



# Code Cracking: Who Murdered The Somerton Man?

## Thesis Draft 2

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## Executive Summary

The Somerton man case is a very famous unsolved case in Australia which related to an unidentified dead man on Somerton beach. The aim of this project is to find out new clues about the Somerton man case. Researching this case can expend the knowledge of data analysis, code cracking, engineering statistics and digital forensics.

The spectral hair analysis is the main method in my project to find out new clues. Through burning and scanning hairs extracted from Somerton man and six other different students (control samples), the hair data with respect to elements content can be recorded separately. Then the hair data comparison between Somerton man and control samples will be processing. Finally, the differences derived from comparison can provide some information about the man's living conditions before death.

This research will involve an unknown study area for Somerton man case and put forward new reasonable assumptions based on hair analysis. This unknown area is that the hairs are tested on quartz plate instead of glass which can contribute to more accurate results.

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# 1 Introduction

## 1.1 Background

This project is based on an unsolved murder case that happened on the 1st of December 1948. At 6:30 am of that day, a man was found dead on Somerton beach. This dead man carried with no identifications and his teeth were not matched with any known person, so he is called Somerton man. After postmortem, the coroner picked some information from this dead man, such as the heart was of normal size and the death time was around 2 am of the found day. Besides, the coroner figured out that approximate three to four hours before death the man ate a pasty as meal which pathologist Dr. Dwyer suggested some poisons causing the man's death. But the pasty should not be the source of poison through further researching. Finally, the coroner could not tell any conclusion about this man's identity or cause of death and the dead man's body was buried in Adelaide's West Terrace Cemetery in 1949. It became one of the Australia's most fascinating cold cases. [2][4][10]

For continuing study, a plaster cast of Somerton man was made in 1949. The hairs which were extracted from Somerton man plaster cast and other six different students are used for spectral analysis. [9] Hair data is recorded by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and this instrument is effective for micro-sampling of solid material for trace elements and the analysis of predominantly cation. [1] For collecting data, the hairs were burned by laser. Then, the instrument measured the levels of different isotopes and the relatively values of elements. After testing, the comparison for experimental results between Somerton man and six other different students will be processing.

## 1.2 Motivation

This project aims to provide some useful clues which are derived from hairs spectral analysis for solving this cold case. Even if the case has happened for decades, it is not been forgotten. The residents still would like to see the case is resolved. In addition, this project can expand the knowledge for data analysis, code cracking, engineering statistics and digital forensics. In fact,

this dead man was suspected to be a foreign spy due to his unknown identity. So, it is meaningful for country security as well.

### 1.3 Objectives and Methods

- Understanding the hair biology knowledge and some related chemical knowledge.
- Hair mass spectral experiment: hairs were burned by laser. Then, the instrument measured the levels of different isotopes and the relatively values of elements. The scan speed of mass spectrometer was 5 micrometers per second. The scan length of each control sample was 1000 micrometers, so the method length was 230 seconds including 30 seconds background. The scan length of Somerton man's hair was 6054.6 micrometers and the method length was 1240.9 seconds including 30 seconds background as well. In this experiment, all the hair test will be processed on quartz plate.
- Experiment results analysis: For a healthy person, the hair growth rate is approximate 0.4 millimeters per day [7]. So we can get about 2.5 days information of control and 2 weeks information of Somerton man before his death. All the experiment data is plotted by Matlab and the plotting figures are listed in Appendix A. Then, the comparison between Somerton man and control samples will be processing. The comparisons are focus on the different elements content in hair which can provide some useful information about living and healthy conditions.
- Put forward some reasonable assumptions and new clues: Based on experiment data analysis, some reasonable assumptions needed to present. These assumptions can be related to some activities before his death and expand research scope. The new clues should be depending on reasonable assumptions.

- Validation of assumptions and clues: clues and assumptions needed to be verified through researching.

#### 1.4 Structure of this Report

The rest of the report will talk about the middle work result which includes the list of elements and some comparison figures. After that, it is going to write the project management which contains timeline, budget and risk management. Then, drawing the conclusion of this project. The Gantt Chart of project timeline will be attached on the end of this document.

## 2 Literature Review

### 2.1 Previous Studies

In addition to police men's investigation, there already have several academic studies. Prof. Derek Abbott has worked on this case for more than 2000 hours. [9] His team took the hairs from Somerton man's plaster cast and recorded elements data by ICP-MS. Since 2009, it had become a final project for the University of Adelaide students and some students participated this project. In 2013, the project group plot some Somerton man's hair elements relative value figures and compared with control samples. [6] They have analysed the differences between Somerton man's hair and control samples. However, those hairs' data were all got from glass test. In this project, we redo the analysis based on the data that got from quartz test. In addition, we will compare those two different data figures. However, the new data should not be compared with old directly due to different drift values. The new data will multiply a constant which is got from the glass test remainder that is a bit rest of Somerton man's unburned hair. Besides, the different year of plasters needed to be considered as well.

### 2.2 Software

Hair data is recorded by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and presented in the form of Excel tables. Matlab is used to plot figures which are used to show the elements comparison results clearly. It has some graphing capabilities and can be applied for making engineering plots.[3] In this project, the massive hair element data are plotted by Matlab command 'scatter'. Then, use command 'hold on' to put the Somerton man's and control samples hair data on the same figure and make the comparison clear.

### 2.3 Hair elements

Hair analysis can demonstrate the content level of the heavy metal and essential elements in human body. [3] The different value of some essential elements in hair may be correlated with nutritional status and diseases, such as Calcium (Ca), Chromium (Cr), Zinc (Zn), Copper (Cu), and Selenium (Se). The high values of some elements such as lead (Pb), Arsenic (As),



Mercury (Hg), and Cadmium (Cd) in hair can indicate the intoxicating phenomenon. [3]

Using this analysis method can discover the useful information about the Somerton man healthy condition and has possibility to find the cause of death.

#### **2.4 The relation between living environment and hair elements**

The living environment can affect the content level of elements in human body. This effect not only caused by polluted water and food, but through the injury and radiation. Trace elements values in hair can reflect the source of behaviors including the diet hobbies, smoking and medication. Human absorbs pollution source by different ways such as oral, breath, injection and radiation. These contaminants stored in different body organs and tissues can affect human health.

Hair is a good indicator of environment change. Normally, it shows the variation of trace element in human body as the hair growth.

### 3 Progress to Date

#### 3.1 Data screening

The hair data was recorded by mass spectrometer. The data is got from glass test. There are 44 elements gained by laser ablation (shown in Table 1). Three of these elements are needed to be mentioned. The first one is sulphur (S7) which must exist in human's hair. The value of Sulfer can be refered to the drift value of environment. The second one is lead (Pb206), the high level of Lead is harmful for human health. The third one is strontium (Sr88). This element has high percentage in Adelaide's soil compared with other areas. So, the analysis of the change tendency of Strontium's value will provide useful information about Somerton man's living environment before his death.

Table 1 Elements table

| These elements gained by laser ablation of hair mass spectrometer |      |      |       |       |
|---|------|------|-------|-------|
| Li7   | Ca43 | Cu65 | Zr90  | Hf178 |
| B11   | Sc45 | Zn66 | Mo95  | Au197 |
| Na23  | Ti47 | Ga71 | Ag107 | Hg202 |
| Mg24  | V51  | As75 | Cd111 | Tl205 |
| Al27  | Cr52 | Se77 | Sn118 | Pb206 |
| Si29  | Mn55 | Se82 | Sb121 | Bi209 |
| P31   | Fe57 | Rb85 | Te125 | Th232 |
| S34   | Co59 | Sr88 | Cs133 | U238  |
| K39   | Ni60 | Y89  | Ba137 |       |

#### 3.2 Element classification

Some recorded hair data contains toxic and heavy mental elements which are harmful for human health in high values. Most are essential elements in human body. Table 2 shows the toxic elements and essential elements in hair. The comparison of toxic elements is an important research subject.

Table 2 The Different Type Elements of Hair

| Type of Element              | Chemical Symbol                                      |
|------------------------------|--|
| Essential and other elements | Li K Ca P Na B Cr Mg V Mn Fe Cu Mo Zn Co Sr Au Se Ge |
| Toxic elements               | Pb Al Hg Ag Ba As Cd Sb Sn Bi Ni Th                  |

In previous study, the hair data analysis is based on glass test result. However, the impurity material has influence on element values. In this project, the data analysis mainly relies on quartz test rather than glass test. Compared with glass, the quartz is a purity material composition. Table 3 shows the main composition of glass and quartz.

Table 3 The different Elements of Glass and Quartz

|        |  |
|--------|--|
| Glass  | SiO <sub>2</sub> , TiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , FeO, MnO, MgO, CaO, Na <sub>2</sub> O, K <sub>2</sub> O |
| Quartz | SiO <sub>2</sub>   |

### 3.3 Data comparison

The mass hair data need to be disposed by software for a visual comparison. In order to speculate the cause of death and living environment, the Somerton man hair data should be compared with control samples.

#### 3.3.1 Excel

At first, the hair data of Somerton man was plotted by Excel (shown in Figure 1). The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of elements content.

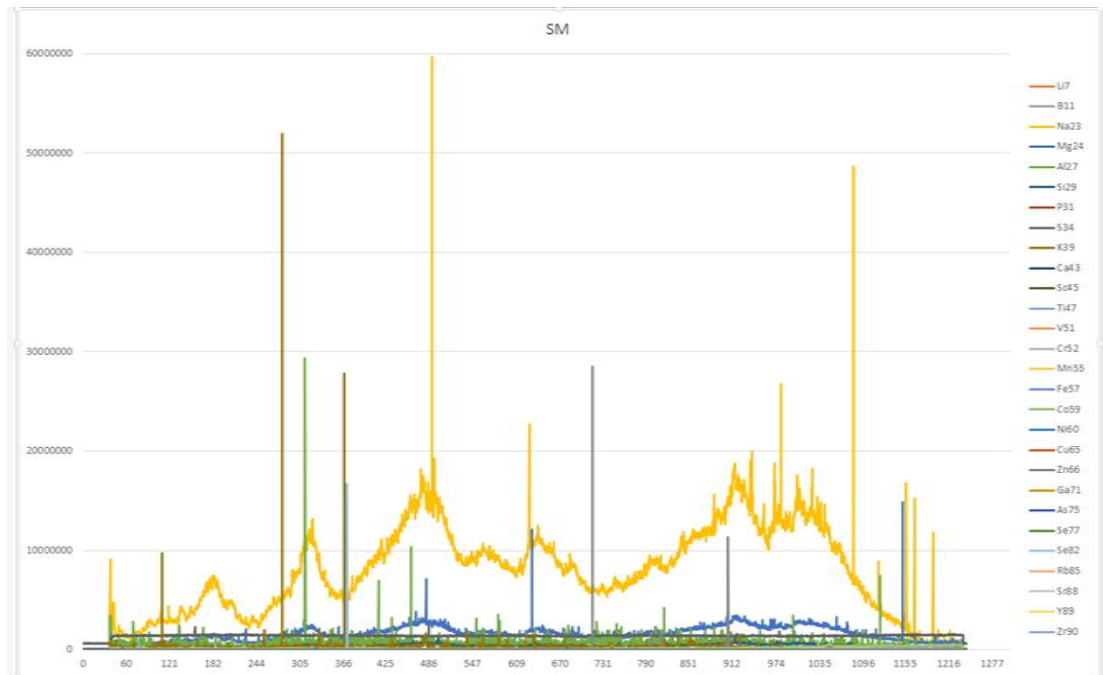


Figure 1 Somerton man's hair data

However, only 28 elements were shown on the chart. Some data was missing due to shortage of Excel. Besides, the elements are not clear except Sodium (Na23). Some traces are out of range and not obvious. Such as the bottom of this chart. So, these troubles result in the difficulties of contrast.

The control samples hair data plotted by Excel (shown on appendix A) as well. Unfortunately, they all have the shortages as the Somerton man's data chart.

### 3.3.2 Matlab

In order to solve these problems, Matlab can be used to plot each element's content distribution. 44 elements comparison figures have been plotted and shown on appendix A.

Some comparison figures of element value show the results clearly. However, some figures have difficulty to find the tendency. The elements figure classification shown on table 4.

Table 4 Classify elements by comparison results

| Comparison Result |                  | Elements   |
|-------------------|------------------|--|
| Good Result       | Same Values      | B11,P31,S34  |
|                   | Different Values | Sr88,Hg202,Pb206   |
|                   | Same Tendency    | Na23,Mg24,Si29,Ca43  |
| Bad Result        | No Tendency      | Li7,Al27,K39,Sc45,Ti47,V51,Cr52,Fe57,Co59,Ni60,Cu65,Zn22,Ga71,As75,Se77,Se82,Rb85,Y89,Zr90,Mo95,Ag107,Cd111,Sn118,Sb121,Te125,Cs133,Ba137,Hf178,Au197,Tl205,Bi209,Th232,U238 |

Referring to the results quality, four elements have the similar tendency which are Na23, Mg24, Si29 and Ca43. In previous research, these four elements are all contained in glass material. That means the recorded elements values are affected by glass slice. However, the elements which do not exist in the glass will not be affected.

