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Halophilic Bacteria Isolated from Hypersaline Water Body in Lagos State, Nigeria and Their Polyhydroxylalkanoate (PHA) Producing Potential

BY

FAYEMI, S O^{1,2} and BOBOYE, B E¹

¹*Federal University of Technology, Akure, School of Science, Department of Microbiology, Ondo State, Nigeria.*

²*Redeemer's University, College of Natural Sciences, Department of Biological Sciences, PMB 230, Ede, Osun State, Nigeria.*

Introduction

- What are halophilic bacteria?
- What are hypersaline water body?
- What are Polyhydroxylalkanoates (PHA)?
- Use and Importance of PHA
- Production of PHA
- Bacteria production of PHA

Objectives

The specific objectives of this research are to:

- Enumerate and identify bacteria associated with hypersaline water body in Lagos State, Nigeria.
- Determine the growth of the bacterial isolates at 3% (w/v) salt tolerance level.
- Assay PHA production potential of the identified bacteria.
- Investigate the physicochemical properties of sampled water.

Methodology

- Water sample collection
- GPS
- water sampler -Modified Bugnicourt *et al.* (2014)
- Bacterial isolation, enumeration and identification methods
- serial dilution
- spread plate PCA (Sanada *et al.* (2011))
- Identification of Bacterial isolates
- Biochemical tests
- Effects of 3% (w/v) salt on bacterial growth:
- Minimal + NaCl (3% w/v)
- Incubation period

Experimental Setting

PHA potentials on all isolates obtained from samples (Modified method of Al Enazi *et al.* (2014))

Site of water collection: St1= lat. 6.35° and long. 3.28° ; St2= lat. 6.35° and long. 3.40° ; and St3= lat. 6.36° and long. 3.47° .

Water collection levels below surface of water: Top= 0-7 cm; Middle= 50 meters; and Bottom= 100 meters.

