

RETENTION OF HARMFUL METALS IN THE ANIMAS RIVER BASIN



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ABSTRACT

WHILE THERE HAVE BEEN SEVERAL STUDIES PREVIOUSLY CONDUCTED USING THE INCORPORATION OF BIOCHAR AT A HIGH ALTITUDE WITH THE INTENT OF REMEDIATING SOIL AND PLANT GROWTH AFFECTED BY ACID MINE DRAINAGE IN THE ENVIRONMENT, THE EFFECTIVE RETENTION RATE OF HARMFUL METALS (SUCH AS LEAD, IRON, COPPER, MANGANESE, ALUMINUM, AND ZINC) IN SOIL LEACHATE HAS NOT YET BEEN CORRELATED TO A SPECIFIC CONCENTRATION OF BIOCHAR. BIOCHAR WAS ADDED TO SOIL SAMPLES THAT HAD BEEN TAKEN FROM FIVE DIFFERENT REMEDIATION AREAS TO IN ORDER TO CONDUCT SEVERAL SMALL-SCALE TRIALS CONDUCTED IN A LAB. BIOCHAR WAS SHOWN TO REDUCE METAL LEVELS AT CERTAIN CONCENTRATIONS AND WAS SHOWN TO CAUSE SIGNIFICANT PLANT AND VEGETATION GROWTH ONCE THE SAMPLES HAD BEEN COLLECTED, BUT THERE WAS NO UNIFORM CONCENTRATION AT WHICH ALL METAL VALUES DECREASED. THERE WERE SEVERAL METAL VALUES THAT SHOWED SIGNIFICANT DECREASES WHEN EXPOSED TO A 10% BIOCHAR CONCENTRATION, BUT JUST AS MANY OTHER METALS SHOWED MUCH MORE ERRATIC RESULTS, MAKING THE CORRELATIONS BETWEEN THE CHANGES IN METALS AND A SPECIFIC CONCENTRATION OF BIOCHAR UNDETERMINABLE. WE CONCLUDE THAT THAT BIOCHAR ADDITION TO SOIL DOES HELP LOWER LEVELS OF HARMFUL METALS, BUT IN AN UNPREDICTABLE MANNER.

Bio-char (%)	Aluminum (PPM)	Arsenic (PPM)	Cadmium (PPM)	Lead (PPM)	Manganese (PPM)	Selenium (PPM)	Copper (PPM)	Zinc (PPM)	Iron (PPM)
0	700.6	19.8	2.21	243.8	116.2	0	87	637.5	1615
10	165.2	0	1.25	14.4	183	0	98.3	359.8	935
20	215.1	0	1.66	28.4	248.3	0	86.2	523.7	638
30	348.3	0	1.13	69.8	74.7	0.7	75.2	370.3	2061
Total	357.7	5.2	1.59	90.1	159.8	0.1	87.3	478.2	1312

INTRODUCTION

THE INTENT OF OUR RESEARCH WAS TO INVESTIGATE HOW WELL BIOCHAR RETAINS HARMFUL METALS THAT ARE HARMFUL FOR DRINKING WATER OR THE RIVER ECOLOGICAL SYSTEM. ACID MINE DRAINAGE IS A NATURAL CONSEQUENCE OF MINING ACTIVITY WHERE THE EXCAVATION OF MINERAL DEPOSITS (METAL BEARING OR COAL), BELOW THE NATURAL GROUNDWATER LEVEL, EXPOSES INORGANIC COMPOUNDS TO OXYGEN AND WATER (McGUINNESS, S. 1999). PREVIOUSLY PUBLISHED RESEARCH SHOWS THAT BIOCHAR, A LOW-DENSITY PYROLYZING MATERIAL PRODUCED BY BURNING BIOMASS UNDER CONDITIONS OF LOW TEMPERATURE AND MINIMAL OXYGEN (BEESLEY AND MARMIROLI 2010), "NEUTRALIZES THE TOXIC QUALITIES OF ORGANIC AND INORGANIC POLLUTANTS.