Through this comparison, three elements have good results that are Sr88, Hg202 and Pb206. Figure 2 shows the Lead (Pb206) relative value comparison between Somerton man and control samples.

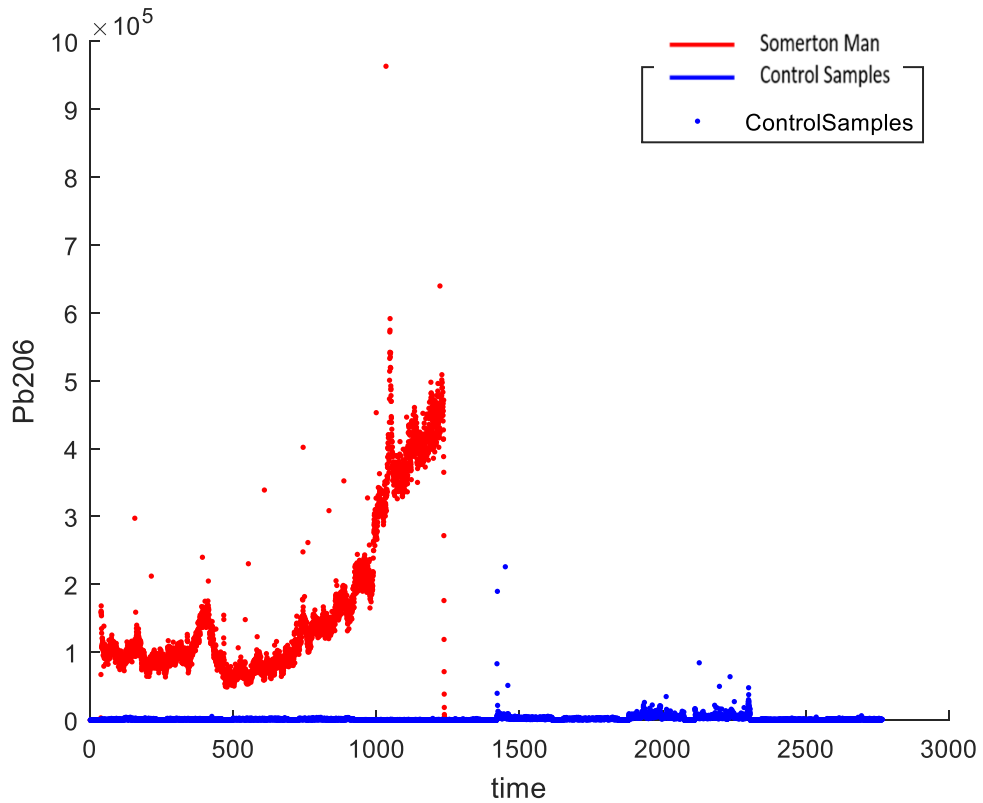


Figure 2 Lead Value Comparison

The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of Lead content. The mass spectrometer scans from the root of hair. So, the left of figure shows the most recent life of sample. There have found a very high level of Lead in Somerton man's hair compared with control samples especially the end of his hair. However, the Lead value has a visual reduction before his death. So, it can be affirmed that high level of lead was not the cause of his death. This study should focus on his living environment before death. We can search relevant materials to know some information about 1948. Such as the solid analysis, petroleum quality, water quality and nuclear power plant location.

Figure 3 shows the Mercury (Hg202) relative value comparing between Somerton man and control samples.

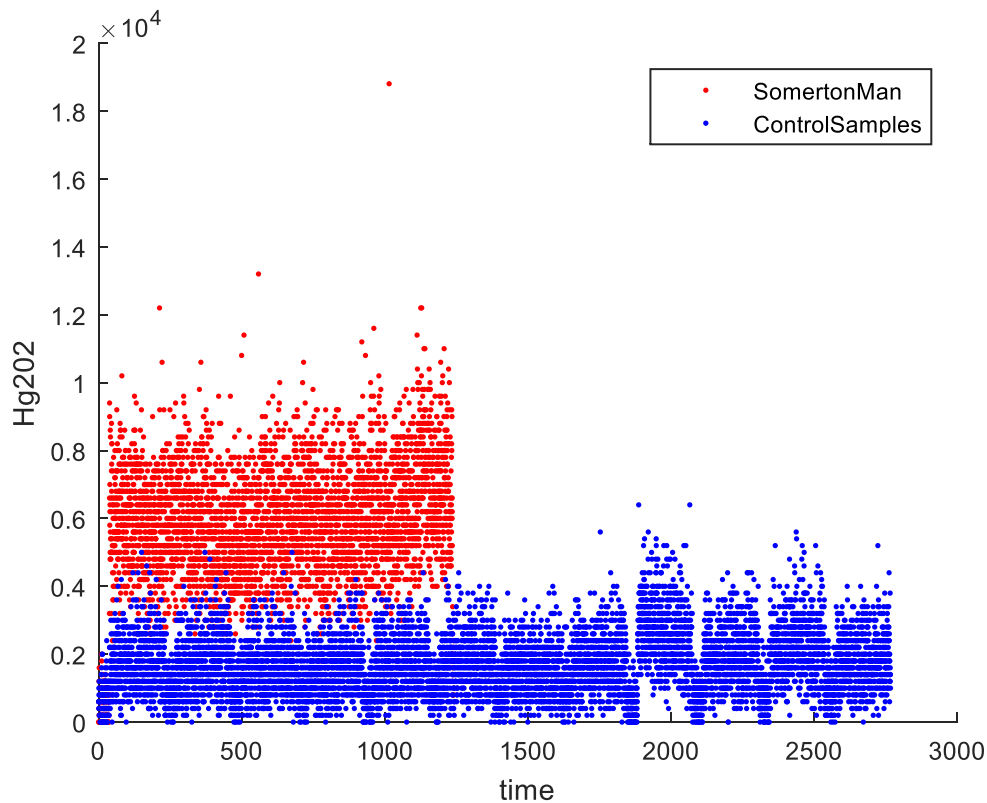


Figure 3 Mercury (Hg202) Value Comparison

The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of mercury content. There have found a higher level of mercury in Somerton man's hair compared with control samples. This value keeps constant from root to the end of hair. By collecting related information, mercury is a highly toxic heavy metal pollutants of biologic toxicity. It is difficult to be discharged back into the organism. So it is a serious threat to human health. However, mercury is ubiquitous in nature. There are trace amounts of mercury existing in plants animals and food. Normally, human can eliminate toxins through excretion and metabolism to keep the amount that should not influence health. This is the reason for finding mercury in human's hair. The main pollution of mercury is from chlor-alkali, plastics, batteries, electronics and other industrial emissions. The Somerton man's higher level of mercury may be due to his living area. However, this should not be regarded as the cause of his death.

Besides, the strontium value between the Somerton man and control samples' hair are obviously different. Figure 4 shows the Strontium (Sr88) relative value comparing between Somerton man and control samples.

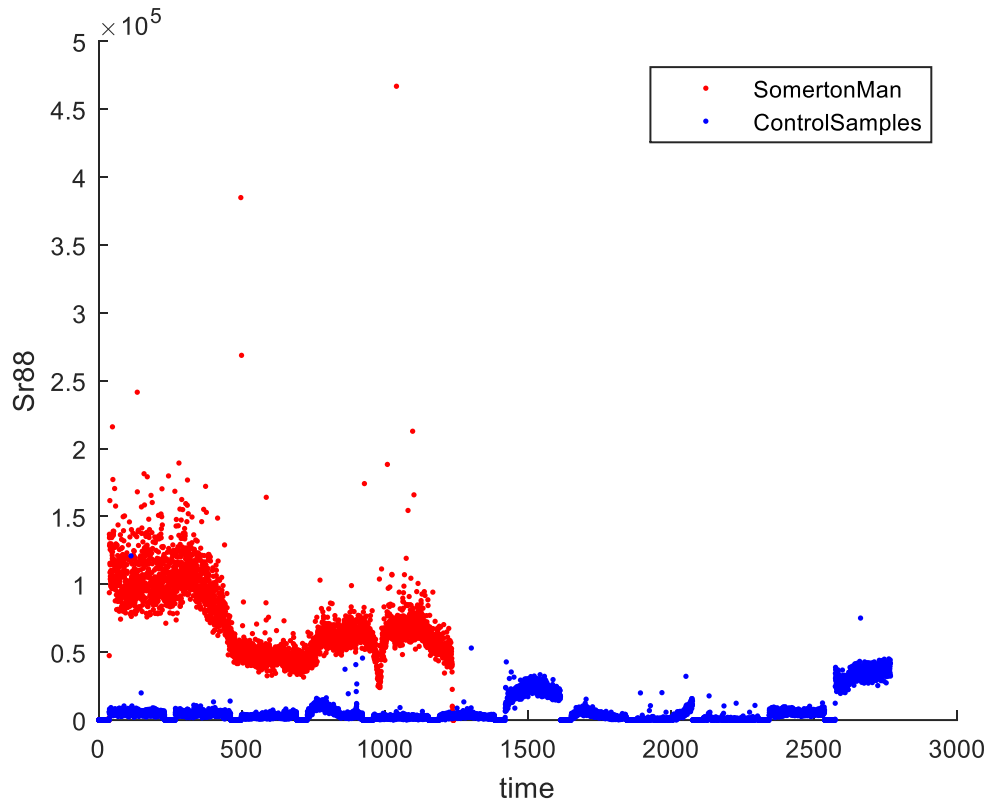


Figure 4 Strontium (Sr88) Value Comparison

The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of strontium content. Strontium exists in mineral water. It is an essential element for human. This element can prevent hardening of the arteries. At the root of Somerton man hair, the content of strontium is significant high. This means the living area for Somerton man contains high level of strontium content before his death. In addition, the strontium value shows an increasing tendency in his last two weeks. However, strontium is not a toxic element and the increasing tendency is not the cause for the death of Somerton man. This graph can only provide some information about the living environment of Somerton man.

### 3.3.3 Moving-average Filter in Matlab



Some comparison figures cannot be shown clearly by Matlab plotting. Thus, the Moving-average Filter should be applied. Firstly, selecting a window size for Filter. Then, calculating the arithmetic average of outliers within the window and make the average of the demand as outlier's window centre point. After that, moving the window as window size and the average method is repeated until this process is complete. This method has a good inhibitory effect on periodic disturbance and makes the figure smoother. It is suitable for high frequency oscillation system.

All of the elements content figures have been plotted by using moving-average filter and shown on appendix B.

After using moving-average filter, the comparison figures have some new finds, such that more similar tendency elements are found and some clear comparison elements have been shown. The details are shown on table 5.

Table 5 Classify elements by comparison results

| Comparison Result |                  | Elements   |
|-------------------|------------------|--|
| Good Result       | Same Values      | B11,P31,S34,K39,Cr52,Co59,Ni60,Cu65, Zn22,Se82,Rb85,Sn118,Te125,Bi209,U238 |
|                   | Different Values | Sr88,Hg202,Pb206,Ag107, ,As75,Au197,Mo95,Cs133                             |
|                   | Same Tendency    | Na23,Mg24,Si29,Ca43, Ti47, Fe57  |
| Bad Result        | No Tendency      | Li7,Al27,Sc45, ,V51,Ga71,Se77,Y89,Zr90,Sb121,Ba137, Hf178,Tl205,Th232      |

Through comparing, As75, Ag107, Cd111 are the new found toxic elements which have high level in the Somerton man's hair.

