

# Bioremediation:

[Literature](#), [Russian Literature](#)



Bioremediation: Manipulating nuclear and heavy metal waste. S James  
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Abstract The cost of progression, as consumption for food, electronics, materials goods, and energy increase, so does the externality of pollution. To keep up with the industrial world demand for power, and with the reducing resources of traditions fuels, science and ingenuity has lead to nuclear power. Nuclear fusion powers the stars and nuclear fission powers 20% of the United States, but at a cost of nuclear waste. The future is here, with the help of microscopic organisms, toxic and nuclear waste can be process to remove the hazards to our environment. This science is called bioremediation.

Introduction Its early Tuesday morning, and you have to remember to take your recycling to the street corner for the city to pickup. Once the city picks up your used; aluminum, steel, paper, and other recyclable materials, it is sorted into homogeneous piles, and process accordingly. Nuclear waste is dangerous when exposed to people and is very hard to recycle. But there is another way, bioremediation. Bioremediation takes specific bacteria or engineered bacteria for the job of processing toxic waste into a more disposable form. Compared to most organisms, metabolism is a key component in life, metabolism is the ability for the

organism to process chemicals to maintain life. These bacteria metabolizes the nuclear / toxic refuse and the waste matter produced by the bacteria is a desired product for recycling or reusing. Currently, scientists are exploiting the chelating, ability to hold properties of bacteria to convert soluble Uranium 6+ Ion into solid Uranium 4+ Ion. Nuclear power plant uses Uranium 235, to produce energy by fusion, smashing the atom with a neutron to produce energy. The Uranium 235 used in nuclear reactors is refined from Uranium hexafluoride, which is mined in the natural form of Uranium 6+, 6+ denotes an ion where six electrons are missing from the outer orbitals of the atomic structure. The problem with this Uranium 6+ ion is that its very soluble in water, making it virtually impossible to prevent from it leaching to the ground water. This Uranium 6+ ion is a toxin that poisons the environment. Scientists have found ways to use microscope bacteria to covert Uranium 6+ ion into Uranium 4+ which is not water soluble and is idea form to work with. The process starts by using bacteria that can utilize Iron Oxide (FeO), which catalyzed the electron donor chain and promotes the Uranium 6+ ion to convert to Uranium 4+ ion (<http://water.usgs.gov>, 2013). Cellular respiration is the technical name for a microscope organism to eat food. But unlike other life forms, bacteria can pull the energy required for life from unlikely food stuffs. Most bacteria used in bioremediation metabolize oils from oil spills or from contaminated soil. These bacteria use petroleum, a long complex hydrocarbon, as a food source in their cellular respiration cycle. Once the bacteria eats the pollutant the byproduct is water (H<sub>2</sub>O) and Carbon dioxide (CO<sub>2</sub>), which are not toxic to the environment. But bioremediation can also work on heavy metals. The

*Shewanella putrefaciens* and *Geobacter metallireducens* are bacteria when introduced to anaerobic conditions they require oxygen to perform cellular respiration, this oxygen is acquired from the oxygen attached to the heavy metal ions. These two bacteria absorb the heavy metal ion through their cell walls, called biosorption. There are two major types of cell wall classified one is gram positive (+) the other is gram negative (-), these classifications explain the outermost cell wall covering the bacteria. The cell walls are composed of peptidoglycan a sugar and amino acid building block woven tightly together, this is known as Gram-positive. If a lipid bilayer is present over the peptidoglycan, it is referred to as lipopolysaccharide which makes the prokaryote Gram-negative (Bauman, 2012). Once the heavy metal ion makes it past the cell wall it is processed by cell organelles to convert these ions to fuel their metabolic cycle. These two bacteria are capable of reducing oxygen bonded to heavy metal ions, and changing the oxidation state directly affecting the ion charge, the bacteria once completely oxidized the Uranium 6 ion it becomes Uranium 4+ ion which is now able to be pulled out of the environment (Fingerman, 2005). With the future desiring more goods, electronics, foods, and fuels, the cost to our health, and our environment goes up. Good thing that mother nature has prebuilt tools in the form of microorganisms to help combat the toxins being produced. What is truly amazing is that microscopic life forms are capable of changing the ions on heavy metals. Conclusion The goal of keeping the world habitable is not possible by limiting the what can be taken out of the earth, man is too stubborn. But by mandating that every effort to reduce environmental and health risks be taken, a cleaner future will arise without Uranium 6+ poisoning

our water supplies, and destroying our environment. REFERENCES

Bioremediation of Uranium Plumes with Nano-Scale Zero Valent Iron. (2013, January 15). USGS Water Resources of the United States. Retrieved April 20, 2013, from <http://water.usgs.gov/wrri/10grants/2010AZ395B.html> Bauman, R. W., Masuoka, E., & Montgomery, J. E. (2012). Microbiology: with diseases by body system (3rd ed.). Boston: Benjamin Cummings. Fingerman, M., & Nagabhushanam, R. (2005). Bioremediation of aquatic and terrestrial ecosystems. Enfield, NH: Science Publishers. Mann, J. E. (2009). Recent advances in the development of *Deinococcus* spp. for use in bioremediation of mixed radioactive waste. *MMG 445 Basic Biotechnology*, MMG445. 371211(5), 60-65. | | Exemplary | Accomplished | Beginning | | | 20 Points | 18 Points | 16 Points | | Individual Presenter | Natural, confident delivery, | Low voice, occasionally | Mumbles the words, too many filler| | | excellent use of volume, pace, | inaudible, some articulation but | words, reads most of the | | | keeps audience engaged | not always clear, occasional eye | presentation from the slides or | | | contact but mostly reads | notes with no eye contact with | | | presentation | audience | | Organization | Strong and engaging introduction | Introduction provides overview of| Introduction does not give | | | provides overview of presentation;| presentation; presentation | overview; organization is unclear,| | | presentation supports | supports introduction and ends | or presentation ends without | | | introduction; conclusion | with appropriate conclusion. | conclusion. | | | reinforces main points in | | | | memorable fashion. | | | Content/Preparedness | Content throughout the | Content is presented succinctly | Presentation of content is | | presentation is well-researched | for the most part. Research and |

disjointed and incoherent; little| | | and presented succinctly; | preparation are evident; able to | evidence of preparation; unable to| | | presentation is well-prepared and | answer some questions | answer any questions | | | has obviously been rehearsed; able| | | | to answer all the questions | | | | effectively | | | Mechanics/Formatting | Background, font formats (colors, | Background, font formats, and | Background, font formats, or | | | size, type), and graphics | graphics generally support the | graphics make reading and | | | significantly enhance the | readability and content of the | understanding the material | | | presentation; no misspellings or | presentation; only 1-2 | difficult OR detract from the | | | grammatical errors. | misspellings or grammatical | presentation; many misspellings or| | | errors | grammatical errors. | Presentation Rubric Group Number: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Report Rubric A scientific, two or three page paper [excluding the title page and bibliography] has to be submitted with the PowerPoint presentation. This report is an individual assignment and not a group project. | Name | Possible Points | Earned Points | | Introduction | 4 | | | Content | 10 | | | Discussion | 3 | | | General | 3 | | | Grammar and Spelling | | | | References [in text and bibliography] | | | | Total | 20 | | Peer Evaluation Please evaluate your group members based on their input in the project. Total points to be awarded is 5.