

Trinity River Bioremediation Demonstration Project



WATER IS ALIVE

Virginia Kilgore

Water Is Alive (c) 2021

JOE'S CREEK



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BIOREMEDIATION

The use of microbes to clean up contaminated soil and groundwater.



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By bringing more microbial life into the Trinity River Basin we can feed the local beneficial organisms and help them breakdown harmful contaminants and bacteria.



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Electron Donor

An **electron donor** is a chemical entity that donates electrons to another compound.

It is a reducing agent that, by virtue of its donating electrons, is itself oxidized in the process.

The Biology of Electron Donors



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In biology, electron donors release an electron during cellular respiration, resulting in the release of energy.

Microorganisms, such as bacteria, obtain energy in the electron transfer processes.

Through its cellular machinery, the microorganism collects the energy for its use.

The final result is the electron is donated to an electron acceptor.

During this process the electron donor is oxidized and the electron acceptor is reduced. (Wikipedia)

Electron Donors in the Trinity



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Petroleum hydrocarbons, chlorinated solvents
like vinyl chloride, soil, organic matter,
and reduced inorganic compounds.

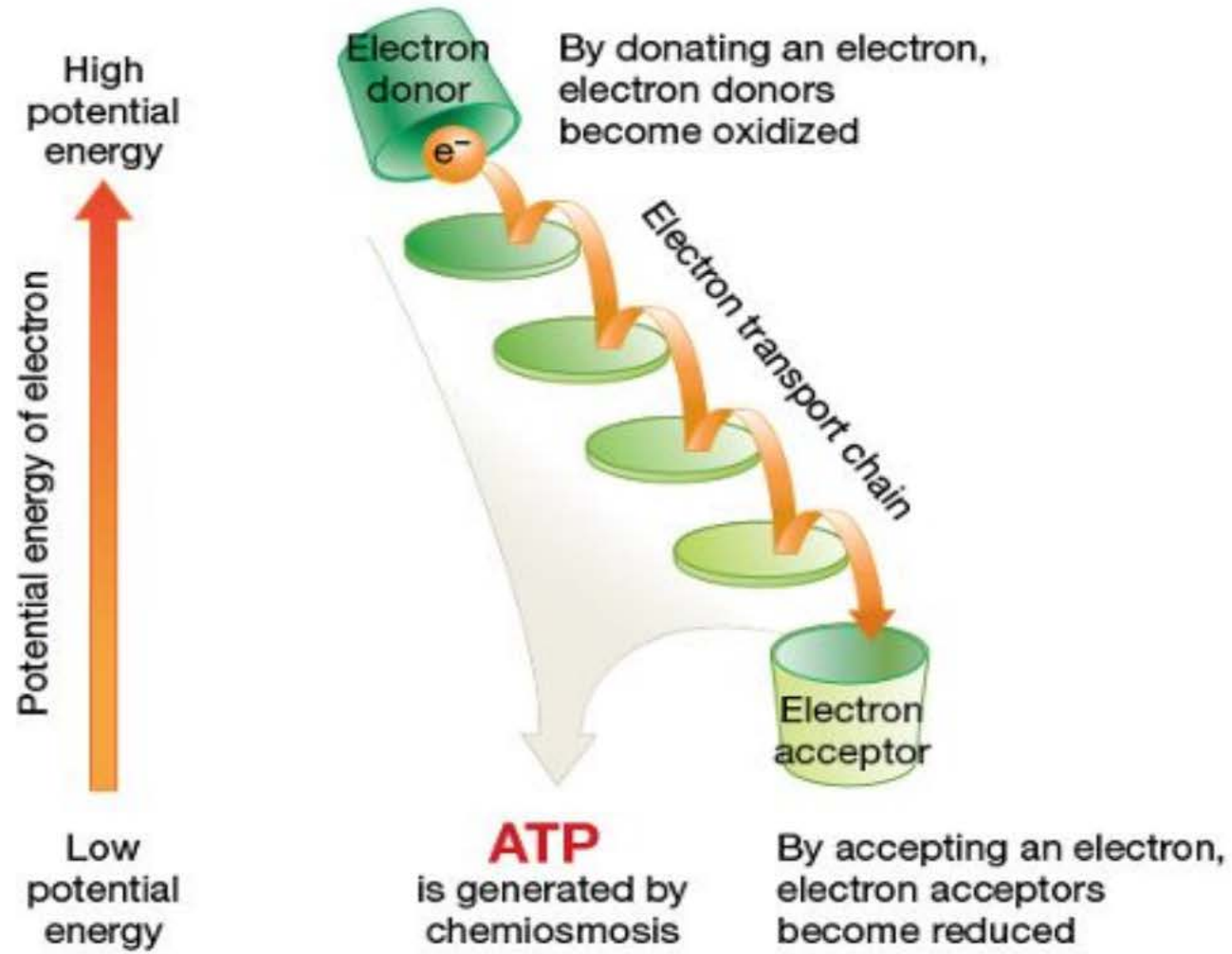
These are all compounds that can act as electron donors.