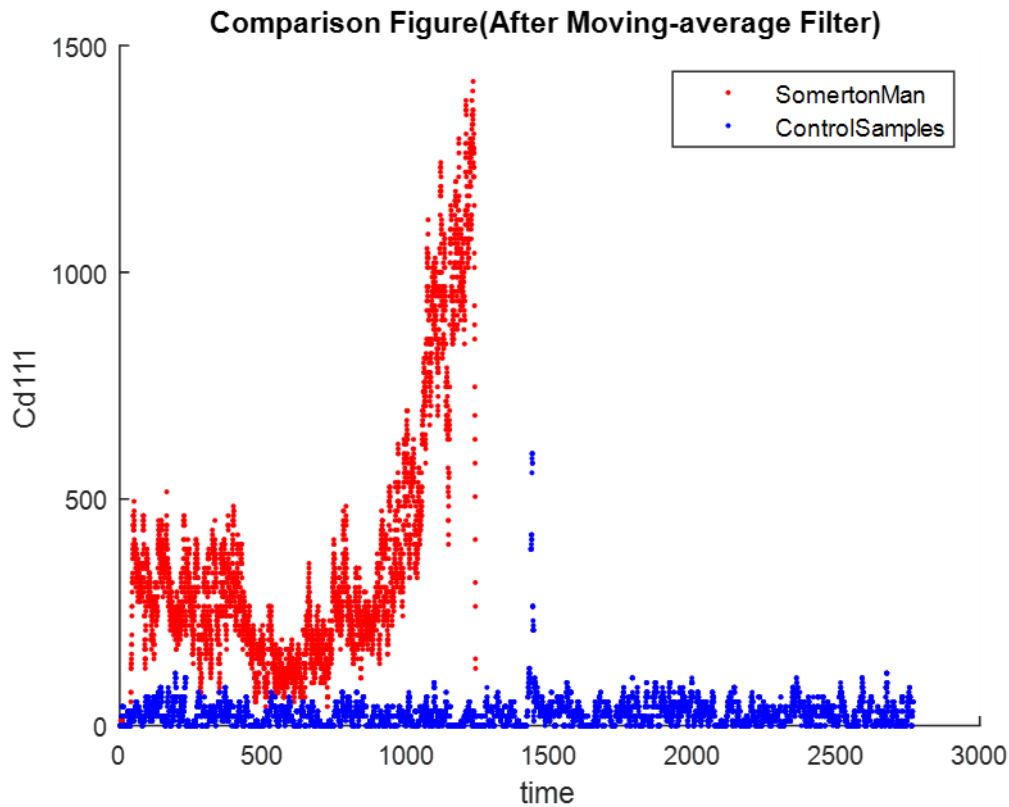


Figure 5 Cadmium (Cd111) Value Comparison

Cadmium is used for the manufacture of nickel-cadmium battery. It is a toxic element which can create poison gas when boiling. The average value of cadmium in Somerton man is much higher than control samples. The content of cadmium has shown a decreasing trend for his last time. This toxic element content should be concerned. It can be regarded as the clue for the death of Somerton man. From Figure 5, all control samples demonstrate that the cadmium content level for them are stable compared with Somerton man.

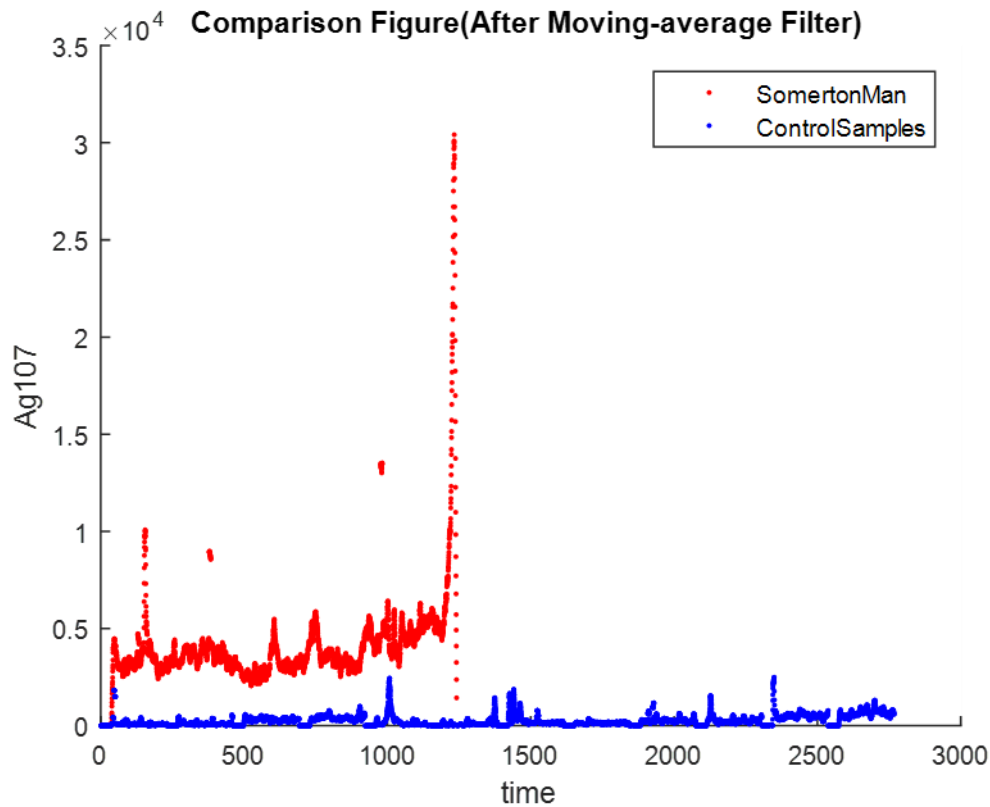


Figure 6 Silver (Ag107) Value Comparison

Through the observation of Figure 6 , the silver content is higher than control samples. The value change for silver in hair of Somerton man is not obvious. General image tends to be stable. This element should not be used for the speculation of Somerton man living condition. Besides, the silver is not harmful for human healthy. It can only make some colour change for skin. Thus, this element should not be researched in this project.

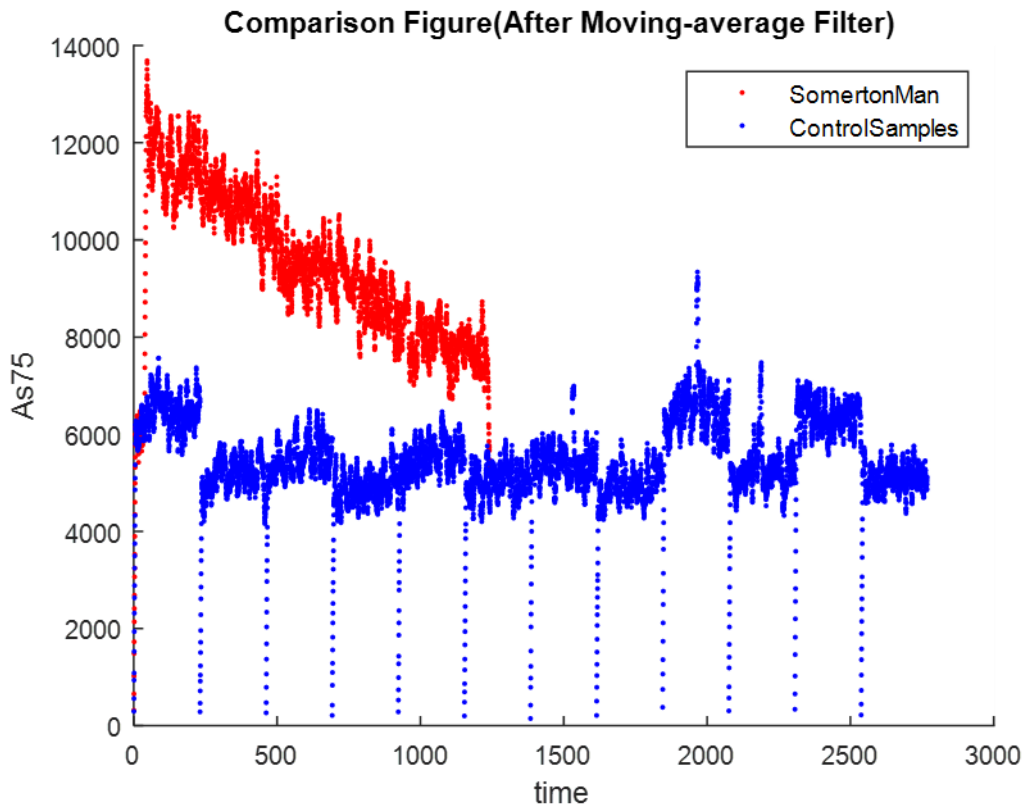


Figure7 Arsenic (As75) Value Comparison

Arsenic content level in Somerton man is increasing during the last two week. At the tip of Somerton hair, the arsenic content is similar with control samples. That means this content level is not harmful for human. Besides, the living area of Somerton can be assumed as same as control samples. However, the arsenic level is significant high at his last few days and the arsenic can be used for making toxicant. So, changing living area or being poisoned should be considered. This comparison can be regarded as one valuable clue.

### 3.4 Knowledge Gaps

This project will generate some new clues for the case of Somerton man. New clues can expand research scope and provide new information for continuing research.

## 4 Future Works

At this moment, Somerton man's hair elements data which got from glass test has been plotted. The future works as following:

- Analysing the uncommon elements value of Somerton man's hair
- Find the Somerton man's living environment clues
- Plot quartz test data
- Compare the difference between glass test data and quartz test data

## 5 Project Management

### 5.1 Timeline

The timeline Gantt chart has been attached in appendix B. It has listed the key milestones of the project (shown in Table 3).

Table 3 Key Milestones of the Project

| Time         | Milestones  |
|--------------|---|
| Semester A   |   |
| Week 1       | Research Methods                                    |
| Week 2-3     | Research Information                                |
| Week 4-5     | Prepare Proposal Seminar                            |
| Week 6       | Proposal Presentation                               |
| Middle Break | 1 <sup>st</sup> Thesis Draft                        |
| Week 7-8     | Plot Comparison Figure                              |
| Week 9-11    | Analysis Glass Test Data<br>Verification Viewpoints |
| Week 12      | Semester A Performance                              |
| Semester B   |   |
| Week 1       | Review  |
| Week 2-3     | Plot Comparison Figures                             |
| Week 4-5     | Analysis Quartz Test Data                           |
| Week 6-7     | Compare Glass Test and Quartz Test                  |
| Week 8-9     | Final Report  |
| Week 10      | Project Exhibition Poster                           |
| Week 11      | Create YouTube Video                                |
| Week 12      | Final Seminar                                       |

## 5.2 Work breakdown

The key task for the project is plotting and comparing data figures. Then, finding clues from the comparison. Due to two group members have different study directions, the project work is individual.

## 5.3 Task allocation

The project has two directions. In general, two group members work on different specific tasks. This report devote to analyzing the mass spectrometer data of the Somerton man hairs. The other group member works on cracking code and writing software.

## 5.4 Management Strategy

To ensure finishing project on time, we have set the following strategies:

- Meeting with supervisors frequently
- Receiving effective feedbacks from supervisors
- Finish tasks without delay
- Communicate with group member frequently.

## 5.5 Budget

The project has 500 dollars budget but the software tools are open source in the University of Adelaide. So we do not need cost money on this project.

## 5.6 Risk Management

The risks of project are listed in Table 2. The first risk should be considered is misunderstanding project tasks. So, the well communication with supervisors is essential. For this report, the crucial task is plotting figures by Matlab. Matlab unavailable will have influence on project processing. However, the Matlab is available on the computers of university. So, this risk can be negligible.

