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CHAOTROPIC EFFECTS OF INORGANIC & ORGANIC COMPOUNDS ON BACTERIA - INFLUENCE ON GRAM NATURE

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Abstract

Inorganic and organic chaotropic agents were analyzed for their effects on pathogenic bacteria, namely Staphylococcus aureus ATCC 25923 a Gram positive species and Escherichia coli ATCC 25922 a Gram negative species, with an objective to understand these effects on the variable membrane configurations and permeability properties that exists among their cell walls and membranes respectively. The studies revealed the extent of bacterial lysis that amplified with rise in concentrations of chaotropic agents, in a time dependent mode. Furthermore findings proved that, the inorganic chaotropic agents had shown a higher efficacy against Gram positive species while the organic chaotropic agents demonstrated a higher efficacy against Gram negative species. The findings revealed, specific type of chaotropic agents affects specific Gram nature of bacteria. This paves way for dimensional understanding of the susceptibility of biological membranes towards specific chaotropic agents.

Author Keywords

Chaotropic agents, ammonium sulfate, urea, Gram positive, Gram negative bacteria, lysis assay

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Reference

References (31)

1. Ananda Vardhan Hebbani and John Barnabas
   Chaotropic agents: a new investigative tool in biomolecule research

   (2012) International Journal Current Life Sciences, Volume 2, Issue 9, Page No 42-44,

2. Anton P. J. Middelberg
   Process-scale disruption of microorganisms

   (1995) Biotechnology Advances, Volume 13, Issue 3, Page No 491-551,
   DOI: https://doi.org/10.1016/0734-9750(95)02007-P
   Article Link: https://www.sciencedirect.com/science/article/abs/pii/073497509502007P?via=ihub

3. Blumberg, P. AL, and J. L Stromlnger
   Interaction of penicillin with the bacterial cell: penicillin-binding proteins and penicillin-sensitive enzymes

   (1974) Bacteriological Reviews, Volume 38, Issue 3, Page No 291-335,
   DOI: https://doi.org/10.1128/br.38.3.291-335.1974
   Article Link: https://journals.asm.org/doi/10.1128/br.38.3.291-335.1974

4. Cronan, J. E., Jr., and P. R. Vagelos
   Metabolism and function of membrane phospholipids of Escherichia-coli

   (1972) Biochimica et Biophysica Acta (BBA) - Reviews on Biomembranes, Volume 265, Issue 1, Page No 25-60,
   DOI: https://doi.org/10.1016/0304-4157(72)90018-4
   Article Link: https://www.sciencedirect.com/science/article/abs/pii/0304415772900184?via=ihub

5. Daniel Rigomier, Jean-Pierre Bohin and Bernard Lubochinsky
   Effects of Ethanol and Methanol on Lipid Metabolism in Bacillus subtilis

   (1980) Journal of General MicrobioIogy, Volume 121, Issue 1, Page No 139-149,
   DOI: https://doi.org/10.1099/00221287-121-1-139
   Article Link: https://www.microbiologyresearch.org/content/journal/micro/10.1099/00221287-121-1-139

6. Douglas A. Wait and Mark D. Sobsey
   Method For Recovery Of Enteric Viruses From Estuarine Sediments With Chaotropic Agents

   (1983) Applied And Environmental Microbiology, Volume 46, Issue 2, Page No 379-385,
   DOI: https://doi.org/10.1128/aem.46.2.379-385.1983
   Article Link: https://journals.asm.org/doi/10.1128/aem.46.2.379-385.1983

7. Ghuysen, J. IL
   The concept of the penicillin target from 1965 until today

   (1977) The Journal of General Microbiology, Volume 101, Issue 1, Page No 13-33,
   DOI: https://doi.org/10.1099/00221287-101-1-13
   Article Link: https://www.microbiologyresearch.org/content/journal/micro/10.1099/00221287-101-1-13

8. Grula, E. A., and M. ML Grula
   Cell division in a species of Erwinia. HI. Reversal of inhibition of cell division caused by D-amino acids, penicillin, and ultraviolet light

   (1962) Journal of Bacteriology, Volume 83, Page No 981-988,

9. Hallsworth JE, Yakimov MM, Golyshin PN, Gillion JL, D'Auria G, de Lima Alves F, La Cono V, Genovese M, McKew BA, Hayes SL,Harris G, Giuliano L, Timmis KN, McGenityTJ
   Limits of life in MgCl2-containing environments: chaotropicity defines the window