Results and Discussion

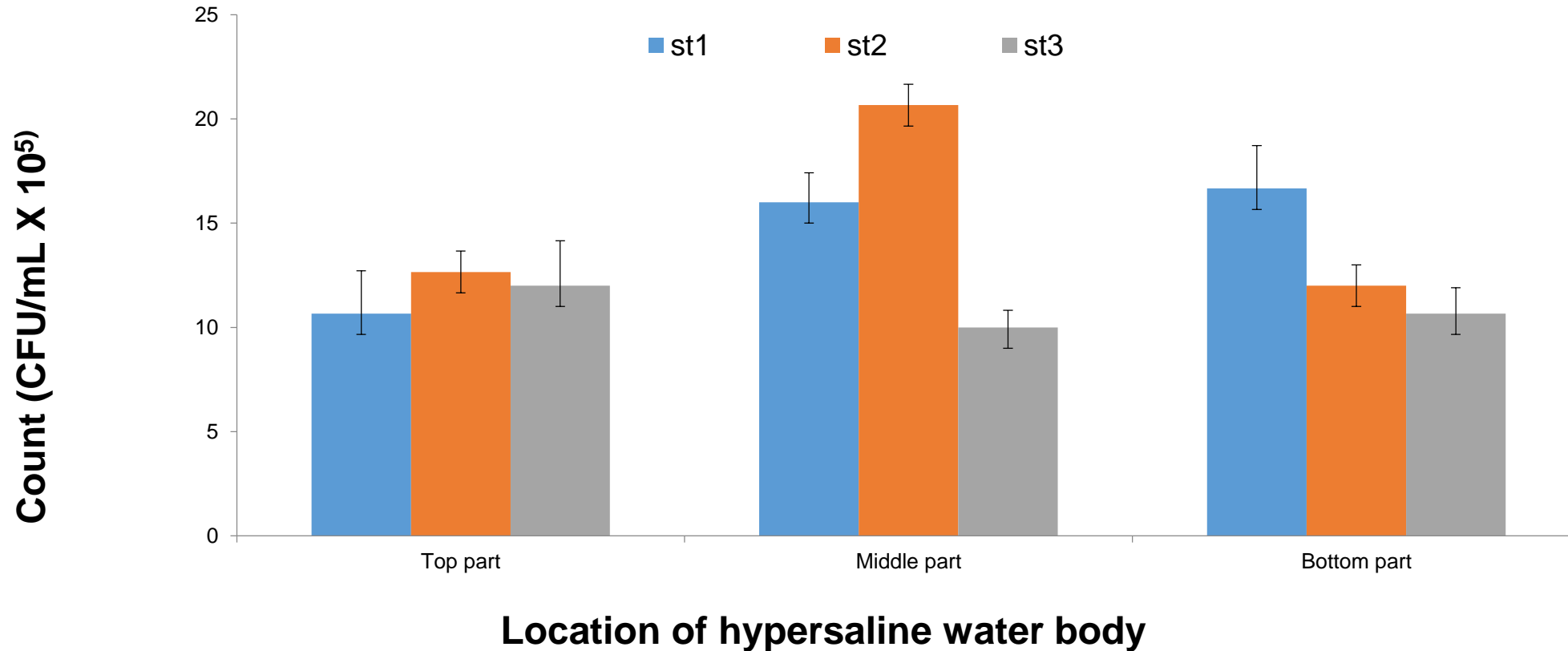


Figure 1: Bacterial load of hypersaline water body in Lagos State, Nigeria

Results and Discussion

Table 1: Types of bacteria isolated from the hypersaline water body in Lagos State, Nigeria

Micrococcus varians

Mycobacterium delbrueckii

Lactobacillus delbrueckii

Micrococcus luteus

Mycobacterium smegmatids

Neisseria veillonella

Corynebacterium kutscheri

Staphylococcus epidermidis

Enterobacter intermedius

Bacillus badius

Staphylococcus saprophyticus

Enterobacter amnigenus

Bacillus macquariensis

Staphylococcus aureus

Serratia marcescens

Bacillus megaterium

Klebsiella pneumoniae subsp pneumoniae

Yersinia pestis



Results and Discussion

Table 2: Potential PHA and non-PHA bacterial producers isolated from the hypersaline water body in Lagos State, Nigeria

	Number of bacterial isolated	Percentage number of bacterial isolates
Total bacterial isolates obtained	185	100%
PHA potential positive bacterial isolates	164	88.6%
PHA potential negative bacterial isolates	21	11.4%



