



Determining Environmental Factors Enhancing Vinyl Chloride Biodegradation Under High Salinity



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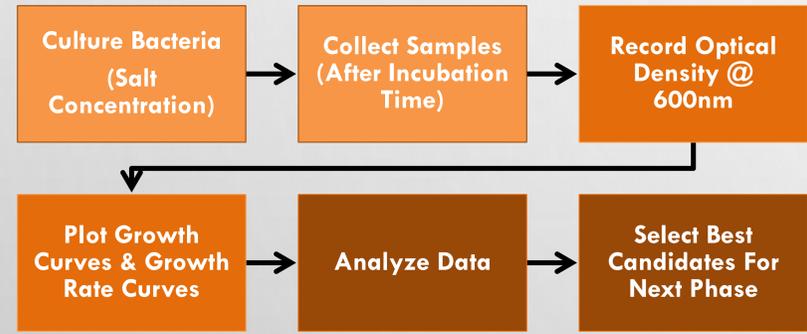
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Background and Significance

- Vinyl Chloride, a human carcinogen, contaminates surface water, groundwater, and soil (1).
- Freshwater polluted or spiked with vinyl chloride have been widely studied.
- Vinyl chloride removal studies near coastal regions are absent.
- This study aims to discover salt-tolerant vinyl chloride degrading bacteria and to understand their growth mechanisms and metabolic activities.

Objective: Discover salt-tolerant vinyl chloride degrading bacteria to understand their growth mechanisms and metabolic activities.

Methodology



Name	ID	Media	Growth Temperature
B-5389 <i>N.albus</i>	1	ISP2 ^a	28°C
B-16231 <i>N.luteus</i>	2	NSG ^b	28°C
B-24725 <i>N.nitrophenolicus</i>	3	TGY ^c	28°C
B-3157 <i>N.simplex</i>	4	TGY ^c	28°C
B-14875 <i>P.putida</i>	5	TGY ^c	28°C
B-24349 <i>M.pyrenivorans</i>	6	NSG ^b	28°C
B-24157 <i>M.vanbaalenii</i>	7	NSG ^b	28°C

Figure 2. Illustrates the various bacteria's name, ID, media, and growth temperatures suggested by the NRRL used in Phase I. (*N.:*Nocardioiodes, *P.:*Pseudomonas, and *M.:*Mycobacterium; ^a: International Streptomyces Project Yeast Extract-Malt Extract Broth, ^b: N-Z Amine with Soluble Starch and Glucose Broth, and ^c: Tryptone-Yeast Extract-Glucose) retrieved from Agricultural Research Service Culture Collection NRRL, USDA, IL (2).

Results & Discussions

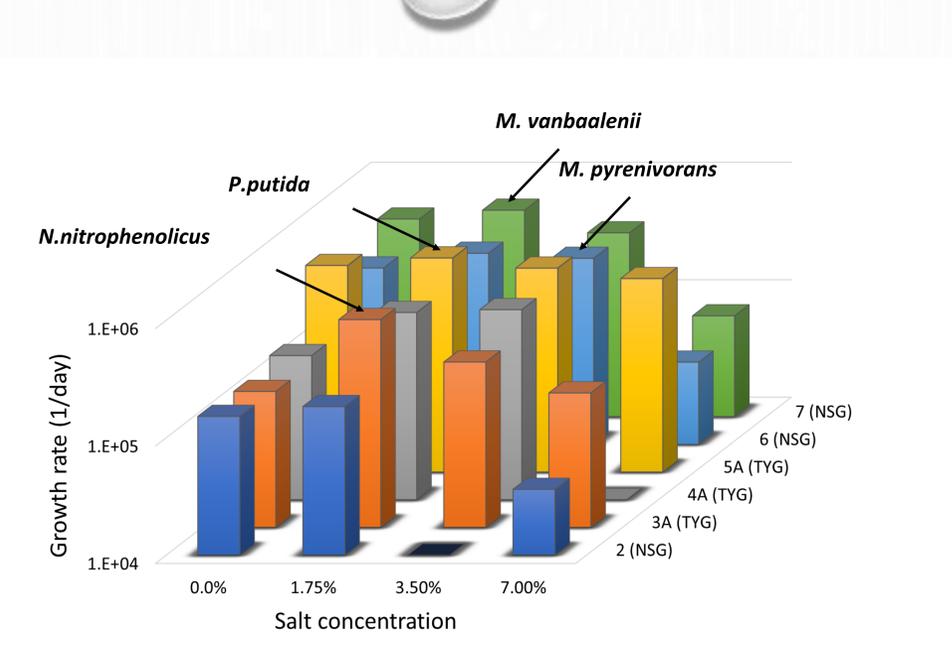


Figure 3. Illustrates growth rate (1/day) of all bacteria selected at all salt concentrations.

