

Application of Innovative Bioremediation Technique Using Bacteria for Sustainable Environmental Restoration of Soils from Heavy Metals Pollution: A Review

School of the Environment, Florida A&M University, Tallahassee, Florida, USA

Hoyle-Gardner J, School of the Environment, Florida A&M University, Tallahassee, Florida, USA, Tel: +18504127049; E-mail: hoylegardner@famu.edu

May 01, 2020;

May 19, 2020;

May 27, 2020

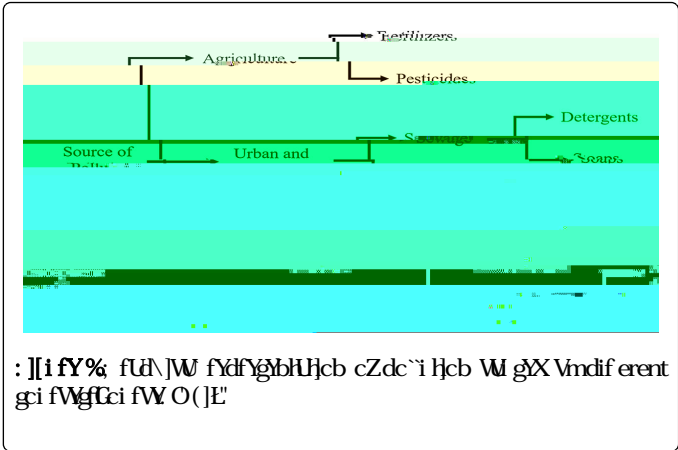
© 2020 Hoyle-Gardner J, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Currently, heavy metals

dc`i hcb gbw`lh lbw`xg g`ghubuy fya`yx`hcb h`wbc`c`]y`g`lc`
 fya`cj`y`wa`d`y`mcf`fy`x`w`h`y`y`j`ma`y`ug`y`y`g`ub`x`f`g`c`f`y`h`y`
 y`w`g`h`a`lc`]g`c`f`]`b`u`w`b`x`h`c`b`c`z`g`c`]"`-`b`h`l`g`f`y`]`k`z`g`i`f`w`g`c`z`g`c`]
 dc`i`h`c`b`k`]h` \`y`j`m`a`y`u`g`e`f`e`c`t`s`c`z` \`y`j`m`a`y`u`g`c`b`g`c`]
 a`]`w`c`c`f`]`u`b`]g`a`g`z`l`c`]`w`e`f`e`c`t`s`c`z` \`y`j`m`a`y`u`g`c`b` \`i`a`u`b`g`z`
 v`c`f`y`a`y`x`h`c`b`c`z`g`c`]`i`g`b`]`v`u`m`f`]`u`f`y`a`u`b`n`x`l`g`w`g`g`x`"