Results and Discussion

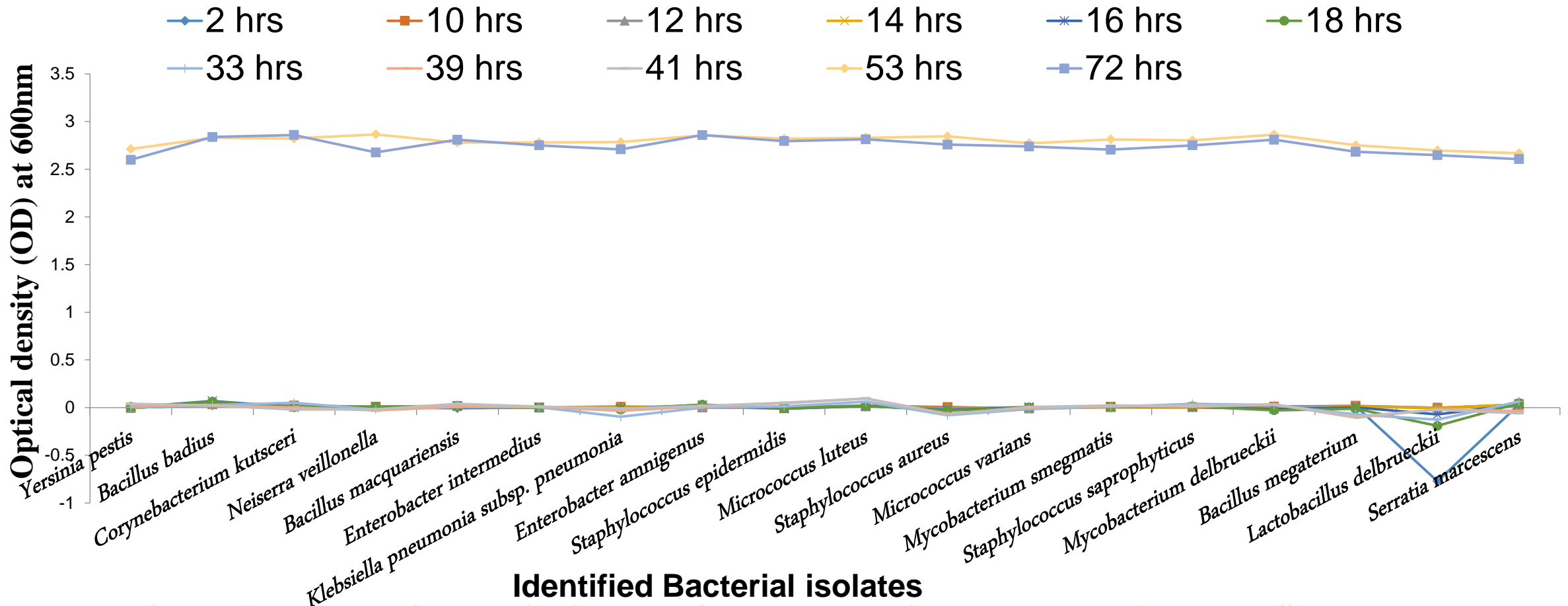


Figure 2: growth of bacterial isolated from hypersaline water body in Lagos State, Nigeria in 3% salt concentration incubated at different periods

Results and Discussion

Table 3: Physical characteristics of different hypersaline water body in Lagos State, Nigeria sampled sites for PHA bacterial isolates

Parameters	0-7cm surface			50m below surface			100m below surface		
	st1 top	st2 top	st3 top	st1 middle	st2 middle	st3 middle	st1 bottom	st2 bottom	st3 bottom
P Temperature (°C)	26.79±0.050	27.71±0.071	27.56±0.0356	28.04±0.042	23.4±0.05 715	26.55±0.04967	27.54±0.04 32	27.04±0. 11431	27.29±0. 08524
h pH	7.88±0.016	7.96±0.049	7.89±0.216	7.78±0.456	7.9±0.221 96	7.91±0.07789	7.7±0.066	7.78±0.1 3952	7.92±0.0 6976
y Turbidity (NTU)	0.255±0.049	0.166±0.071	0.303±0.036	37.4±0.042	17.9±0.05 715	0.863±0.04967	36.4±0.043 2	8.92±0.1 1431	0.933±0. 08521
s Conductivity μS/cm	39000±74.569	38900±231.92	37700±380.833	41600±498.679	38700±94 1.55	37300±462.97 3	43100±731. 208	43500±8 14.843	42000±2 46.079
i Total suspended solids (mg/L)	2±1.247	1±0.817	0±0	48±22.760	21±9.9331 1	8±2.62467	37±2.16025	9±2.4494 9	0±0
a Total dissolved solids (mg/L)	21250±9229.16	21390±504.225	20730±196.903	22880±816.021	21200±88 9.301	20500±530.07 4	23705±225. 038	23900±9 4.078	23100±2 056.42



Results and Discussion

Table 3: Chemical characteristics of different hypersaline water body in Lagos State, Nigeria sampled sites for PHA bacterial isolates

Parameters	0-7cm surface			50m below surface			100m below surface		
	st1 top	st2 top	st3 top	st1 middle	st2 middle	st3 middle	st1 bottom	st2 bottom	st3 bottom
Total acidity (mg/L)	40±8.165	90±21.206	130±14.142	50±8.165	10±0.00	80±16.33	40±0.0	60±16.33	70±8.165
Total alkalinity (mg/L)	50±2.828	54±2.828	50±3.266	66±4.3205	62±2.8284	48±2.828	104±5.099	64±2.828	50±1.633
Chloride (mg/L)	15240±214.17	15670±96.264	16760±134.91	17190±392.26	17900±81.65	15240±176.64	17720±216.4	17930±72.572	14880±200.5
Nitrate (mg/L)	20.4±0.62	21.5±0.852	16.5±0.1414	7.7±0.216	7.6±0.3742	5.2±0.356	9.4±0.637	14±0.163	3.7±0.244
Phosphate (mg/L)	0.97±0.023	0.86±0.057	0.24±0.0374	0.96±0.008	0.74±0.037	0.3±0.014	0.44±0.037	0.93±0.356	0.18±0.0163
Sulphate (mg/L)	2750±66.83	2700±8.165	2770±21.602	2790±37.417	3380±42.426	2990±86.023	2950±64.807	3620±21.6	3220±35.59
Dissolved Oxygen (mg/L)	4.21±0.31	4.42±0.057	4.09±0.0497	4.15±0.155	4.08±0.043	4.26±0.042	4.38±0.107	4.27±0.029	4.24±0.0432
Chemical Oxygen Demand (mg/L)	4.21±8.286	1986±4.969	2174±17.569	2239±28.856	2203±70.8	2737±51.659	1984±47.633	2096±26.7	3699±173.73
Biological Oxygen Demand (mg/L)	4.21±15.776	496.5±19.854	543±16.513	559.75±8.127	350.75±5.199	684.25±5.961	496±4.967	524±12.32	924.75±18.93



