

Evaluation of Bacteriocin Presence in Harsh Industrial Waste Environment

K.L.R. Bonhi and Sabiha Imran

¹Department of Biotechnology,
Faculty of Engineering and Technology,
Manav Rachna International Institute of
Research and Studies,
Faridabad, India

²Department of Biotechnology,
Faculty of Engineering and Technology,
Manav Rachna International Institute of
Research & Studies Faridabad, India.

E mail: ¹klrbonhi@gmail.com, ²sabiha.fet@mriu.edu.in

Abstract—A total number of 45 samples were accumulated from different waste discarding site of Ameetuff Technical Paints Industries (Faridabad), Oriental Plastic Industries (Faridabad) and Baco Metallic Industry (Noida). Thirty six bacterial strains were isolated which were checked for their gram reaction. Twenty four strains were found to be gram negative and 12 bacterial isolates were found to be gram positive. They were checked for their bacteriocin like antimicrobial peptide production but none of the bacteria was found to produce bacteriocin . Bacteriocins are bacterial ribosomal synthesized antimicrobial peptide which are secreted by bacteria itself to promote their growth and suppressing other bacterial growth. On the contrary in harsh environment like those associated with industrial waste with a high concentration of heavy metals ,the degree of adaptation required ensures that both multiplication and survival of bacteria is difficult leading to much smaller populations and hence the competition for survival is much reduced . This important fact might have played an important role in contributing towards the non expression of the gene responsible for bacteriocin synthesis.

Keywords: Bacteriocins, Industrial wastes, Heavy metals.

"1. Introduction"

Due to mechanization and industrialization, there has been need for mining heavy metals form a part of the waste in a large number of manufacturing units and their incorrect disposal into natural water bodies or in landfills leads to contamination and "poisoning" of the soil and other essential resources doing great damage to the ecosystem. The heavy metals are majorly toxic substance which can't be decomposed into natural forms and hence they threaten the stability of environments (1). Natural water bodies like rivers , lakes etc are polluted with heavy metal concentration due to incessant industrial effluents (2). From different primary and secondary industries such as metal manufacturing, paint units, Plastic manufacturing, steel manufacturing and mining for ore

extraction, the heavy metals are contributed to the ecosystems with the pesticides and growth enhancer which are applied in agricultural applications. Ground water resources are affected due to heavy metals that expose both human and animals to harmful health hazards (3) leading to significant morbidity and mortality. Bacteria inhabit and colonize almost every environment imaginable. In favourable environment the different types of bacteria and their rapid multiplication leads to competition for space and nutrients and a fight for survival (4) .The bacteria with the ability to secrete bacteriocins, which have bactericidal property (5) have an advantage in such a situation because they are able to eliminate the competition and emerge as the stronger entity (6). The Present study deals with the efficacy evaluation of bacteria (industrial waste isolates) for their production of bacteriocin.

."2. Material and Methods"

2.1 Sources of Sample :

Soil and water samples were taken in sterile bottles from waste discarding sites of Ameetuff Technical Paints Industries (Faridabad), Oriental Plastic Industries(Faridabad) and Baco Metallic Industry (Noida).

2.2 Isolation of Bacteria :

Samples were diluted serially to isolate the bacteria. For stock solution, the solid waste of 1 g was mixed with d/w (10ml) and in case of waste water 1ml of sample was suspended with 10ml of d/w. The solutions were vortex properly . After sedimentation working solution was prepared till 10⁻⁹dilution. From final 2 dilutions 0.1 ml of sample was poured in empty petri plate and then melted nutrient agar media was poured inside the plate. After proper mixing the plate were kept for solidification and incubated overnight at 37°C to observe

bacterial colony. Gram staining was done to differentiate the gram positive and the gram negative bacteria.

2.3 Screening for Bacteriocin like Activity :

Bacterial Strains and indicator strains were grown in liquid nutrient broth medium. Particular indicator strain was selected for both gram positive and gram negative bacteria. Bacterial isolates (0.5ul) was spotted on BHI agar plates and incubated overnight. After that, soft agar containing particular indicator strains poured into the bacteria spotted BHI agar plates and incubated for 18 hours to observe the bacteriocin like activity of bacteria through the inhibition zone around the spot.

"3. Results and Discussion"

A total number of 36 bacterial isolates of which gram negative (24) and gram positive (12) were tested for their bacteriocin like activity. But none of the bacterial isolates showed inhibitory activity against indicator strains. Microorganisms from industrial wastes consume lot of heavy metals resulting in the failure of bacteriocin production.