   (2007) Environmental Microbiology, Volume 9, Issue 3, Page No 801-13,

DOI: https://doi.org/10.1111/j.1462-2920.2006.01212.x
Article Link: https://sfamjournals.onlinelibrary.wiley.com/doi/10.1111/j.1462-2920.2006.01212.x

10. Hallsworth, John E, Sabina Heim and Kenneth N. Timmis
    Chaotropic solutes cause water stress in Pseudomonas putida

    (2003) Environmental Microbiology, Volume 5, Issue 12, Page No 1-11,
    DOI: https://doi.org/10.1111/j.1462-2920.2003.00478.x
    Article Link: https://sfamjournals.onlinelibrary.wiley.com/doi/10.1111/j.1462-2920.2003.00478.x

11. Hatefi Y., W. G. Hanstein
    Solubilization of Particulate Proteins And Nonelectrolytes By Chaotropic Agents

    (1969) Proceedings of the National Academy of Sciences Biochemistry, Volume 62, Page No 1129-1136,

12. Hawrot, E., and E. P. Kennedy
    Biogenesis of membrane lipids: mutants of Escherichia coli with temperature-sensitive phosphatidylserine decarboxylase

    (1975) Proceedings of the National Academy of Sciences of the United States of America, Volume 72, Page No 1112- 1116,

13. InGram L. O., N. S. Vreeland
    Differential Effects of Ethanol and Hexanol on the Escherichia coli Cell Envelope

    (1980) Journal of Bacteriology, Volume 144, Issue 2, Page No 481-488,
    DOI: https://doi.org/10.1128/jb.144.2.481-488.1980
    Article Link: https://journals.asm.org/doi/10.1128/jb.144.2.481-488.1980

14. InGram L. O
    Regulation of Fatty Acid Composition in Escherichia coli: A Proposed Common Mechanism for Changes Induced by Ethanol, Chaotropic Agents, and a Reduction of Growth Temperature

    (1982) Journal of Bacteriology, Volume 149, Issue 1, Page No 166-172,
    DOI: https://doi.org/10.1128/jb.149.1.166-172.1982
    Article Link: https://journals.asm.org/doi/10.1128/jb.149.1.166-172.1982

15. InGram L. O
    Mechanism Of Lysis Of Escherichia Coli By Ethanol And Other Chaotropic Agents

    (1981) Journal of Bacteriology, Volume 146, Issue 1, Page No 331-336,
    DOI: https://doi.org/10.1128/jb.146.1.331-336.1981
    Article Link: https://journals.asm.org/doi/10.1128/jb.146.1.331-336.1981

16. InGram, L O., and E. L Thurston
    Potassium requirement for cell division in Anacystis nidulans

    (1976) Journal of Bacteriology, Volume 125, Issue 1, Page No 369-371,
    DOI: https://doi.org/10.1128/jb.125.1.369-371.1976
    Article Link: https://journals.asm.org/doi/10.1128/jb.125.1.369-371.1976

17. Jennifer L. Proc, Michael A. Kuzyk, Darryl B. Hardie, Juncong Yang, Derek S. Smith, Angela M. Jackson, Carol E. Parker, and Christoph H. Borchers.
    A Quantitative Study of the Effects of Chaotropic Agents, Surfactants, and Solvents on the Digestion Efficiency of Human Plasma Proteins by Trypsin

    (2010) Journal of Proteome Research, Volume 9, Issue 10, Page No 5422–5437,
    DOI: https://doi.org/10.1021/pr100656u
    Article Link: https://pubs.acs.org/doi/10.1021/pr100656u

18. Johnson, J. H., and E. A. Grula
Cell membrane phospholipids and their constituent fatty acids in dividing and non dividing cells of Micrococcus Iysodeikticus

(1980) Canadian Journal of Microbiology, Volume 26, Page No 658-666,

19. Kennell, D., and A. Kotoulas
Magnesium Starvation of Aerobacter aerogenes IV. Cytochemical Changes

(1967) Journal of Bacteriology, Volume 93, Issue 1, Page No 367-378,
DOI: https://doi.org/10.1128/jb.93.1.367-378.1967
Article Link: https://journals.asm.org/doi/10.1128/jb.93.1.367-378.1967

20. Lekha Patel, Shimon Schuldiner and H. R. Kaback
Reversible effects of chaotropic agents on the proton permeability of Escherichia coli membrane vesicles

