# Natural Extraction of Metals by Trees rooted in Contaminated Soils
# Phase I: Establishing Standards for Analyzing Tree Sap using XRF Spectroscopy

Mentor: Dr. Alan Jacobs
Brandy Peprah, Bryan Ortiz , Salam Picard

## Introduction

The purpose of this experiment was to determine if certain metals on the periodic table were present in our diluted standard solutions. Standard solution is a solution that contains a concentration of an element or a substance. The goal is to detect Pb (Lead) in each of the solutions: pine oil, maple syrup, and olive oil. The standard that was used in this experiment contained many different elements and they were added to the diluted solutions to determine which elements and metals were detected using and ICP and XRF machine.

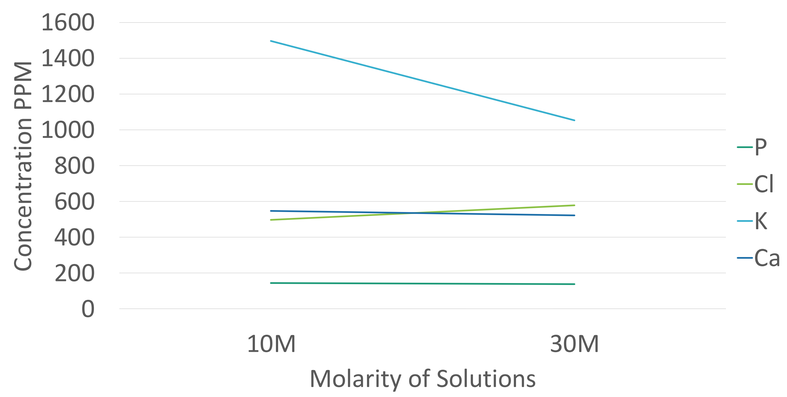
## Overview

We prepared standards that will be used to calibrate a portable x-ray fluorescence spectrometer (p-XRF). This instrument will be used in the field to identify toxic metals in the trees rooted in contaminated soil in the banks of the Mahoning River near Youngstown, Ohio. The standards consist of 50-ml samples in two solvents: maple syrup and pine oil (simulating tree sap) that have been spiked with various known concentrations of a solution of toxic metals. The samples were then analyzed for metals that have been found in the contaminated river banks using two different laboratory spectrometers: an inductively coupled plasma (ICP) and a benchtop XRF. Most of the metal concentration results were similar in the spiked solutions of both maple syrup and pine oil using both the ICP and XRF instruments. Therefore, the solutions will function as standards for calibrating a p-XRF to be taken to the field to analyze the trees rooted in contaminated soil in the banks of the Mahoning River. Tree species that are absorbing toxic metals can be used to remediate the contaminated soils.

## Results

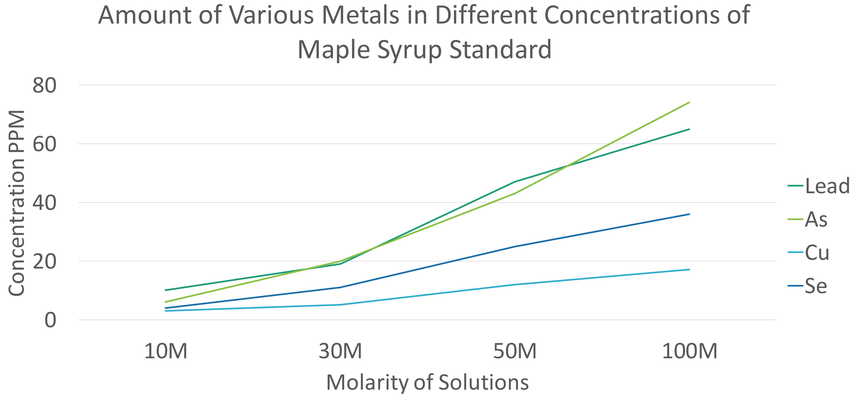
Molarity of Solutions

| | 10M | 30M |
|---|---|---|
| P | 144 | 137 |
| Cl | 497 | 578 |
| K | 1495 | 1054 |
| Ca | 548 | 522 |




Molarity of Solutions

| | 10M | 30M | 50M | 100M |
|---|---|---|---|---|
| Lead | 10 | 19 | 47 | 65 |
| As | 6 | 20 | 43 | 74 |
| Cu | 3 | 5 | 12 | 17 |
| Se | 4 | 11 | 25 | 36 |




## Methods

Three solutions, pine oil, maple syrup, and olive oil were used along with a standard solution to detect if Lead was present in each of the solutions. To determine the value of the concentrated dilute solution, the equation m1v1=m2v2 was used to solve for the volume " V2". First, Nitric acid was slowly added to deionized water. 5ml of pine oil was added to each volumetric flask for that solution, 12.5 ml of maple syrup added to each volumetric flask for the solution, and etc. Based on the concentration levels regarding parts per million, 2.5ml for 100 pm, 1.25ml for 50 ppm, .8ml for 30 ppm, .25ml for 10 ppm of the standards were added to each of the solutions with metals listed on the standard bottle. Then, nitric acid was added to 25 ml mark of each of the volumetric flasks. Finally, the solutions in the volumetric flask were poured into the centrifuge tube to be later used for the ICP and XRF machine to detect the metals found.

## Conclusion

The results from the ICP and XRF showed that there was Lead detected in all volumes of maple syrup (10,30,50,100 ml). It also showed that Lead was not detected in olive oil and pine according to the information given by the ICP and XRF machine.

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