Table 2 Project Risks

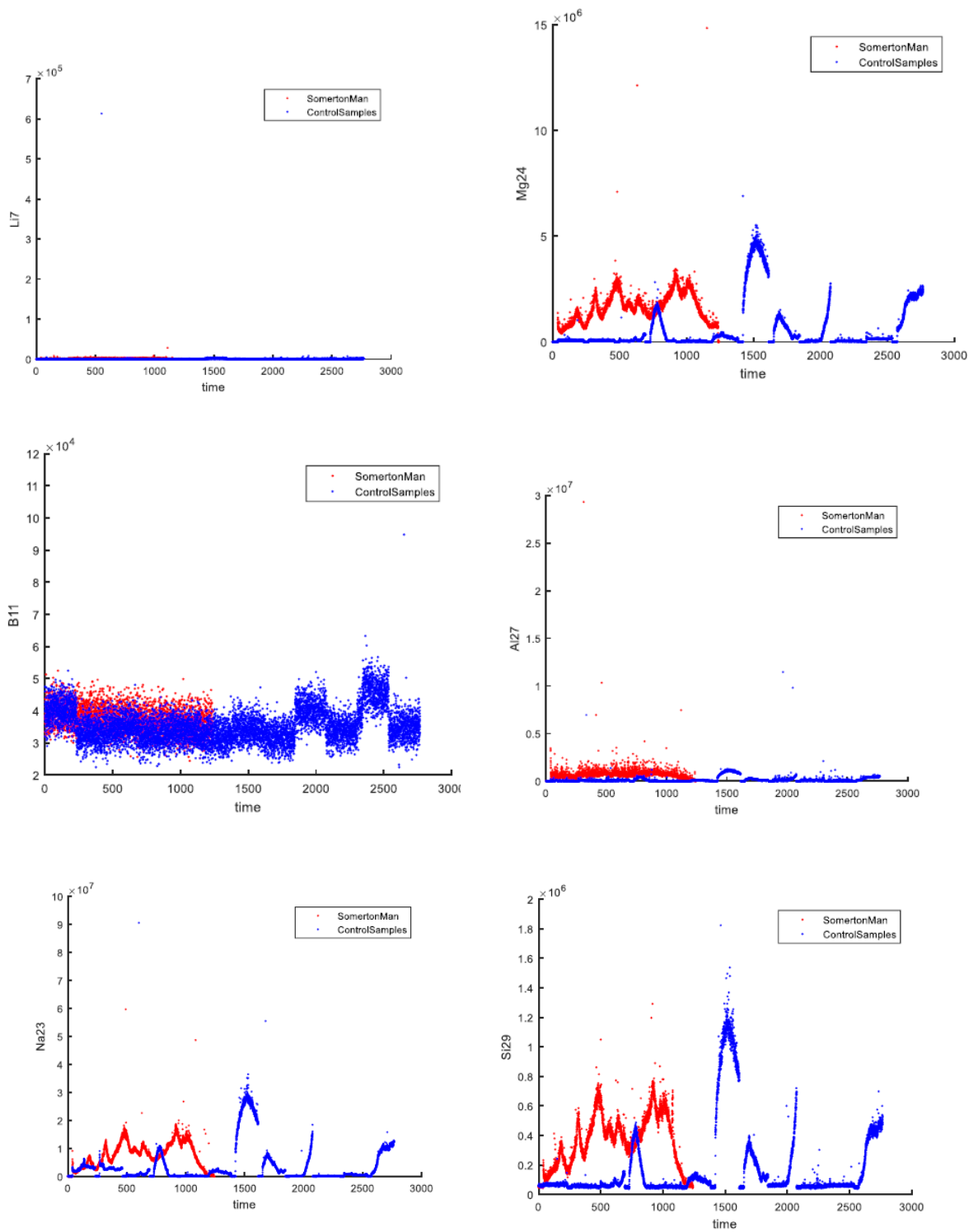
| Risk                                     | Likelihood | Rating     | Risk Estimation |
|--|------------|------------|-----------------|
| 1. Group member absent                   | Rare       | Low        | Medium          |
| 2. Group members' communications failure | Unlikely   | Moderate   | Medium          |
| 3. Data Loss                             | Slight     | Negligible | Medium          |
| 4. Task completion time delay            | Rare       | low        | Low             |
| 5. Bugs in code                          | Likely     | Moderate   | Medium          |
| 6. Matlab Unavailable                    | Rare       | Moderate   | Negligible      |
| 7. Group member leaves                   | Unlikely   | Negligible | Negligible      |
| 8. Lack of resources                     | Rare       | low        | Low             |
| 9. Misunderstanding project tasks        | Slight     | Negligible | Low             |

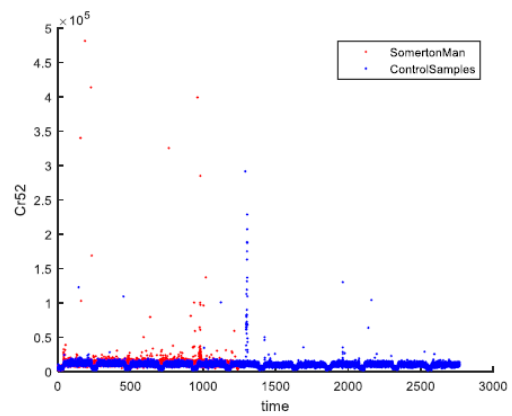
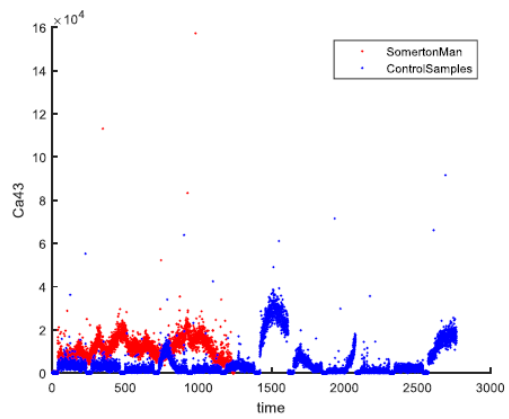
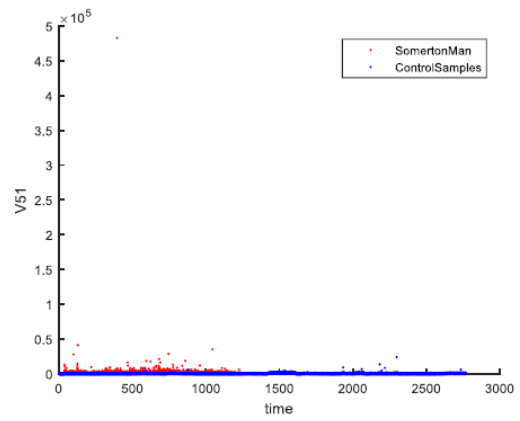
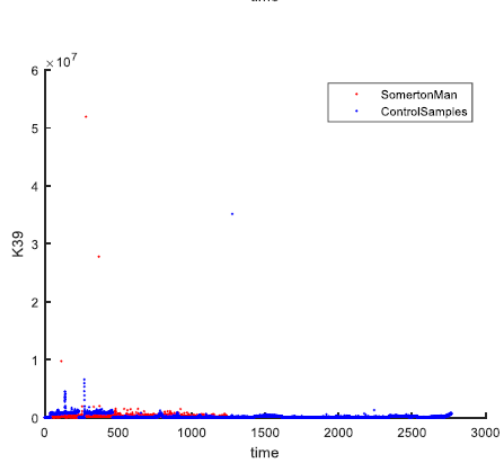
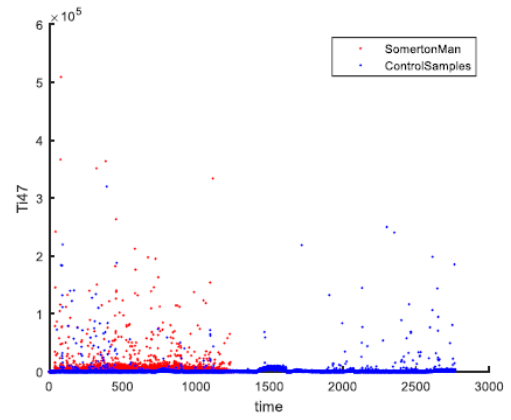
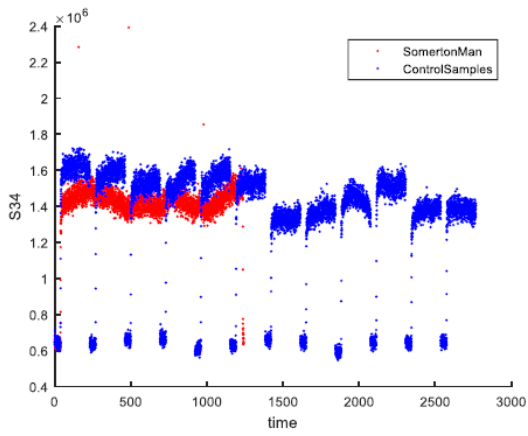
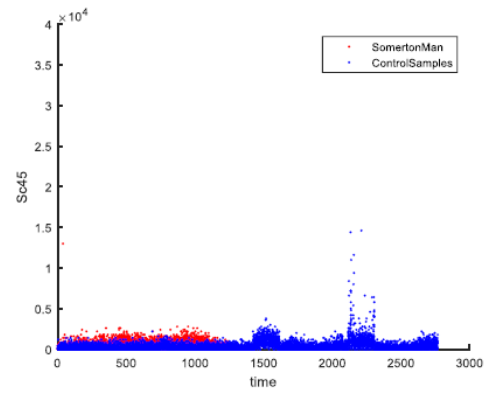
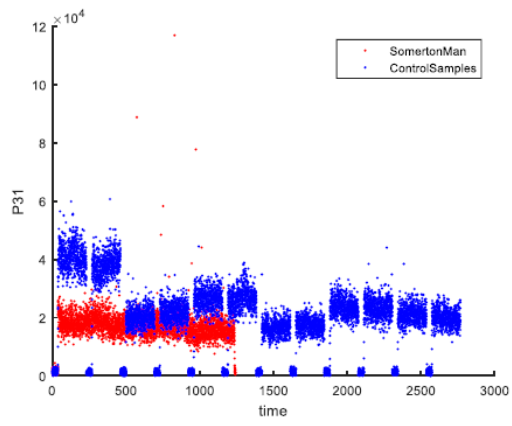


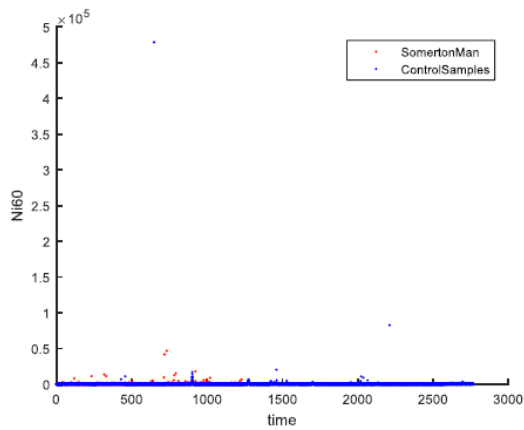
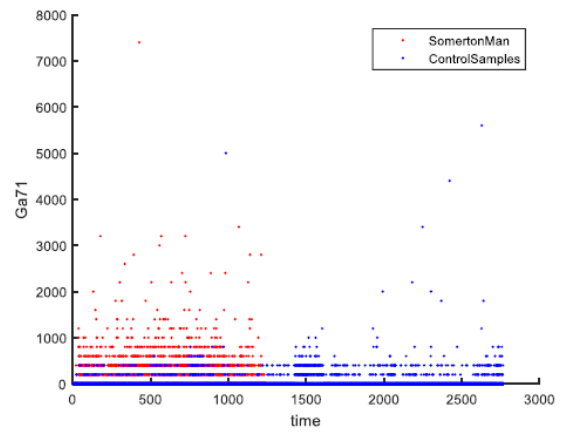
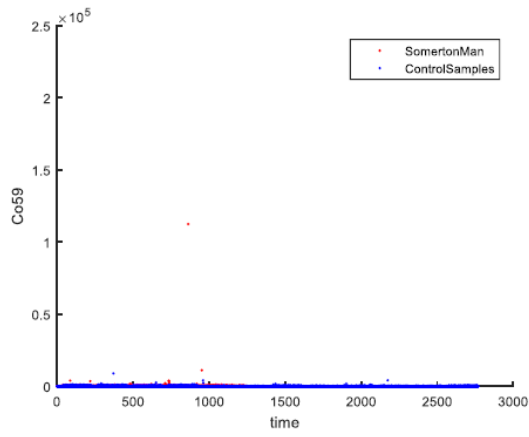
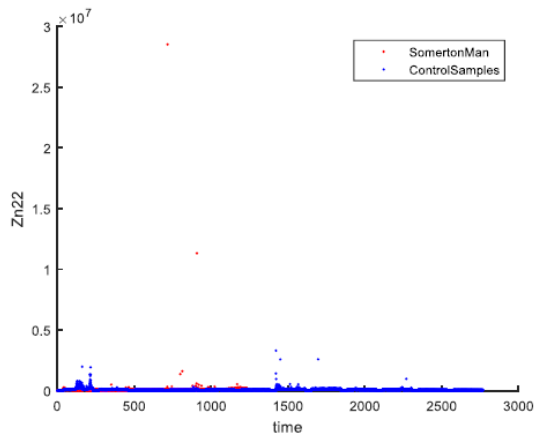
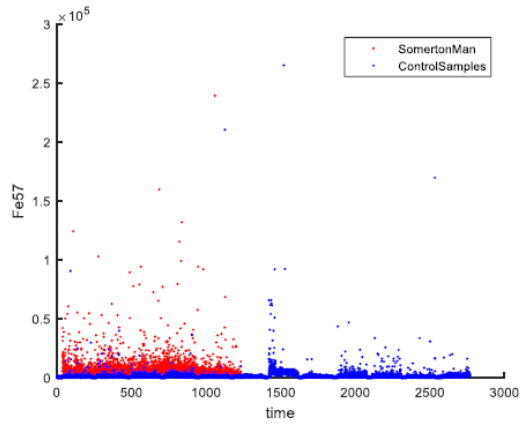
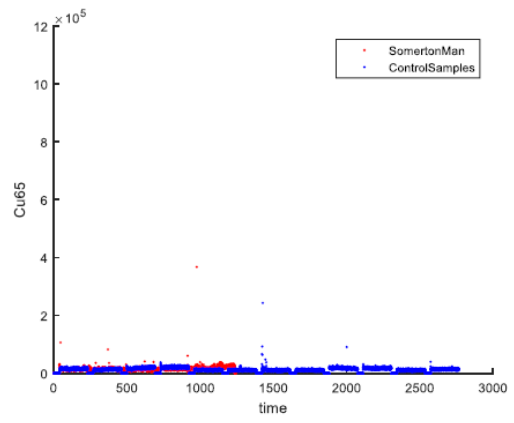
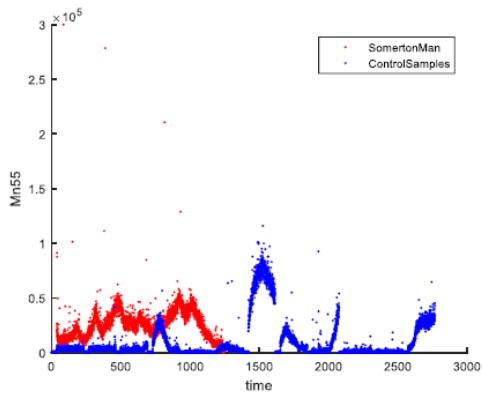
## 6 Conclusions

