Ecological Applications Topic
Using Genetically Engineered Microbial Bioreporters in the Environment
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Using genetically engineered microbial bioreporters in the environment has been around for well over a decade, with substantial uses, ranging from TNT detection in abandoned minefields, to Fe (Iron) concentrations in water samples. This technology provides interest in terms of low-cost, low-maintenance, environmentally friendly sources of detection of various substances.

From the various research articles I have selected, it is apparent that using microbial bioreporters in the environment has positive attributes, allowing the detection of explosives in fields and the detection of Fe bioavailability in soil/water samples. As for the efficacy, it has been reported that the light requirement of cyanobacteria may be somewhat inconvenient/inefficient, the advantages of using photoautrophic bacteria for whole-cell bioreporters stem from the following factors: ability to grow on low-cost minimal media and low maintenance requirements. With more testing, emphasis, and support of using bioreporters in the environment, advances in the technology could be made to make the methods more efficient and effective, which could prove to be a beneficial advancement in the use of bioreporters in the environment.

Bibliography

Research Article

Shemer B, Palevsky N, Yagur-Kroll S, Belkin S (2015).
Genetically engineered microorganisms for the detection of explosives' residues.
Front Microbiol 29:1175.

This research article used *E. coli* that had been genetically modified to fluoresce upon exposure to various explosive compounds such as TNT and DNT after being sprayed onto the target area (landmine). This article contributes a method of bioreporter use in detecting explosive residues in the environment. I found this from the Subcommittee website.

Research Article

Xu, Tingting et al. (2013).

"Genetically modified whole-cell bioreporters for environmental assessment"

Ecological indicators vol. 28 125-141.

https://www.sciencedirect.com/science/article/pii/S0147651301921244?via%3Dihub

This research article provided field applications of bacterial bioreporters for heavy metal bioavailability assessment (Table 1). Various bacteria host strains (*Bacillus subtilis* BR151, *E. coli* CM1166, *Synechococcus* sp. KAS101) had excited promotor activity for the luminescing genes (*cadC-luc*, *ars-luxAB*, P_{isiAB}*-luxAB)*, tested against certain Analytes (Cd, As & Sb, Fe^{3+}) and were given a certain response time (3hr, 1hr, 12hr), measuring the detection limit of said analytes (3.3 nM (Cd), <0.1 mg/L, 0.45 nM). Contributes valuable information, procedures, and mechanisms of bioreporter usage in the environment. I found this article by searching the phrase: "luminescent bioreporters ecological applications," in Google, where the cited research article came up as the first hit.

Research Article

Boyanapalli, Ramakrishna et al. (2006).

"Luminescent whole-cell cyanobacterial bioreporter for measuring Fe availability in diverse marine environments"

Applied and environmental microbiology vol. 73,3 1019-24.

This article tested a *Synechococcus* sp. Strain Fe bioreporter containing the *isiAB* promoter fused to the *Vibrio harveyi luxAB* genes. They researched the Depth profile of a dissolved iron isotope [DFe] and bioavailable Fe measured in nM at station IOW 271 (Gotland Deep) in the Baltic Sea. This article contributes another method of using bioreporters to assess Fe availability in the environment.

I found this article by reading through Table 1 of the previously cited research article. I noticed that the majority of the samples in Table 1 were soil samples, but found one that was a seawater sample. The far right column of Table 1 has references to each experiment, so I clicked on the reference (#24), which has a link to the PMC free article.

Review Article

Normal, L et al (2014).

"Iron Biogeochemistry in Aquatic Systems: From Source to Bioavailability."

https://www.ingentaconnect.com/contentone/scs/chimia/2014/00000068/00000011/art00002?crawler=true

This article provides context on the importance of the bioavailability of Iron in the environment. This contributes to the overall knowledge and importance of the subject of Iron bioavailability, and serving as an educational support to the previous article

I found this article by reading part of the 2nd paragraph of the previously cited article, and wondering why Fe bioavailability was of concern. I searched the phrase, "Iron Biogeochemistry," in Google, and this research article came up as the 4th hit.