(1975) Proceedings of the National Academy of Sciences of the United States of America, Volume 72, Issue 9, Page No 3387-3391,

21. Loveless, L E., E. Spoerl, and T. H. Weiman
A survey of effects of chemicals on division and growth of Escherichia coli

(1954) Journal of Bacteriology, Volume 68, Issue 6, Page No 637-644,
DOI: https://doi.org/10.1128/jb.68.6.637-644.1954
Article Link: https://journals.asm.org/doi/10.1128/jb.68.6.637-644.1954

22. Makris KC, Shakya KM, Datta R, Sarkar D, Pachanoor D
Chemically catalyzed uptake of 2,4,6-trinitrotoluene by Vetiveria zizanioides

(2007) Environmental Pollution, Volume 148, Issue 1, Page No 101-106,
DOI: https://doi.org/10.1016/j.envpol.2006.10.047
Article Link: https://www.sciencedirect.com/science/article/abs/pii/S026974910600604X?via=ihub

23. Naota Oku and Robert C.MacDonald
Solubilization Of Phospholipids By Chaotropic Ion Solutions

(1983) The Journal of Biological Chemistry, Volume 258, Issue 14, Page No 8733-8738,

24. Nunn, W. D., and B. E. Tropp
Effects of phenethyl alcohol on phospholipid metabolism of Escherichia-coli

(1972) Journal of Bacteriology, Volume 109, Issue 1, Page No 162-168,
DOI: https://doi.org/10.1128/jb.109.1.162-168.1972
Article Link: https://journals.asm.org/doi/10.1128/jb.109.1.162-168.1972

25. Previc, E., and S. Richardson
Growth-physiological changes in Escherichia coi and other bacteria during division inhibition by 5-diazouracil

(1969) Journal of Bacteriology, Volume 97, Issue 1, Page No 416-425,
DOI: https://doi.org/10.1128/jb.97.1.416-425.1969
Article Link: https://journals.asm.org/doi/10.1128/jb.97.1.416-425.1969

26. Rogus, H. J
Biogenesis of the cell wall in bacterial morphogenesis

(1979) Advances in Microbial Physiology, Volume 19, Page No 1-62,

27. Samuel R. Farrah, Dinesh O. Shah and Lonnie O. InGram
Effects of chaotropic and antichaotropic agents on elution of poliovirus adsorbed on membrane filters

(1981) Proceedings of the National Academy of Sciences of the United States of America, Volume 78, Issue 2, Page No 1229-1232,

28. Slater, M., and M. Schaecter
Control of cell division in bacteria

(1974) Volume 38, Issue 2, Page No 199-221,
DOI: https://doi.org/10.1128/br.38.2.199-221.1974
Article Link: https://journals.asm.org/doi/10.1128/br.38.2.199-221.1974

29. Spratt, B. G., A. Boyd, and N. Stoker
Defective and plaque-forming lambda transducing bacteriophage carrying penicillin-binding protein-cell shape genes: genetic and physical mapping and identification of gene products from the lip-dacA-rodA-pbpA-leuS region of the Escherichia coli chromosome

(1980) Journal of Bacteriology, Volume 143, Issue 2, Page No 569-581,
DOI: https://doi.org/10.1128/jb.143.2.569-581.1980
Article Link: https://journals.asm.org/doi/10.1128/jb.143.2.569-581.1980

30. Tetsuaki Tsuchido, Ancharida Svarachorn, Hiroko Soga and Mitsuo Takano
Lysis And Aberrant Morphology Of Bacillus Subtilis Cells Caused By Surfactants And Their Relation To Autolysin Activity

(1990) Antimicrobial Agents And Chemotherapy, Volume 34, Issue 5, Page No 781-785,
DOI: https://doi.org/10.1128/AAC.34.5.781
Article Link: https://journals.asm.org/doi/10.1128/AAC.34.5.781

31. Victor A. Fried, Aaron Novick
Organic Solvents as Probes for the Structure and Function of the Bacterial Membrane: Effects of Ethanol on the Wild Type and an Ethanol-Resistant Mutant of Escherichia coli K-12

(1973) Journal of Bacteriology, Volume 114, Issue 1, Page No 239-248,
DOI: https://doi.org/10.1128/jb.114.1.239-248.1973
Article Link: https://journals.asm.org/doi/10.1128/jb.114.1.239-248.1973