Chemically high toxic metals pose serious threat to human health by adversely affecting the function of the various organ systems (7). Metals such as As, Ni, Cu etc. are available in lower concentration compatible with functioning of flora and fauna in the ecosystem are beneficial but higher concentration causes chronic diseases like carcinoma and harmful mutations affecting the DNA (8). The oceanic ecosystem is heavily polluted with heavy metals such as iron, copper, zinc, manganese, molybdenum, selenium and nickel etc. Scientists have come up with several solutions as a part of ongoing research over the past several years to address the issue of high mercury levels in the sea along with other heavy metals (9). The term "heavy metals" is a mammoth terminology usually applied to the set of metals that possess atoms either above 4000 kg/ m³ or five times above water (10). The contaminations emerging out of heavy metals adversely affect the environment. They are augmented from nineteenth centuries onwards as a consequence of excessive urbanization which involved ore extraction. The heavy metals are routed to rivers and sea by soil erosion due to human activities (11). Bacteriocin Producing bacteria was reported from agro industrial waste (12) but due to heavy metal consumption no bacteriocin like activity production by bacteria was reported from the paint industry, plastic industry and metal industry.

"4. Conclusion"

The inability to isolate bacteriocin from bacteria inhabiting industrial waste leads us to the conclusion that bacteriocins do not have a role to play in a scenario where there is not much competition for space and nutrients. This is because the Genes responsible for the synthesis of bacteriocins are shut down as the bacteria evolve. Thus the environment in which the bacteria finds itself plays an important role in deciding the genetic makeup and properties of the bacteria. Favourable conditions would lead to expression of bacteriocin gene that promote survival and vice versa.

"5. References"

- [1] Asha L.P., and Sandeep R.S., "Review on bioremediation potential tool for removing environmental pollution", *International Journal of Basic and Applied Chemical Sciences*, 3(3), 2013, pp. 21-33.
- [2] Bao M.T., Wang L.N., Sun P.Y., Cao L.X., Zou J., and Li Y.M. "Biodegradation of crude oil using an efficient v consortium in a simulated marinen environment", *Mar Pollut Bull*; 64(6), 2012, pp. 1177± 85.
- [3] Selvapathy P., Juliet J., Jeslien and S, Prabha., "Heavy metals removal from waste water by water lettuce", *Indian J. Environmental protection*; 18, 1997, pp. 1-6
- [4] Tashakor, A., Hosseinzadehdehkordi. M., Emruzi, Z. and Gholami, D., "Isolation and identification of a novel bacterium, *Lactobacillus sakei* subsp. dgh strain 5, and optimization of growth condition for highest antagonistic activity", *Microbial Pathogenesis*, 106, 2017, pp. 78-84.
- [5] Zheng, J., Ganzle, M.G., Lin, X.B., Ruan, L. and Sun, M. "Diversity and dynamics of bacteriocins from human microbiome. Environ", *Microbiol.*, 17, 2015, pp. 2133–2143.
- [6] Chikindas ,M.L., Weeks, R., Drider, D., Chistyakov, V.A. and Dicks, L.M. "Functions and merging applications of bacteriocins", *Curr.Opin.Biotechnol*, 49, 2017, pp 23–28.
- [7] Suranjana R., and Manas K. R., " Bioremediation of Heavy metals Toxicity with special Reference to Chromium", special: 5763, ISSN09741143, 2009
- [8] Salem H.M., Eweida E.A., and Farag A., "Heavy metals in drinking water and their environmental impact on human health", Giza, Egypt , 2000, pp. 542556.
- [9] Bryan G.W., and Gibbs P.E., "Zn a major inorganic component of nereidpolychaete jaws", *Journal of the Marine Biological Association of the United Kingdom*; 59, 1980, 969-973
- [10] Paul D.S., and Sinha S.N., "Isolation and characterization of a phosphate solubilizing heavy metal tolerant bacterium from river Ganga, West Bengal, India, Songklanakarim" *J. Sci. Technol*, 37, 2015, 651e657
- [11] Gupta N., Yadav K.K., Kumar V., and Singh D. " Assessment of Physicochemical Properties of Yamuna River canal in Agra City" *International Journal of Chem Tech Research CODEN (USA)*; 5(1), 2013, pp. 528-531
- [12] Alam , S. I. "Studies on Bacteriocins from Environmental Bacteria", *Ph.D Thesis, University of Karachi*, 2010