Results and Discussion

Table 4: Trace/heavy metals characteristics of different hypersaline water body in Lagos State, Nigeria sampled sites for PHA bacterial isolates

Parameters	0-7cm surface			50m below surface			100m below surface		
	st1 top	st2 top	st3 top	st1 middle	st2 middle	st3 middle	st1 bottom	st2 bottom	st3 bottom
Calcium (mg/L)	1230±68.430	1016±142.857	907.7±8.709	1182±24.124	1007±73.842	984.4±68.504	1360±1.414	2064±11.313	1270±122.90
Magnesium mg/L)	463±18.457	314.8±1.203	398.2±6.364	449.8±8.510	371.3±17.196	398.2±5.273	393.1±29.635	290.7±7.091	309.7±10.114
Zinc (mg/L)	0.0122±0.001	0.0126±0.000	0.0174±0.075	0.0321±0.003	0.05±0.001	0.0194±0.000	0.0106±0.001	0.0167±0.001	0±0.0
Copper (mg/L)	0±0.0	0±0.0	0±0.0	0±0.0	0.0149±0.001	0±0.0	0±0.0	0±0.0	0±0.0
Iron (mg/L)	0.1367±0.002	0.1367±0.002	0.4407±0.035	3.8239±0.285	1.10787±0.001	0.5842±0.020	1.3499±0.008	0.1147±0.001	0±0.0
Chromium (mg/L)	0.399±0.005	0.7081±0.089	0.6636±0.012	0.399±0.046	0.9703±0.033	1.0462±0.0157	0.0448±0.013	1.273±0.001	1.3047±0.1
Sodium (mg/L)	4560±14.142	4580±117.757	4330±2009.377	4720±16.997	4470±336.749	4200±11.776	4890±216.024	4900±137.625	4826±84.048
Manganese (mg/L)	0±0.0	0±0.0	0.0562±0.005	0.1755±0.005	0.0377±0.002	0.0137±0.001	0.311±0.018	0.0017±0.000	0±0.0
Lead (mg/L)	0±0.0	0±0.0	0±0.0	0±0.0	0±0.0	0±0.0	0.0129±0.002	0±0.0	0±0.0
Cadmium (mg/L)	0.0672±0.005	0.0077±0.001	0.1147±0.048	0.2187±0.004	0.848±0.0403	0.0809±0.001	0.0367±0.001	0.0558±0.00	0.0687±0.00
Potassium (mg/L)	23.81±0.891	27.09±0.870	25.78±0.270	27.0939±2.842	24.7147±0.516	24.26±0.460	23.7395±0.573	22.3581±0.859	25.1444±0.8
Nickel (mg/L)	0±0.0	0±0.0	0±0.0	0±0.0	0±0.00	0±0.0	0±0.0	0±0.0	0.0122±0.00
Silver (mg/L)	0.0571±0.009	0.2367±0.001	0±0.0	0.8942±0.017	0.01811±0.000	0.1998±0.005	0.1503±0.0102	0.0134±0.000	0.0132±0.00



Conclusions & Recommendations

- Highest microbial load as recorded at fifty 50m below water surface (table 1) signifies the ideal target area for rich microbial diversity in the hypersaline water body of Lagos State, Nigeria. A total of eighteen (18) bacteria identified isolates were recorded in this water body, viz: *Micrococcus varians*, *Micrococcus luteus*, *Bacillus badius*, *Bacillus macquariensis*, *Bacillus megaterium*, *Corynebacterium kutscheri*, *Mycobacterium delbrueckii*, *Mycobacterium smegmatis*, *Staphylococcus aureus*, *Staphylococcus saprophyticus*, *Staphylococcus epidermidis*, *Lactobacillus delbrueckii*, *Klebsiella pneumonia subsp. pneumonia*, *Neisseria veillonella*, *Enterobacter intermedius*, *Enterobacter amnigenus*, *Serratia marscens* and *Yersinia pestis* across the three (3) sites and depths. In all *Enterobacter intermedius* and *Yersinia pestis* are non PHA producers. However, these bacterial isolates showed optimum growth in 3% salt concentration. The results established the presence of PHA producing bacteria in the studied hypersaline water body of Lagos State, Nigeria.

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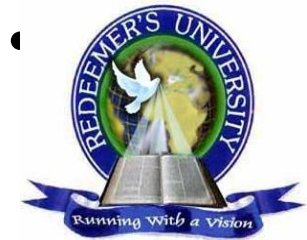
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