



Arsenic concentrations in CCA treated wood

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Introduction

Pressure treated wood, also called CCA wood, is resistant to rotting and insects, as opposed to conventional wood. CCA wood contains Copper, Chromium, and arsenic. It has been used for decades since 1970 until it was banned in 2003 by the EPA from being used in residential areas. CCA wood contains toxic substances which, if released into the environment, can cause serious diseases to the people around. In this research, we will be concentrating on the effects of arsenic. Arsenic is a toxin, also considered to be a carcinogen. Minute exposures of arsenic have many hazardous effects on humans, such as problems regarding respiration, tachycardia, hypertension and if chronic, can cause damage to kidneys, heart and brain. The lethal dose of arsenic in adults is between 70mg-200mg and less in children. Samples of wood were taken from residential areas and tested for the presence of arsenic. The concentration of arsenic in the wood samples were determined by Inductively Coupled Plasma (ICP).

Materials and methods

Collection

•Samples of wood were taken from the decks and fences of residential areas in Westlake, Ohio

Extraction

•The wood samples were ground and then subjected to a nitric acid digestion.
•The samples were shaken for 3 days.

Analysis

•ICP was used to detect the amount of Arsenic in the digested sample

•A qualitative analysis was conducted to determine the presence of arsenic.

•Once the presence of arsenic was confirmed, a quantitative analysis was conducted

•To know the concentration of arsenic, a calibration curve was constructed

•A stock solution of 1000ppm of sodium arsenite(NaAsO_2) was prepared

•Standard solutions were prepared by serial dilutions from the stock solution using 2% Nitric acid (HNO_3)

•Using 6 standard solutions from the range of 1ppm to 500ppm, a calibration curve was constructed

•The control sample was prepared as above

•After making a calibration curve, the control sample was analyzed, followed by the analysis of the actual deck sample using the ICP

Results

A qualitative analysis was conducted using ICP to detect copper, chromium and arsenic in all the samples collected. Sample C tested positive for all three elements. Sample C was used for the quantitative analysis. The absorbance value for sample C is 1,767,382. Inserting that value into the regression equation ($y = 5515.2x + 26686$) yields a y value of 316, which indicates there is 316ppm of arsenic in this wood sample.