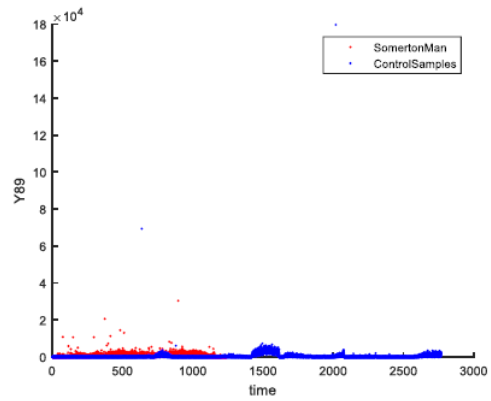
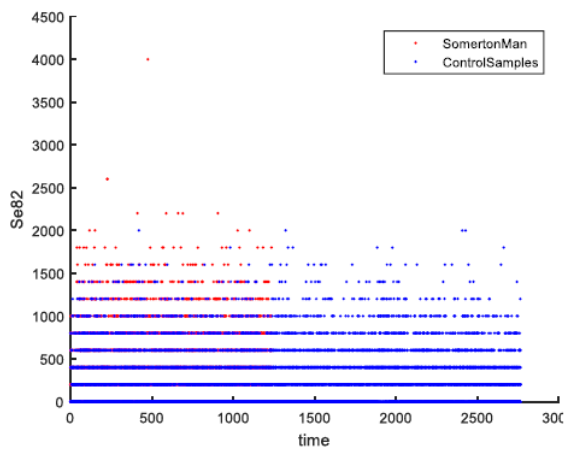
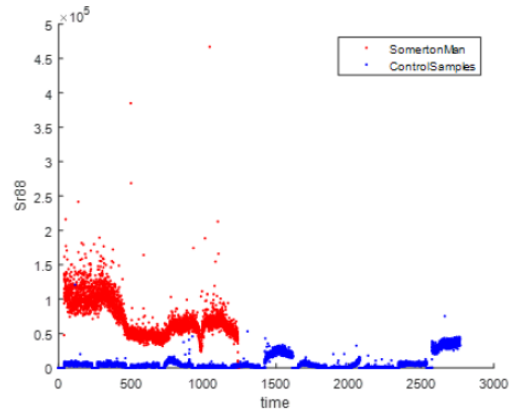
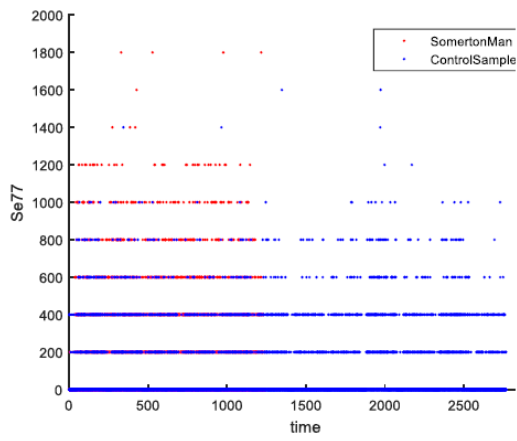
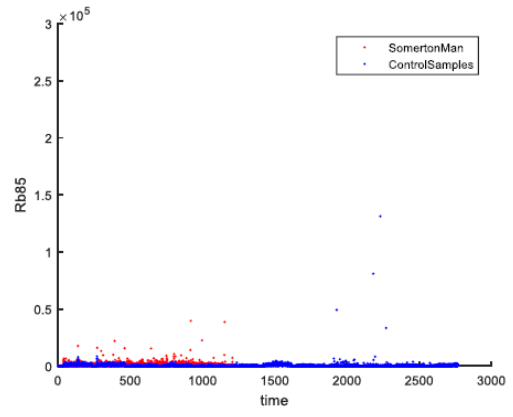
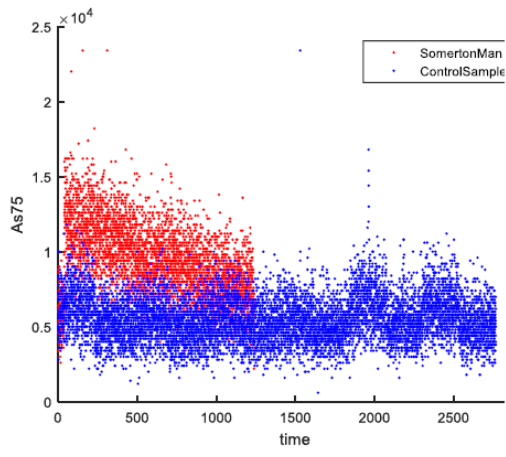
Depending on nearly three months research, I have confidence to complete the project on time. The literature review has provided some useful information for spectral hair analysis and living environment. The further data analysis and comparison has finished. Founding and validating the suspicious clue is the key task for this project in the future.

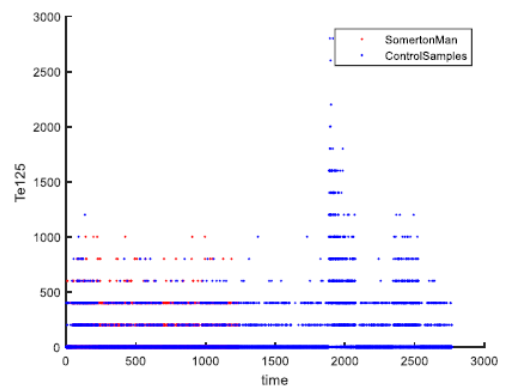
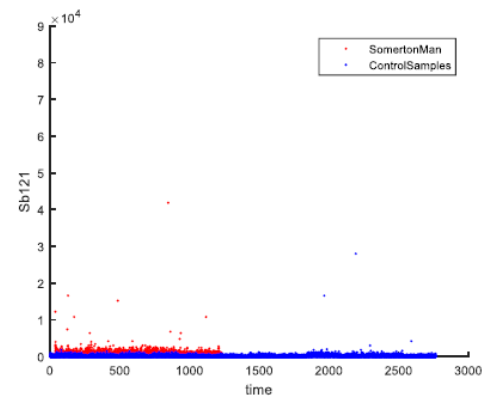
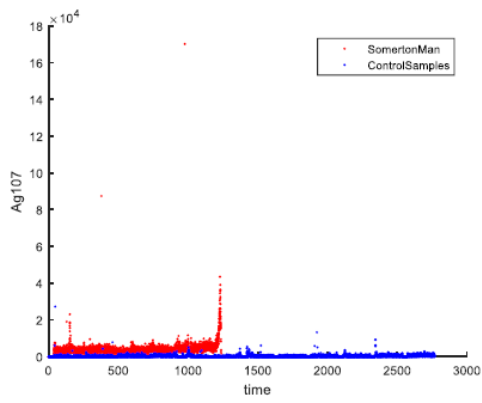
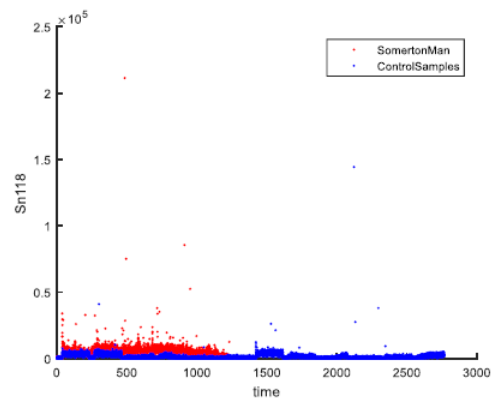
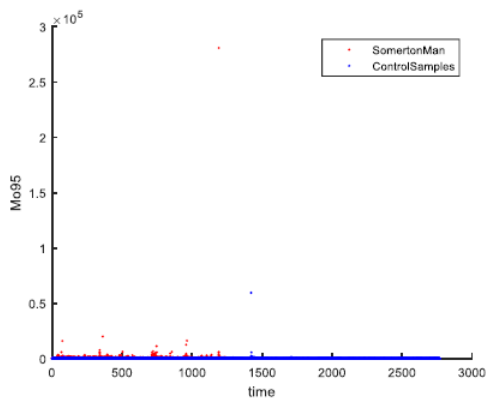
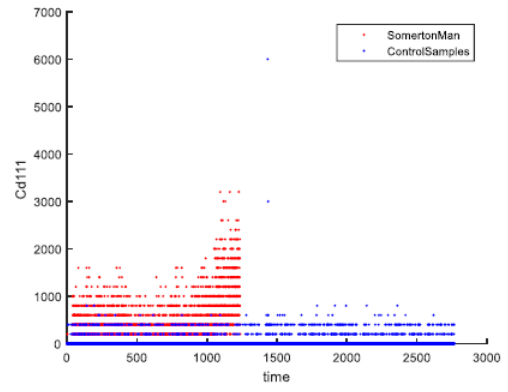
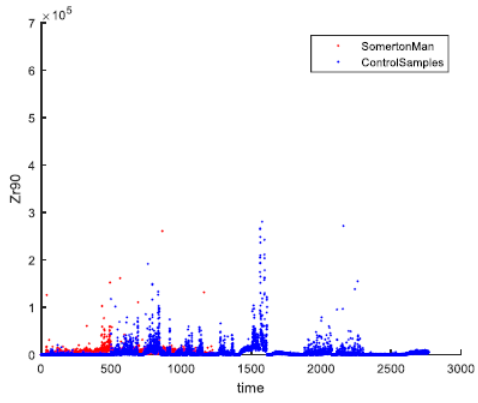
# Appendix A:

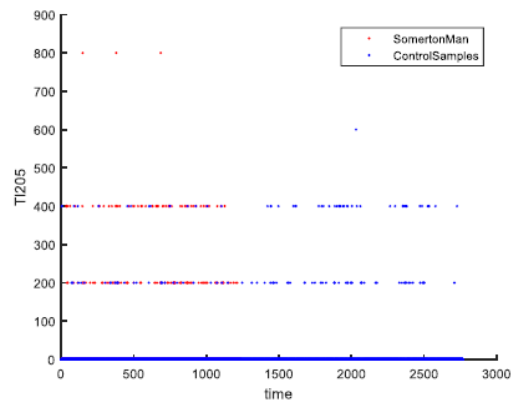
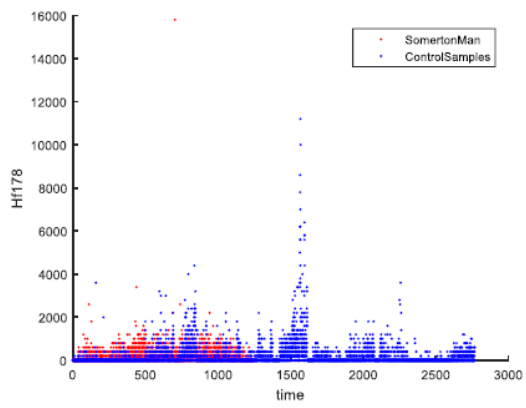
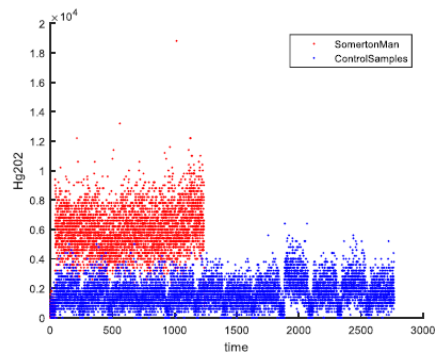
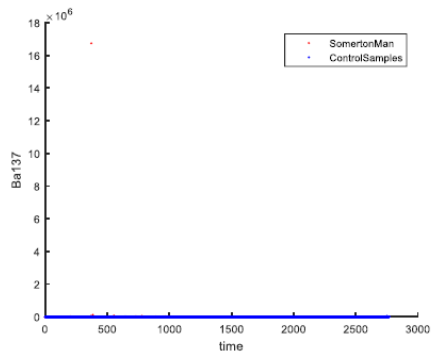
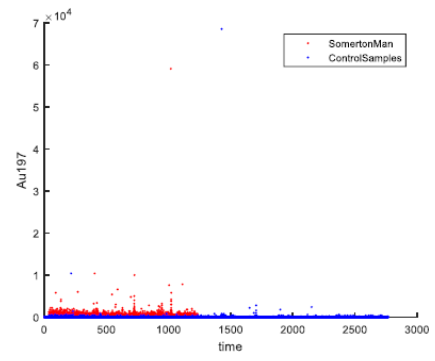
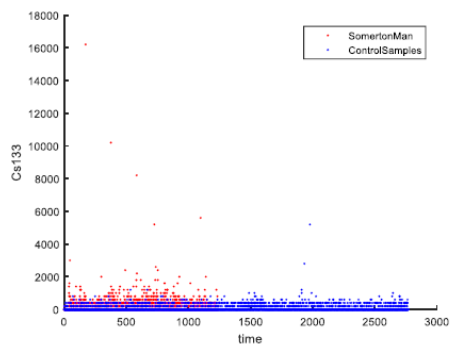


