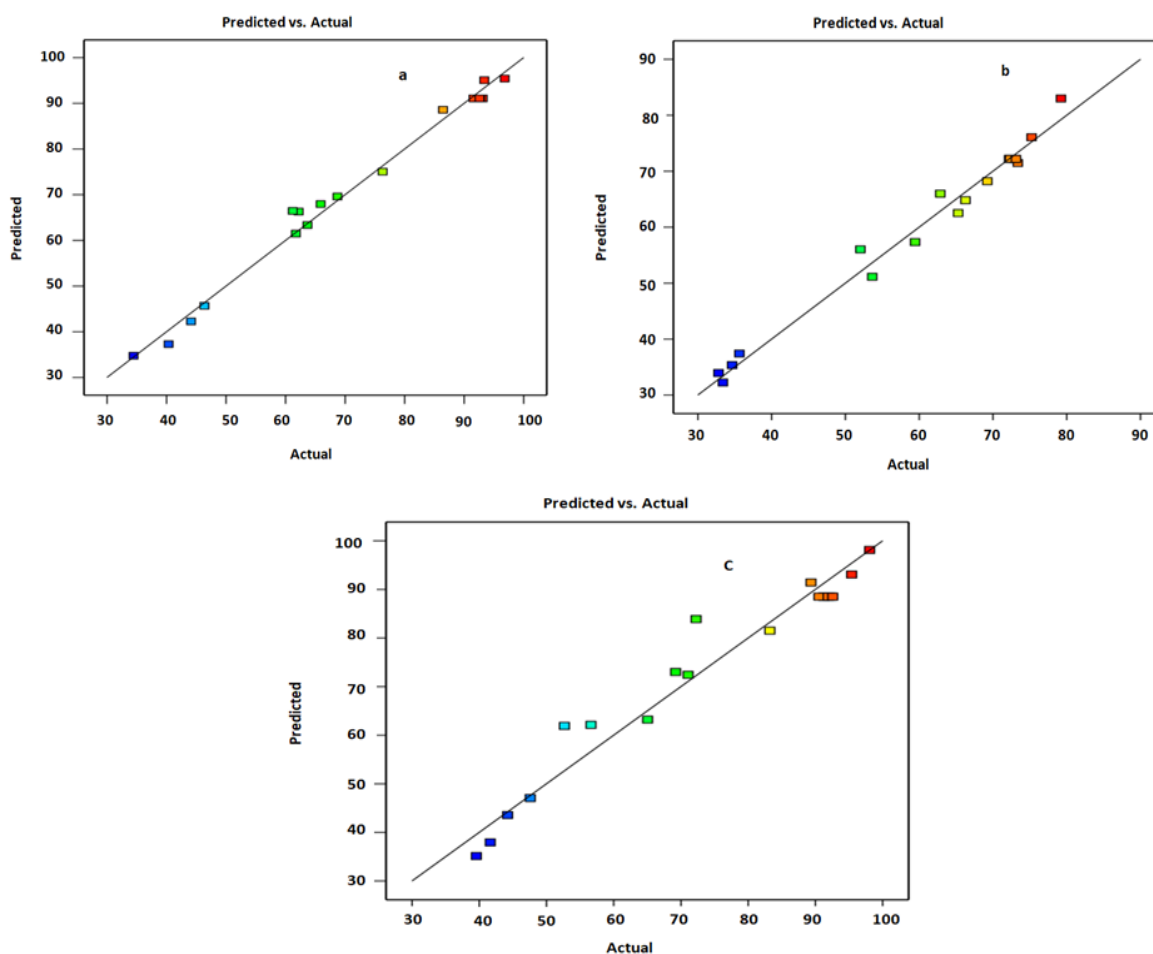


Fig. A.2. The plots for the actual vs. predicted for the removal of (a) phenol, (b) COD, (c) ammonia in moving bed biofilm reactor.

Table A.1. Profile of intermediates identified using GC-MS during biodegradation of phenol.

Compound name	Molecular formula	Retention time (min)	m/z of fragment ions
Phenol	C_6H_5OH	7.80	166, 151, 121, 95, 91, 77, 75, 65, 43
Catechol	$C_6H_4(OH)_2$	17.89	254, 243, 239, 220, 147, 133, 112, 102, 91, 73, 59, 45
2-hydroxy muconic semialdehyde	$C_6H_6O_4$	22.48	286, 271, 257, 227, 204, 187, 169, 157, 147, 133, 111, 95, 73, 55, 45, 28

LIST OF RESEARCH PUBLICATIONS

List of publications from thesis (First author)

- ❖ **Swain, G.**, Sonwani, R. K., Singh, R. S., Jaiswal, R. P., Rai, B. N. 2021. A comparative study of 4-chlorophenol biodegradation in a packed bed and moving bed bioreactor: Performance evaluation and toxicity analysis. *Environmental Technology & Innovation*, 101820.
- ❖ **Swain, G.**, Sonwani, R. K., Singh, R. S., Jaiswal, R. P., Rai, B. N. 2021. Removal of 4-Chlorophenol by *Bacillus flexus* as free and immobilized system: Effect of process variables and kinetic study. *Environmental Technology & Innovation*, 21, 101356.
- ❖ **Swain, G.**, Sonwani, R. K., Giri, B. S., Singh, R. S., Jaiswal, R. P., Rai, B. N. 2020. Collective removal of phenol and ammonia in a moving bed biofilm reactor using modified bio-carriers: Process optimization and kinetic study. *Bioresource technology*, 306, 123177.
- ❖ **Swain, G.**, Sonwani, R. K., Giri, B. S., Singh, R. S., Jaiswal, R. P., Rai, B. N. 2020. A study of external mass transfer effect on biodegradation of phenol using low-density polyethylene immobilized *Bacillus flexus* GS1 IIT (BHU) in a packed bed bioreactor. *Water and Environment Journal*.
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Literature communicated

- ❖ **Swain, G.**, Maurya, K. L., Kumar, M., Sonwani, R. K., Singh, R. S., Jaiswal, R. P., Rai, B. N. 2021. The biodegradation of 4-chlorophenol in a moving bed biofilm reactor using response surface methodology: Effect of biogenic substrate and kinetic evaluation. *Applied Biochemistry and Biotechnology* (Manuscript ID: ABAB-D-21-01048).

Other publications during Ph.D. work

- ❖ Maurya, K. L., **Swain, G.**, Sonwani, R. K., Verma, A., Singh, R. S. 2021. Bioremediation of Congo red in an anaerobic moving bed bioreactor: Process optimization and kinetic modeling. *Bioresource Technology Reports*, 16, 100843.
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- ❖ Sonwani, R. K., **Swain, G.**, Giri, B. S., Singh, R. S., Rai, B. N. 2020. Biodegradation of Congo red dye in a moving bed biofilm reactor: Performance evaluation and kinetic modeling. *Bioresource technology*, 302, 122811.
- ❖ Sonwani, R. K., **Swain, G.**, Giri, B. S., Singh, R. S., Rai, B. N. 2020. Optimization of Methylene blue removal by mixed bacterial culture isolated from dye contaminated site. *Journal of Indian Chemical Society*, 97, 345-350.
- ❖ **Swain, G.**, Sonwani, R. K., Singh, R. S., Jaiswal, R. P., Rai, B. N. 2020. Removal of Acid blue 113 dye in a moving bed biofilm reactor using isolated bacterial species. *Journal of Indian Chemical Society*, 97, 1668-1672.
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