These reactions are of interest not only because they
allow organisms to obtain energy, but also because they
are involved in the natural biodegradation of organic
contaminants.

MODEL OF ELECTRON TRANSPORT CHAIN (ETC)



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THE DIVERSITY OF ELECTRON DONORS AND ACCEPTORS



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Fuels (edibles)	Oxidants (breathables)
<div> <div>Sunlight</div> <div>Organics {</div> <div>Glucose</div> <div>Ethanol</div> <div>Formaldehyde</div> <div>Methanol</div> </div> <div> <div>Hydrogen</div> <div>Ammonia</div> <div>H₂S*</div> <div>Sulfur*</div> <div>Iron*</div> <div>Manganese*</div> <div>Carbon monoxide*</div> <div>Arsenite*</div> </div>	<div> <div>Organics {</div> <div>Fumarate</div> <div>DMSO</div> <div>TMAO</div> </div> <div> <div>Carbon dioxide*</div> <div>Sulfur*</div> <div>Sulfate*</div> <div>Arsenate*</div> <div>Selenite*</div> <div>Iron*</div> <div>Manganese*</div> <div>Nitrate</div> </div> <div>Oxygen</div>
<div> <div>Black = Used by Eukaryotes and Prokaryotes</div> <div>Red = Used by Prokaryotes only</div> <div>* = Becomes a solid (or forms a solid compound) after oxidation or reduction</div> </div>	



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Effective Microorganisms (EM)

- EM is a liquid culture made up of lactic acid bacteria, photosynthesizing bacteria, yeast, and fermenting fungi.
- Applying EM controls the cold fermentation of organic wastes.
- During fermentation, the Effective Microorganisms multiply as the sugar cane molasses breaks down.



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EM contains about 30 species of micro-organisms which purify and revive nature.

The main species involved are:

Lactic acid bacteria: *Lactobacillus plantarum*, *L. casei*, and *Streptococcus lactis*

Photosynthesizing bacteria: *Rhodopseudomonas palustris* and *Rhodobacter spaeroides*

Yeasts: *Saccharomyces cerevisiae* and *Candida utilis*

Actinomycetes: *Streptomyces albus* and *S. griseus* and *Aspergillus oryzae*

Fermenting fungi: *Penicillium sp.* and *Mucor hiemalis*

Advantages Of Effective Microorganism Biofilters



- Quickly made, the substrate is inoculated with EM and can be placed in the water in 2 weeks
- Uses readily available ugly or unsellable hard fruits and vegetables containing fructose
- Inexpensive because of the time and resources involved
- Extremely effective at metabolizing many kinds of contaminants



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EM Produces

- Enzymes
- Vitamins C and E
- Amino acids
- Antioxidants
- Polysaccharides
- Chelated minerals
- And micro-nutrients



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Trinity River Bio-Remediation Demonstration Project Probiotic Filters

The microorganisms growing on donated agricultural by-products will continue to reproduce in the underwater anaerobic environment.

The inoculated fruits or vegetables will remediate contamination by breaking down and metabolizing contamination and bacteria in the water 24 hours a day.

TESTED SUBSTRATES INOCULATED WITH EFFECTIVE MICROORGANISMS



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BAMBOO SHOOTS



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ONIONS



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THE SAME ONIONS AFTER SITTING IN EFFECTIVE MICROORGANISMS FOR 10 MONTHS



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ONION BIOFILTERS!



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5 GALLONS OF ONIONS PRODUCED 3
BIOFILTERS AND SOAKED IN 2.1 GALLONS OF
EFFECTIVE MICROORGANISMS



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PINEAPPLE BIOFILTERS!



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MYCOREMEDIATION

OR FUNGAL REMEDIATION IS THE PROCESS OF UTILIZING MUSHROOMS TO CLEAN TOXINS AND POLLUTANTS OUT OF THE ENVIRONMENT.