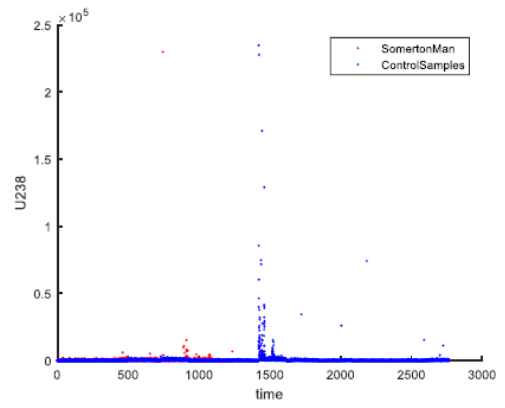
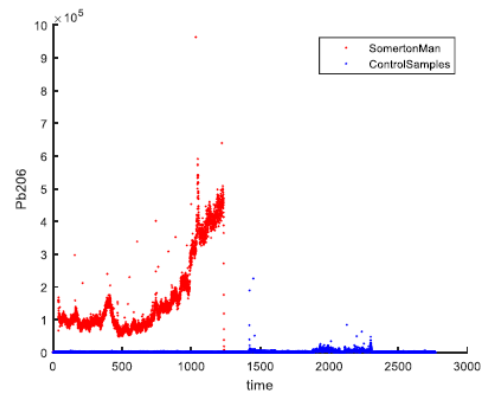
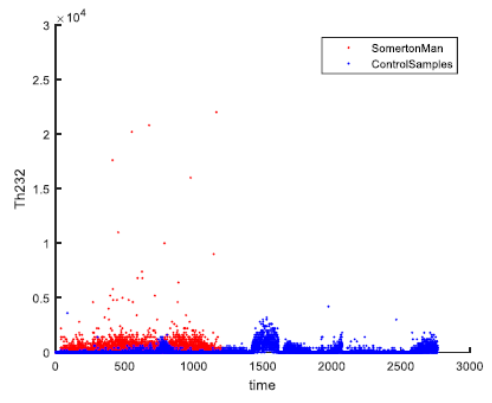
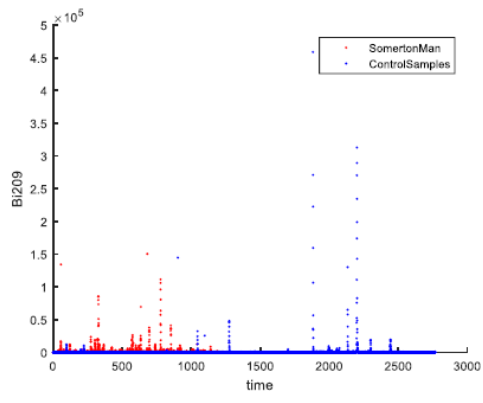






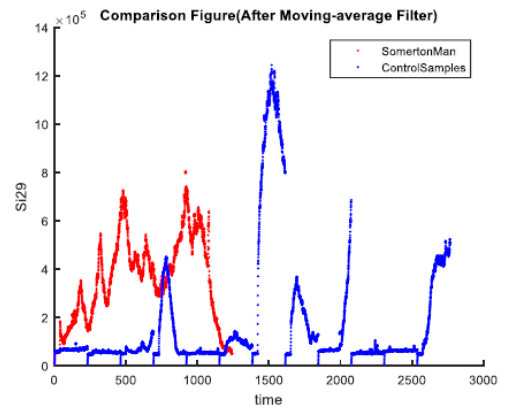
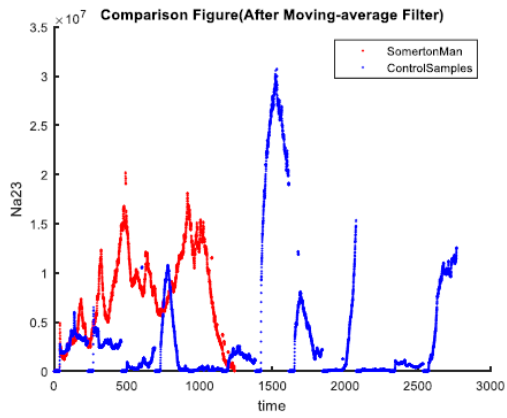
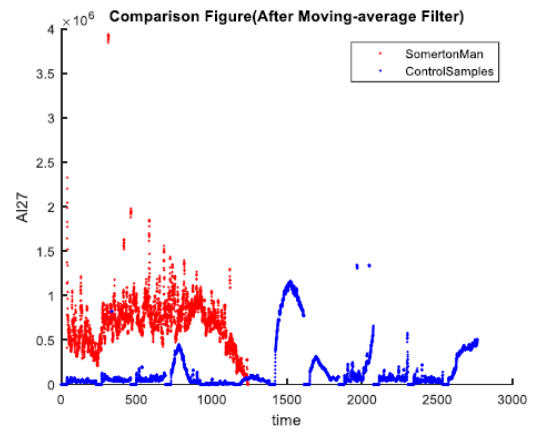
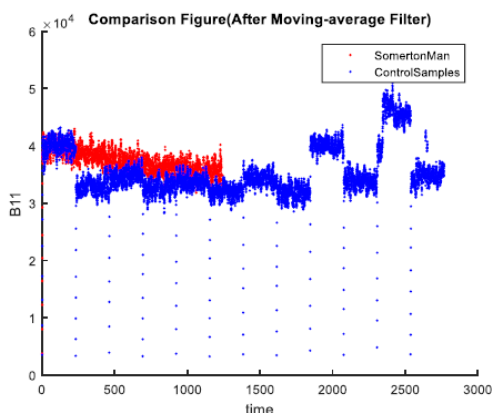
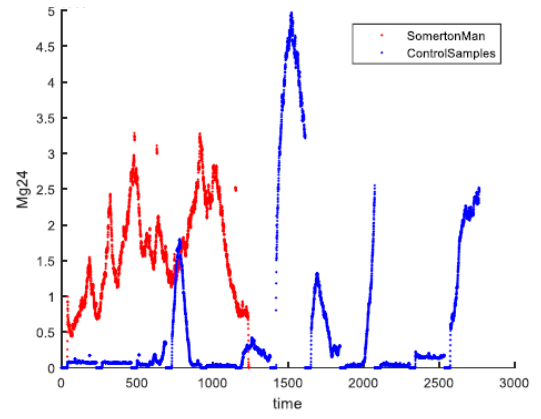
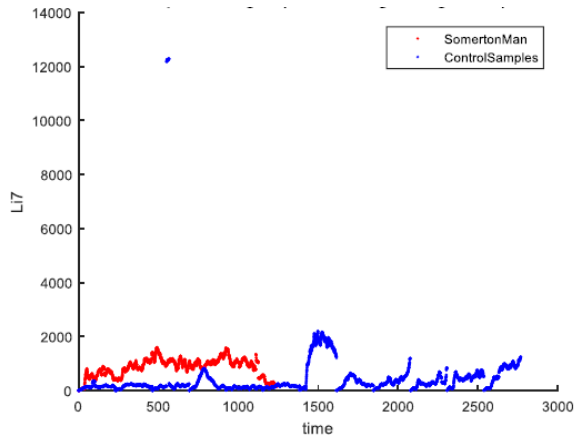


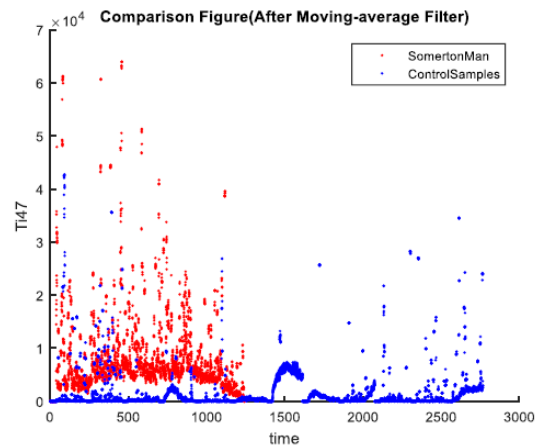
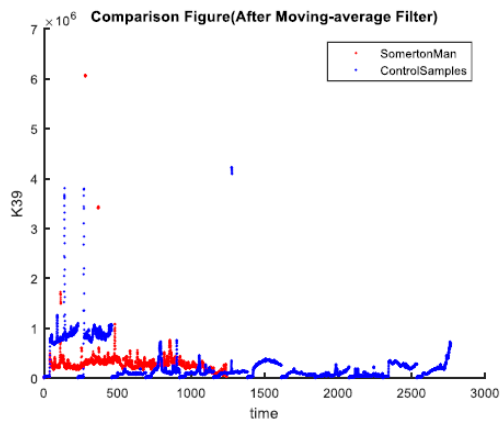
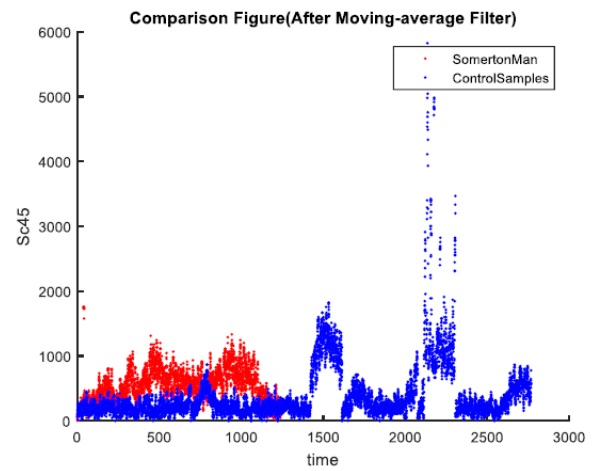
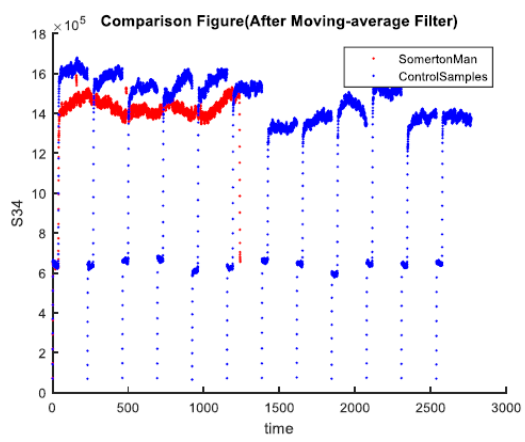
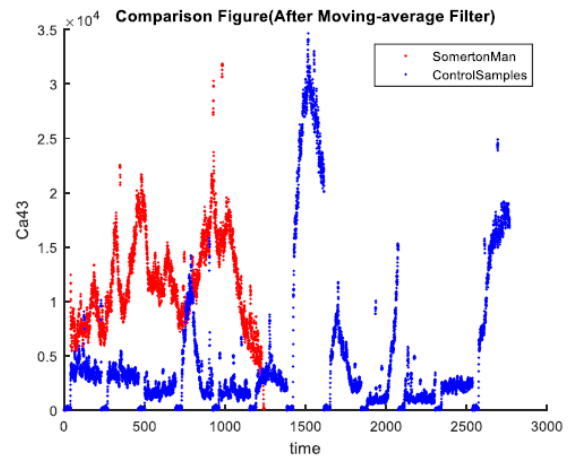
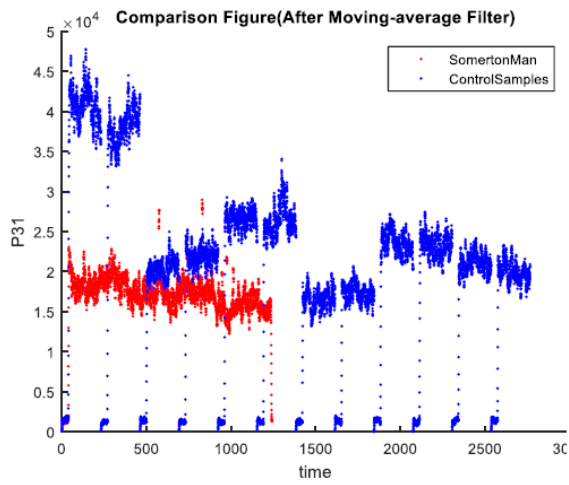