METHODS

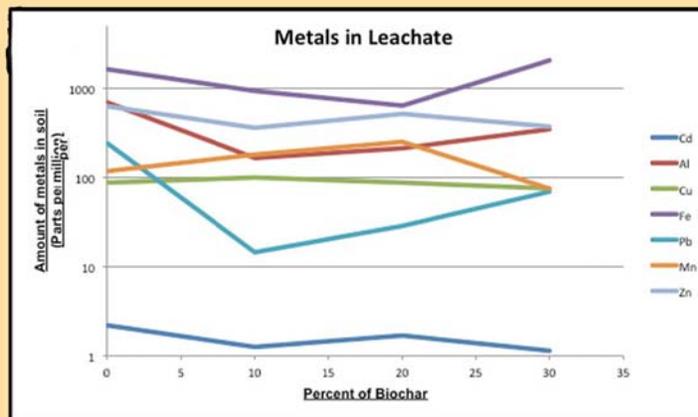
SOIL SAMPLES WERE COLLECTED FROM FIVE DIFFERENT SITES THAT ARE PART OF THE ANIMAS RIVER BASIN. THE SAMPLES WERE TAKEN TO THE LAB AND COMBINED WITH DIFFERENT PERCENTS OF BIOCHAR. A LEACHATE SAMPLE WAS TAKEN AT THE BEGINNING AND END OF THE EXPERIMENT TO TEST FOR PARTS PER MILLION OF SPECIFIC METALS.

RESULTS

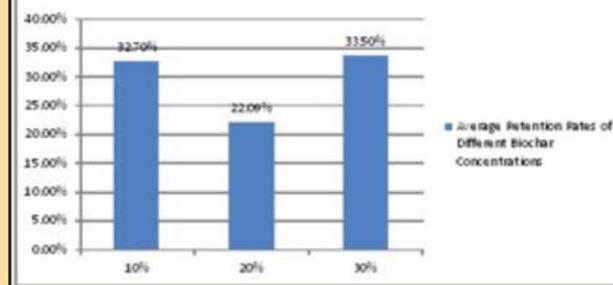
THE TRENDS FOR THE METALS IN LEACHATE DIDN'T SHOW A DISTINCT PATTERN IN RELATION TO THE VARYING PERCENTS OF BIOCHAR. ALUMINIUM, LEAD, AND CADMIUM SHOW A SIGNIFICANT DROP AT TEN PERCENT BIOCHAR, AND THEN INCREASE. IF THEY WERE TO LEVEL OFF THEN IT COULD BE ARGUED THAT BIOCHAR REDUCES SOME OF THE HARMFUL METALS. OUR DATA DOESN'T SHOW ANY OBVIOUS TRENDS TO POINT US IN THE DIRECTION THAT BIOCHAR EFFECTS THE CONCENTRATION OF METALS.

DISCUSSION

THE GRAPH OF THE DATA DOESN'T SHOW ANY OBVIOUS PATTERNS THAT WOULD PROVE THAT BIOCHAR RETAINS METALS IN THE SOIL. OUR HYPOTHESIS, BIOCHAR HELPS RETAIN A GREATER THAN 50% OF HARMFUL METALS, CANNOT BE THERE FOR NOT BE PROVEN. EVEN THOUGH IN SOME METALS, ALUMINIUM AND LEAD, THERE IS AN AVERAGE DECREASE. THIS LEADS US TO BELIEVE THAT BIOCHAR CAN HELP TO REDUCE SOME HARMFUL METALS.



Average Retention Rates of Different Biochar Concentrations



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REFERENCES

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McGUINNESS, S., 1999. TREATMENT OF ACID MINE DRAINAGE. RESEARCH PAPER 99/10 HOUSE OF COMMONS PP. 1-6

NAME	X	Y	Elevation	Type	Year	pH
Joe John	264258	4197339.454	3473	Mine	2010	5.45
Brooklyn Mine	261090.5	4193850.25	3460	Mine	2011	5.79
Bonner	259121.9	4192007.522	3125	Mine	2010	4.08
Road Cut	262453.4	4188957.862	2875	Non-Mine	2011	6.16
Across from Bonner	259246.8	4192422.259	3253	Mine	2011	5.54