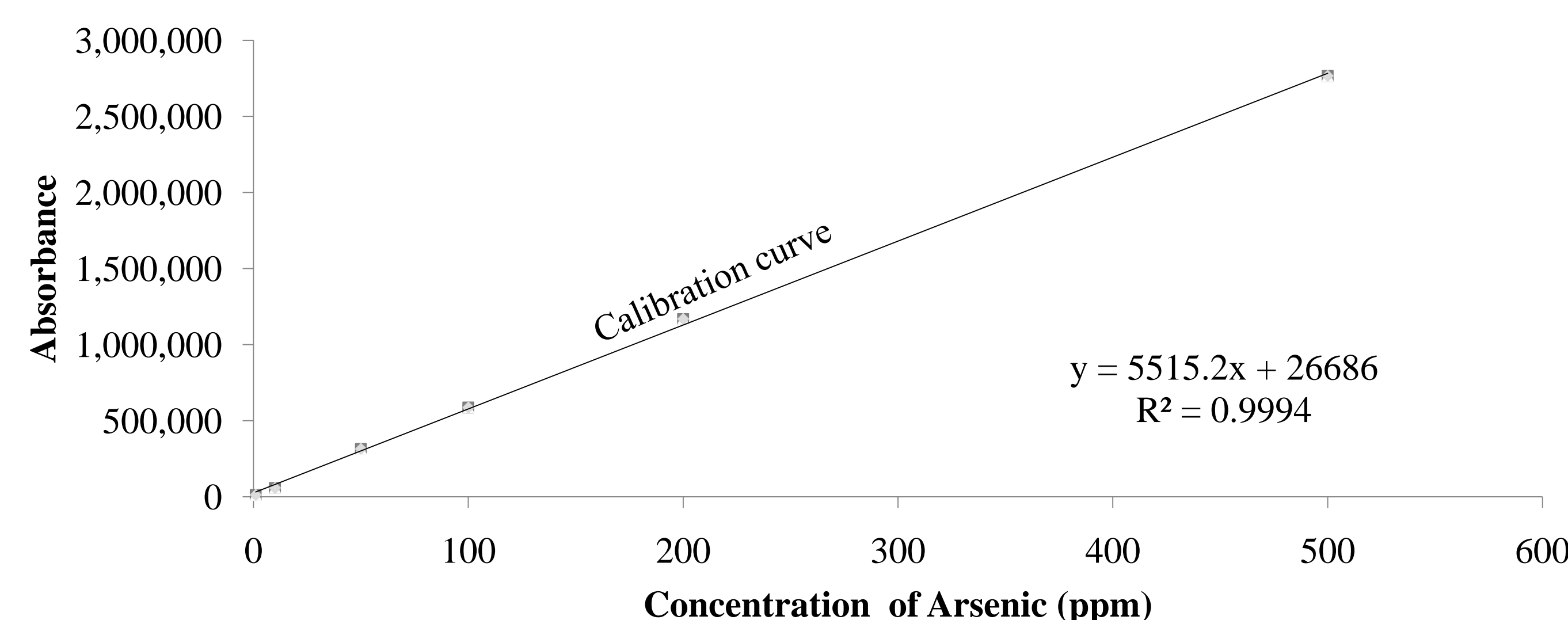


Figure 1. Calibration curve used to determine the amount of arsenic in the wood sample. Six standard solutions were prepared to produce the calibration curve :- 1ppm,10ppm,50ppm,100ppm,200ppm, and 500ppm.

	Trial 1	Trial 2	Trial 3	Mean	Std. Dev.	RSD	Concen.
Blank	323	344	314	327	15.3	4.67%	0 mg/L
Standard 1	12,857	12,762	12,719	12,779	70.5	0.55%	1 mg/L
Standard 2	58,425	59,457	58,569	58,817	558.9	0.95%	10 mg/L
Standard 3	315,495	315,049	314,661	315,069	417.1	0.13%	50 mg/L
Standard 4	587,224	582,772	591,298	587,098	4,264	0.73%	100 mg/L
Standard 5	1,158,127	1,176,392	1,171,990	1,168,836	9,532	0.82%	200 mg/L
Standard 6	2,725,053	2,804,066	2,769,151	2,766,090	39,595	1.43%	500 mg/L
Control	17,843	9,557	5,853	11,084	1.1	63.05%	
Sample	1,720,034	1,799,718	1,782,393	1,767,382	7.58	2.40%	315 mg/L