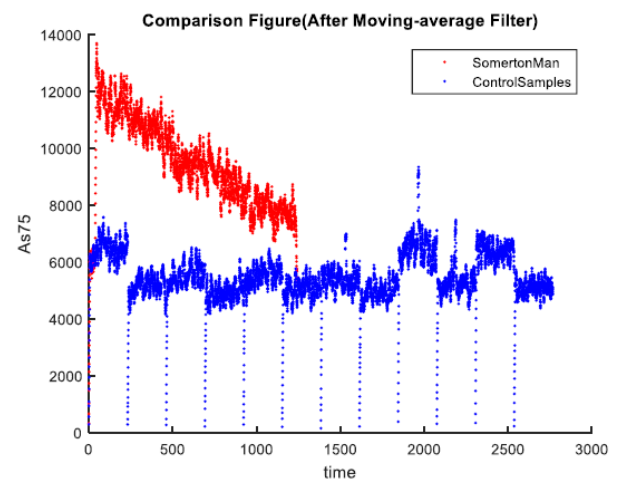
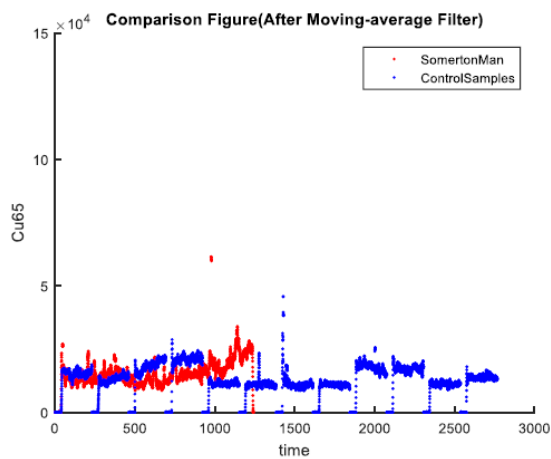
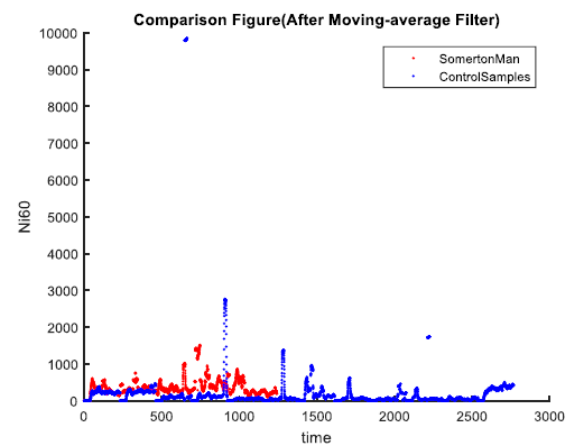
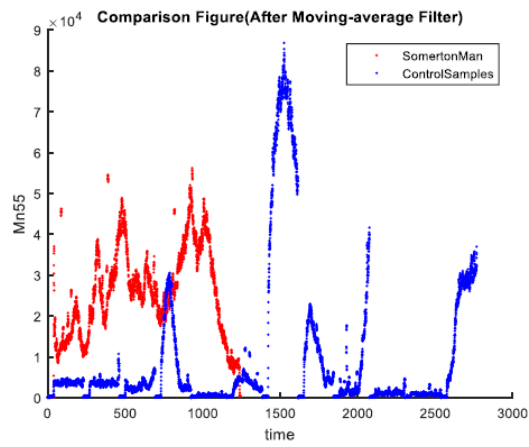
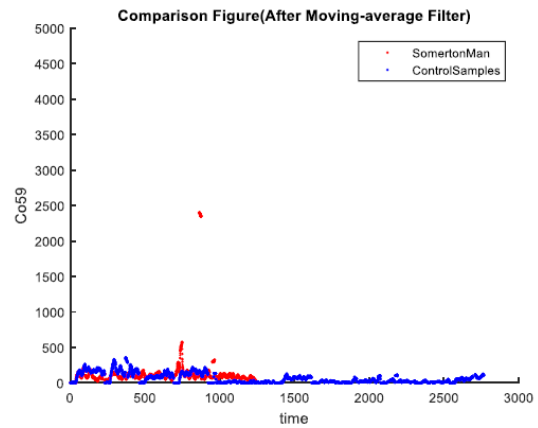
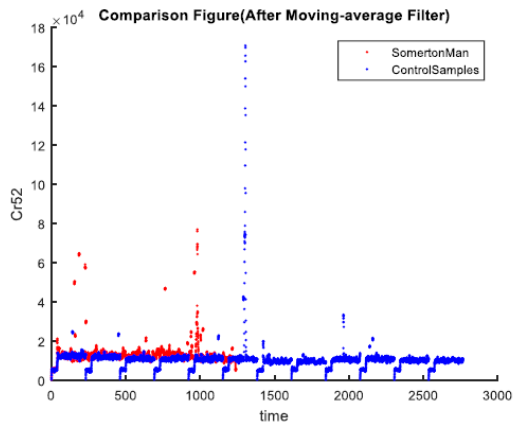
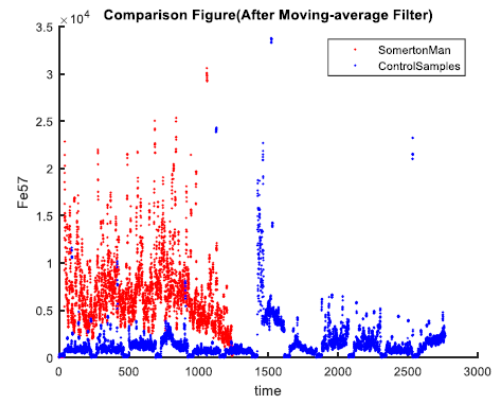
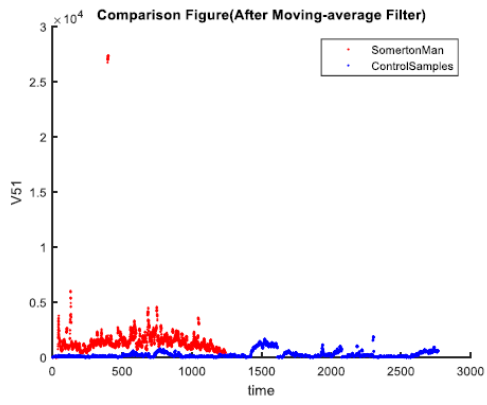


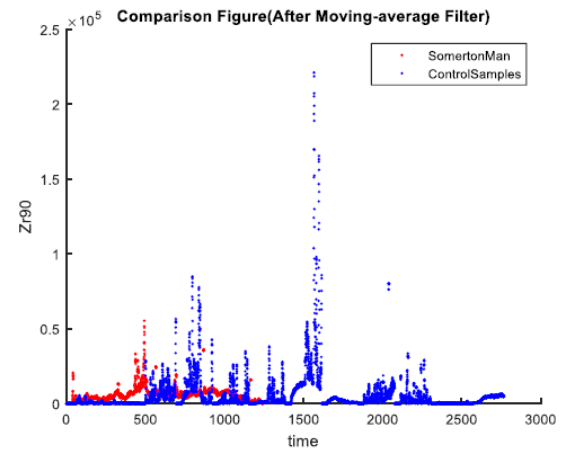
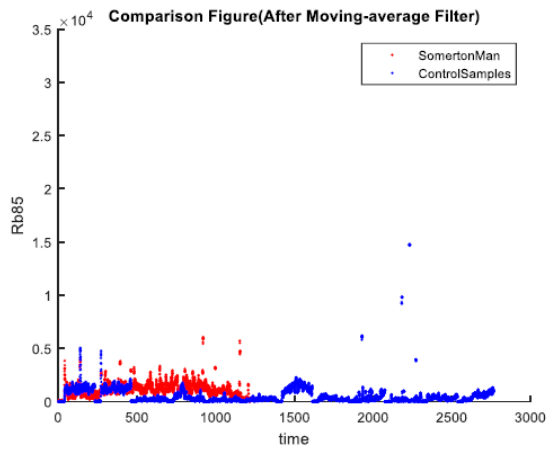
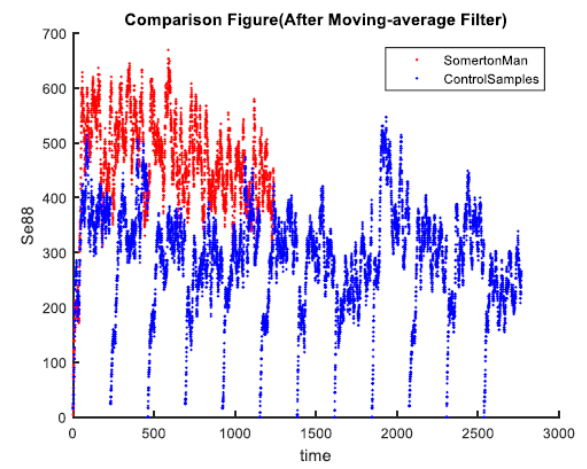
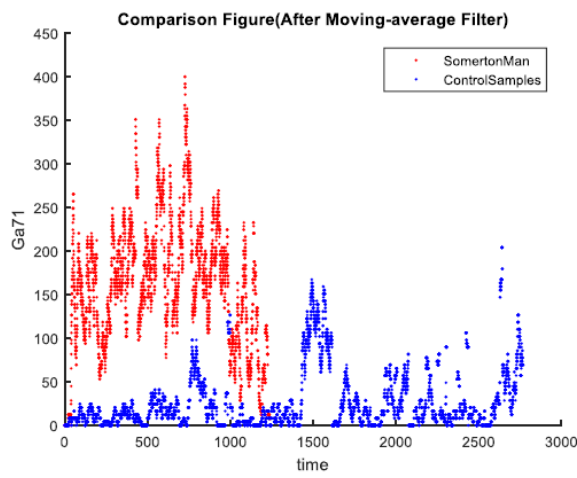
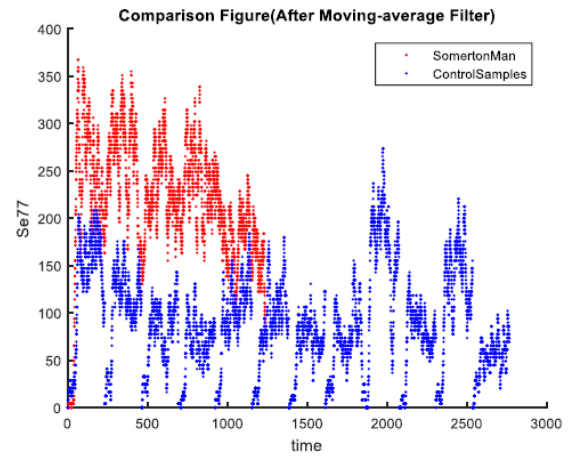
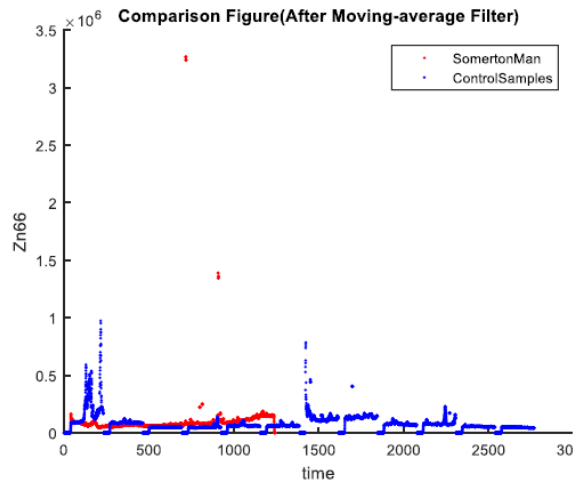