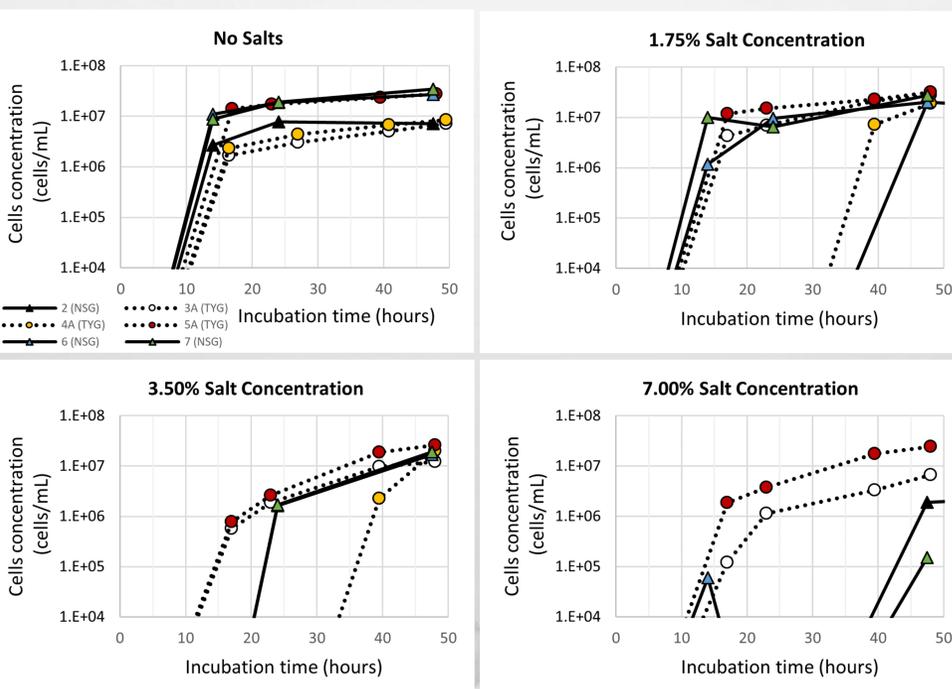


Figure 4. Illustrates cell concentration (cells/mL) against incubation time (hours) of each bacteria. No salt (top left), 1.75% (top right), 3.5% (bottom left), and 7.0% (bottom right).

Results & Discussions (continued)

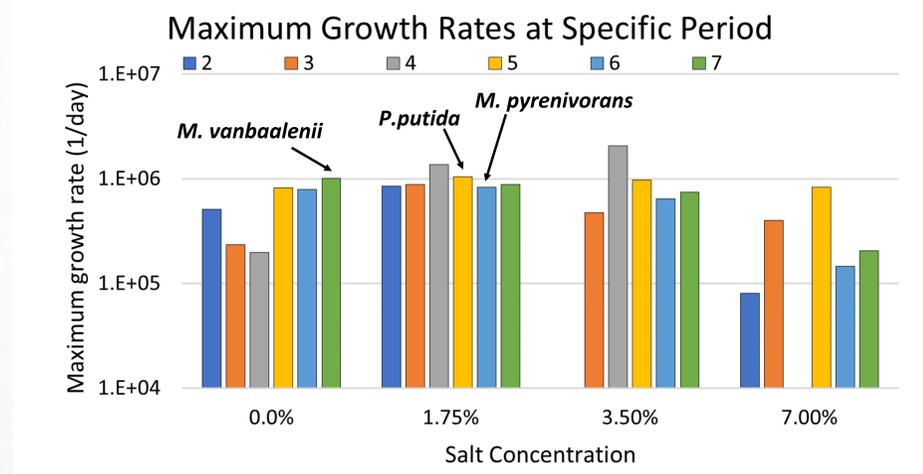


Figure 5. Illustrates maximum growth rates (1/day) of all bacteria at specific period.

- Conclusion:**
- Bacteria (5) and (7) highest growth rate for 0%, 1.75% and 3.50% salt concentrations.
 - (3), (5), (6), and (7) overall growth rate >1x10⁴ cells /hr for all salt concentrations.

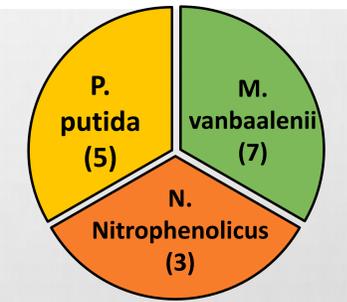


Figure 6. Bacteria advancing to phase II.

On-going & Future Work

- Phase I • Salt Concentrations => 0%, 1.75%, 3.5%, 7%
- Phase II • Temperature (top 3 bacteria) => 28°C, 20°C, 15°C
- Phase III • Respiration => Anaerobic/ Aerobic
- Phase IV • Substrate Concentrations => 100%, 50%, 10%, 1%, and 0.1%
- Phase V • Vinyl Chloride Concentrations

Acknowledgements

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References:

- (1) Richards, P.M., Liang, L., Johnson, R.L., Mattes, T.E., 2019. Cryogenic soil coring reveals coexistence of aerobic and anaerobic vinyl chloride degrading bacteria in a chlorinated ethene contaminated aquifer. Water Research 157 (2019) 281-291. (2) Agricultural Research Service Culture Collection (NRRL), USDA, IL. (nrml.ncaur.usda.gov)