Table 1. Absorbance readings for standard solutions of arsenic

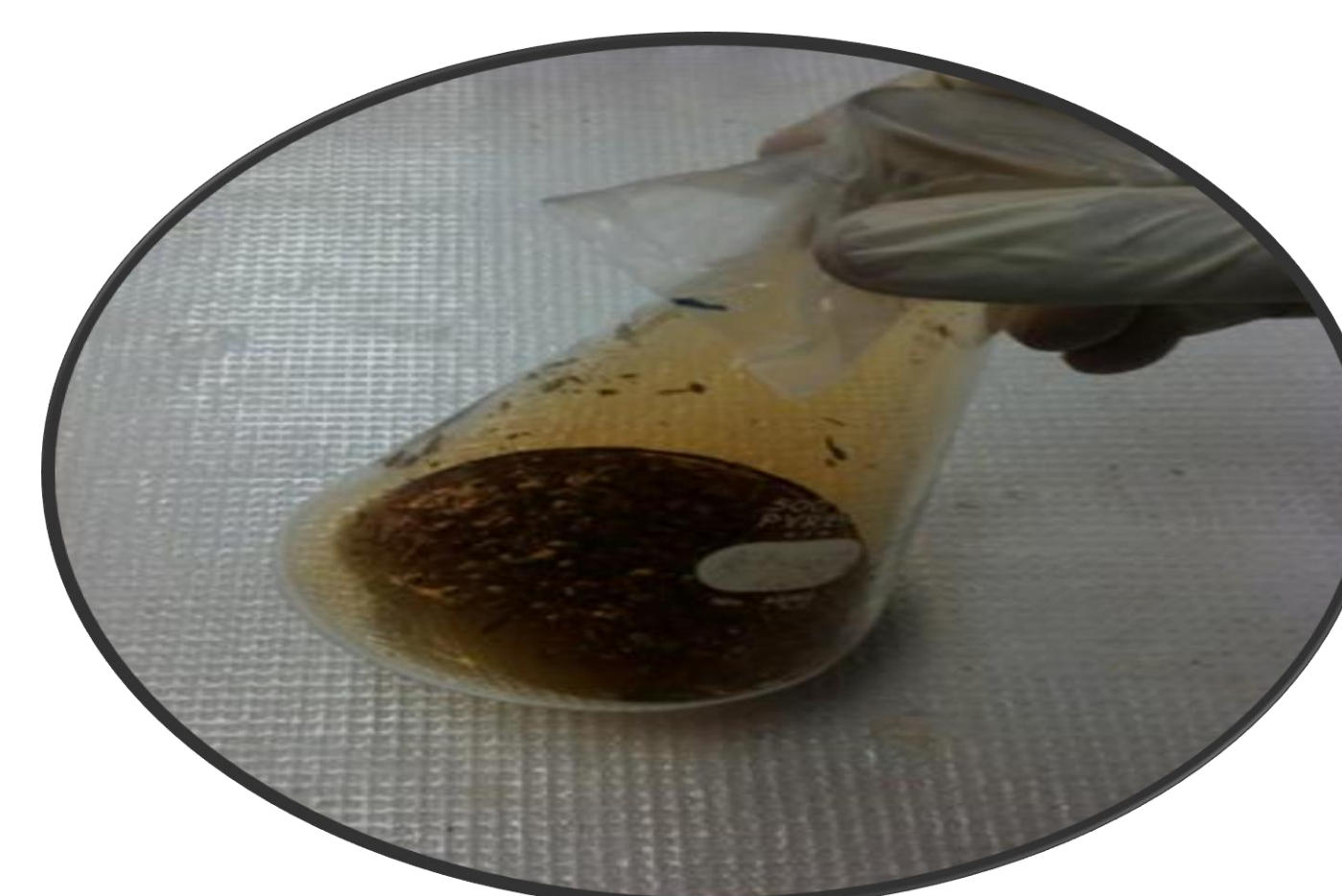


Figure 2. Digested sample of the wood taken from a deck in Westlake, Ohio

Conclusions

Even though CCA wood is banned, it is still present in the environment, and as the experiment -al results show, it is present in significant amounts (316mg/L). Therefore, there are still dangers of exposure to the toxin and carcinogen arsenic. Arsenic can be released from the wood in the following ways:

1. When the wood is burned
2. Mechanical Abrasion
3. Direct Contact
4. When acid contacts the treated lumber

Without proper care of the CCA wood, arsenic would be released to the environment and cause sickness to the people exposed. To prevent this danger from occurring, the following precautions should be taken:

1. Use pressure treated wood which does not contain arsenic
2. Seal existing construction every 2 years
3. Never burn CCA wood



Figure 3. Preparation of standard solutions in the lab

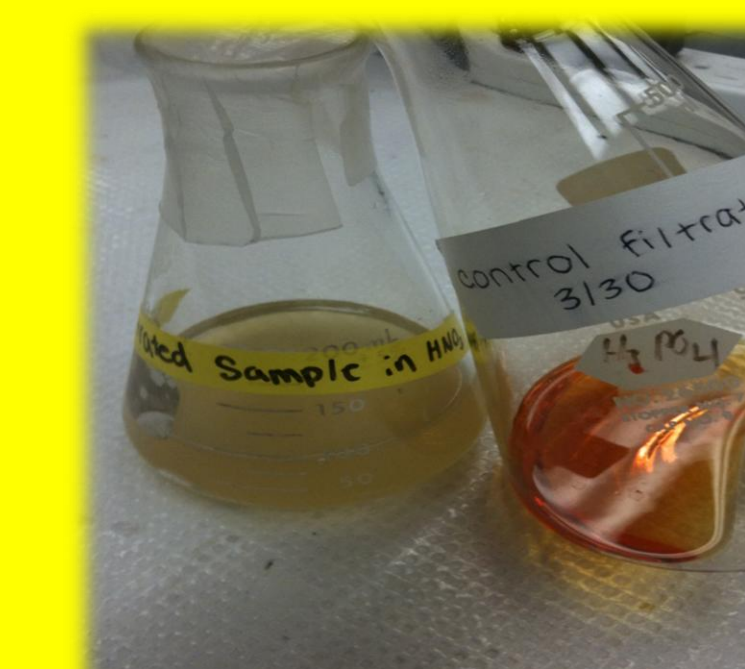


Figure 4. Notice the difference in the control filtrate and the sample filtrate. Both were prepared using the same procedure.



Literature cited

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Future Directions

More wood samples will be obtained and tested for CCA. In addition, we will attempt to determine arsenic concentrations in the samples. That way, we can confirm whether or not CCA wood still exists around us in significant amounts and the posed dangers to the surrounding environment. This will be accomplished by determining the amount and concentration of arsenic. Afterwards, we are going to test the toxicity of the concentration of arsenic obtained from the analysis by exposing the same concentration to *Vibrio fischeri*, which is a bacteria sensitive to metal concentrations. We will use its bioluminescent properties to assess the toxicity of different arsenic concentrations.