Oyster Mushrooms will eat almost ANYTHING.

They are capable of breaking down oil, plastic, diesel, lead, and much more.

Oyster mushrooms come in a variety of species, and between them they can clean up some of humanities most problematic pollutants.

DONATED AGRICULTURAL BY-PRODUCTS



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MULCH + MYCELIUM =
MUSHROOM
BIOFILTER SUBSTRATE



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100% VOLUNTEER DRIVEN

It takes a village to pollute
a watershed.

And it takes a village to clean it up...



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GROWING MYCELIATED BIOFILTERS IN A TENT



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OYSTER MUSHROOMS



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MYCELIATED BIOFILTER WITHOUT A COFFEE BAG



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THIS DOG HOUSE WAS FOUND ON THE SIDE OF THE ROAD



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INGREDIENTS FOR THE FIRST OYSTER MUSHROOM BIOFILTER TO GO INTO JOE'S CREEK



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DAY 2 OF MYCELIATED FILTER
IN JOE'S CREEK, AFTER A RAIN STORM
AUGUST 15, 2021



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Other measures municipalities can
apply
to NURTURE LIFE
and CLEAN UP contamination
in OUR watershed...

Myceliated Filter Strips



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Tracts of vegetated land that are used to reduce the contamination of surface water.



A FILTER STRIP IS AN AREA VEGETATION
USED TO REDUCE SEDIMENT, ORGANICS,
NUTRIENTS, PESTICIDES, AND OTHER
CONTAMINANTS FROM RUNOFF AND TO MAINTAIN
OR IMPROVE WATER QUALITY.




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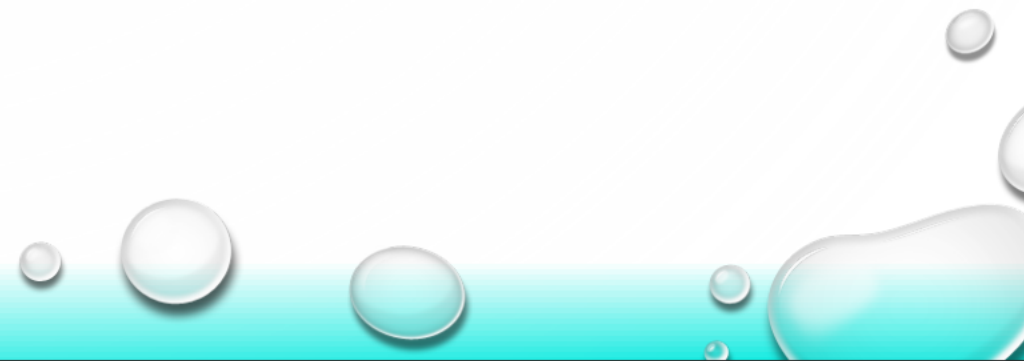
What does a wastewater treatment plant do?



REDUCING AMMONIA AND PH IN WASTEWATER WITH UV TREATMENT



Advantages:

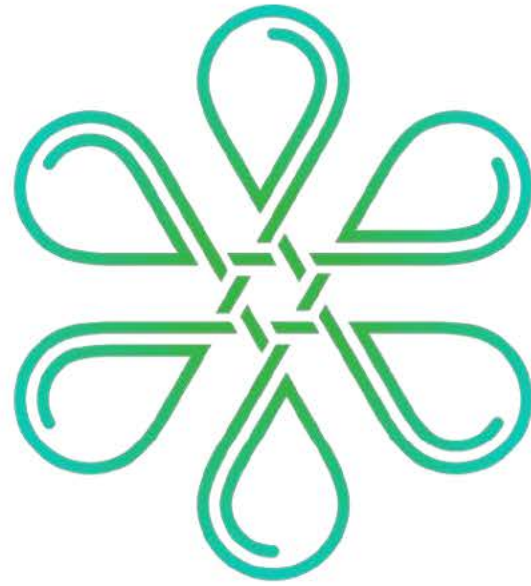
- Inactivates most bacteria, spores and cysts.
 - A physical process that eliminates the need to generate, handle, transport and store corrosive chemicals.
 - No residual effect that can be harmful to humans or aquatic life.
 - UV disinfection is user friendly for operators.
 - Requires less space than other methods.
- 



Be a
Citizen Scientist
and

Let's Grow Biofilters that Will
Eat Contaminants in Our
Waterways!





**Thank
you!**

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