Gci fWgcZGc]` Dc`i hcb k]h < YJ mA YUg

Gc]` Wb]Ubg`y`j`ma`y`ug`b`u`i`f`u`m`]b`h`y`z`f`a`c`z`f`c`w`g`T`e`y`f`y`
 Ugc`d`f`c`x`i`w`x`l`g`v`n`d`f`c`x`i`w`g`x`i`f`]b`]`b`x`i`g`f`]u`d`f`c`w`g`g`g`Gc]`g`f`y`
 dc`i`h`x`k`]h` \`y`j`m`a`y`u`g`h`f`c`i`[` \`b`u`i`f`u`u`b`x`u`b`h`f`c`d`c`]`y`b`]w`
 g`i`f`w`g`T`e`b`u`i`f`u`g`i`f`w`g`f`y`k`u`h`y`f`]b`]`c`z`a`]b`y`f`u`g`z`y`f`c`g`c`b`u`b`x`
 j`c`w`b`]w`u`m`]j`]h`y`g`z`f`y`g`h`f`r`e`s`u`b`x`v`c`]`y`b`]w`g`i`f`w`u`b`x`d`u`h`]w`g`
 f`y`y`g`g`x`v`n`j`y`]`y`h`]c`b`Q`S`]`u`b`x`h`y`f`w`b`w`b`h`f`h`c`b`g`]b`g`c`]`g`j`f`]y`g`
 u`w`e`x`]b`]`l`c`h`y`b`u`i`f`y`c`z`h`y`f`c`w`z`]l`g`c`w`h`c`b`u`b`x`u`y`r`e`f`i`n`i`n`g`u`b`x`
 a`]b`]b`]`c`z`f`c`w`g`z`d`y`g`]w`x`g`z`v`u`h`f`]y`g`z`d`u`y`f`]b`x`i`g`f`]y`g`z`h`b`b`y`f`]y`g`z`
 z`f`]h`]n`y`f`]b`x`i`g`f`]y`g`z`g`]x`k`u`h`y`g`x`l`g`c`g`u`]b`w`x`]b`]`g`k`u`y`g`i`x`i`y`z`
 k`u`h`y`k`u`h`f`]f`]h`]c`b`u`b`x`j`y`]w`u`f`y` \`u`g`h`f`y`h`y`u`b`h`f`c`d`c`]`y`b`]w`
 g`i`f`w`g`c`z` \`y`j`m`a`y`u`g`dc`i`h`c`b`]b`h`y`g`c`]`f`]i`f`y`%`A`]b`]b`]`u`b`x`
 a`u`b`i`z`u`m`]f`]b`]`]b`x`i`g`f`]y`g`f`y`h`y`a`u`b`g`i`f`w`g`c`z` \`y`j`m`a`y`u`g`h`u`h`
 dc`i`h`y`h`y`g`c`]"`S`i`y`l`c`]b`w`u`g`g`x`i`f`v`u`b`]n`h`]c`b`u`b`x`]b`x`i`g`f`]u`n`h`]c`b`z`
 d`i`f`e`r`e`n`t`_`]b`x`g`c`z`g`k`u`y`z`]f`]h`]c`b`z`]b`x`i`g`f`]u`k`u`h`y`z`u`b`x`g`i`x`i`y`
 w`b`h`]b`]b`]` \`y`j`m`a`y`u`g`f`y`f`y`y`g`g`x`]b`l`c`h`y`g`c`]`O`%`'`]"`<`y`j`m`
 a`y`u`g`f`y`]b`h`c`x`i`w`x`]b`l`c`z`c`x`w`u`b`g`g`w`l`g`]f`u`b`g`u`b`x`j`y`]`y`h`u`y`g`
 [f`c`k`b`]b`dc`i`h`x`g`c`]`g`O`-`]"`



Ef ects cZ< YJ mA YUgcb Gc]` A]Wccf] U]g`a`g

A`y`u`g`k`]h`c`i`h`v`c`c`]w`z`b`w`]c`b`g`w`l`g``y`u`z`a`y`f`w`f`m`f`y`

Ag 0.1 Exposure may cause skin and other body

Ni	<i>Micrococcus sp.</i> , <i>Pseudomonas spp.</i> , <i>Acinetobacter sp.</i> <i>Desulfovibrio desulfuricans</i> (immobilize on zeolite)	[87],[97]
Hg	<i>Klebsiella pneumoniae</i> , <i>Pseudomonas aeruginosa</i> , <i>Vibrio parahaemolyticus</i> (PG02), <i>Bacillus licheni formis</i> , <i>Vibrio fluvialis</i>	[91],[98],[99]
Cr	<i>Bacillus cereus</i> , <i>Acinetobacter spp.</i> and <i>Arthrobacter sp.</i>	[88],[100]
Zn	<i>Bacillus firmus</i> , <i>Pseudomonas spp.</i>	[87],[101,102]
Co	<i>Enterobacter cloacae</i>	[91]

HWY .

h Ym dYzfa a i HdY Z bWjcbg g W Ug ja dfcj YX g]` ei U]hã
Yb\UbWX d'Ubh[fckhž