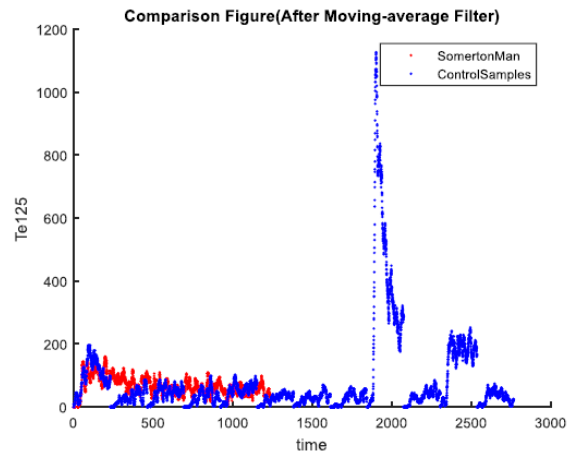
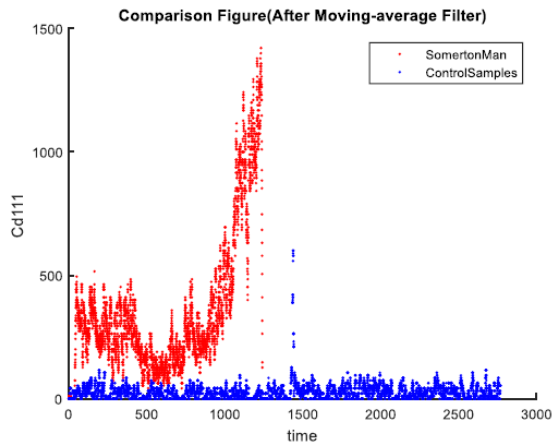
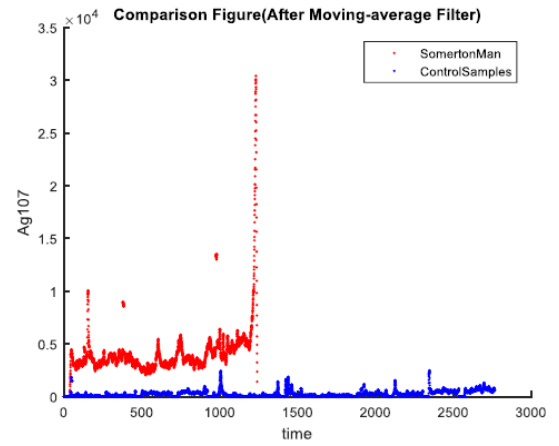
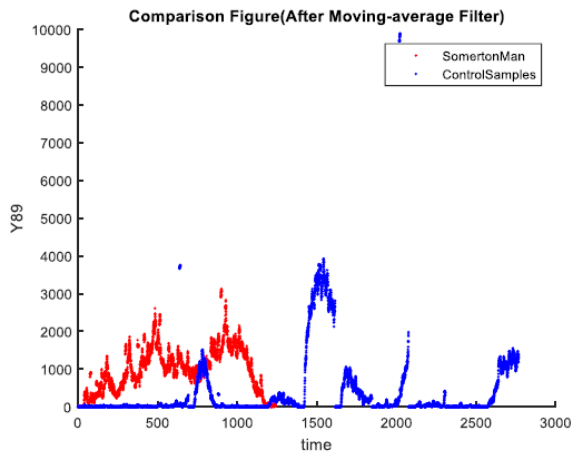
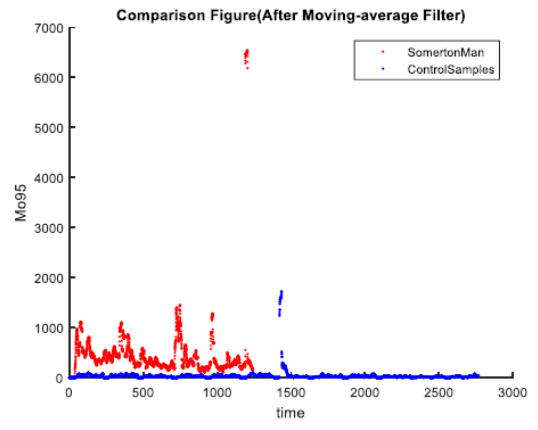
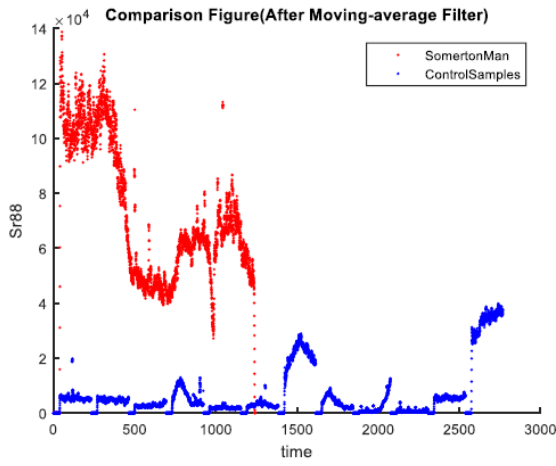
## Appendix B:

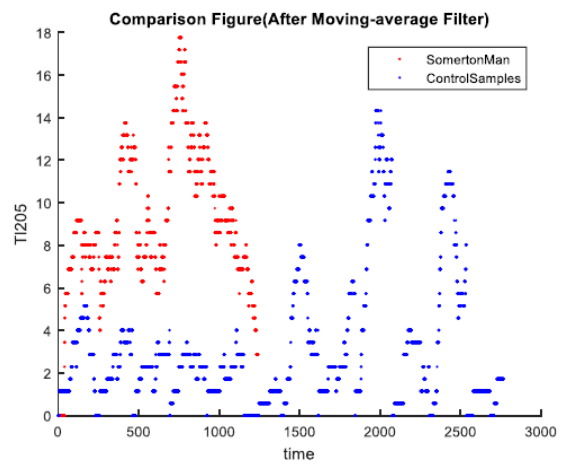
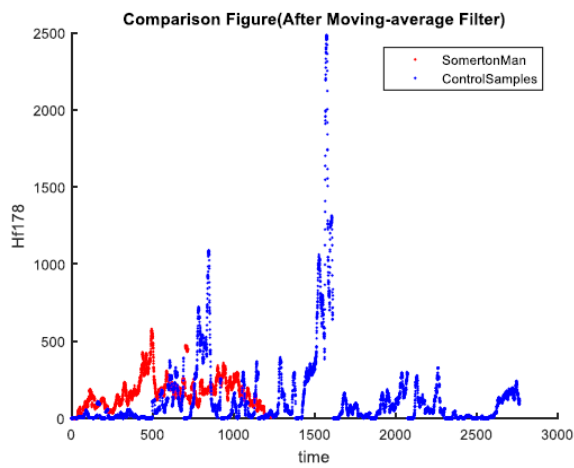
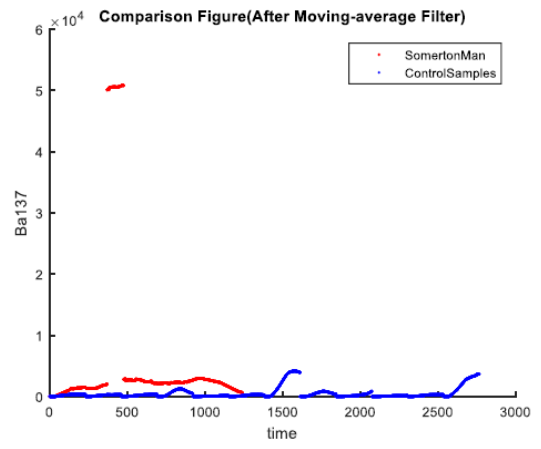
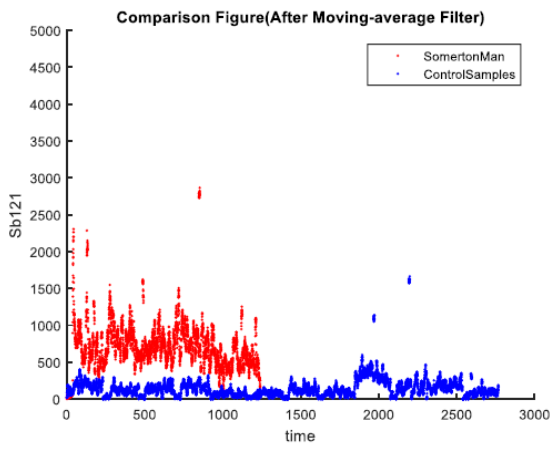
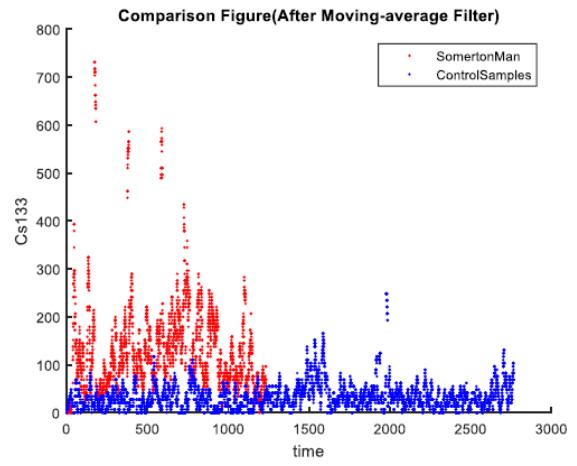
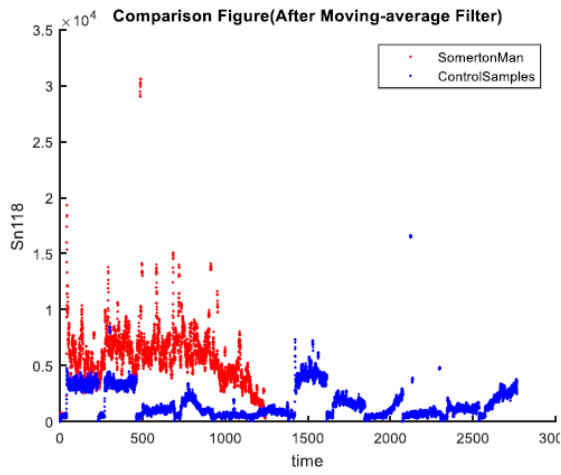


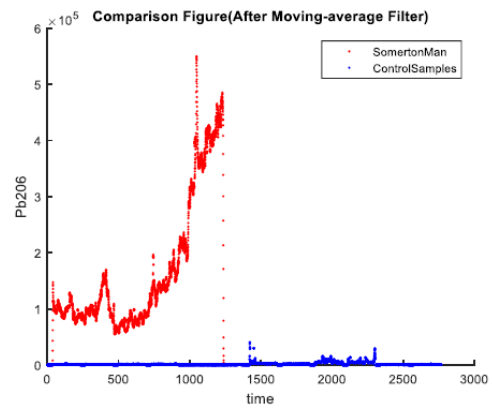
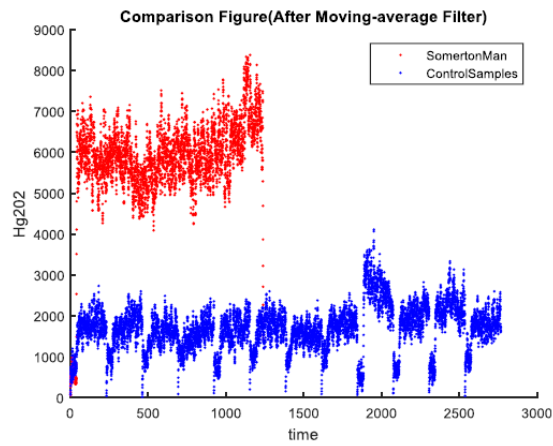
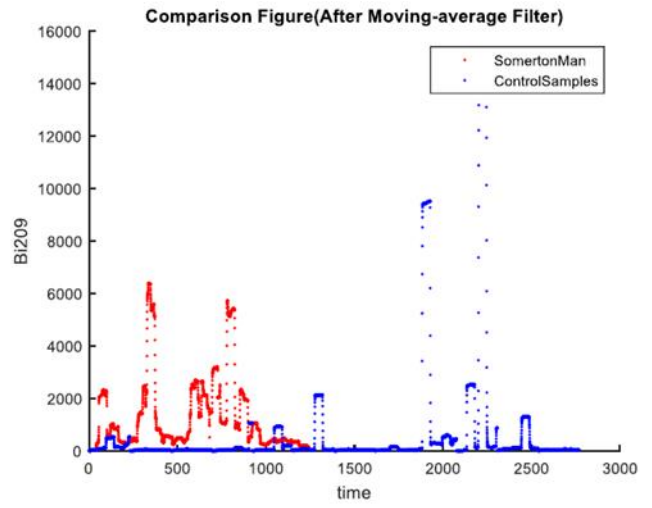
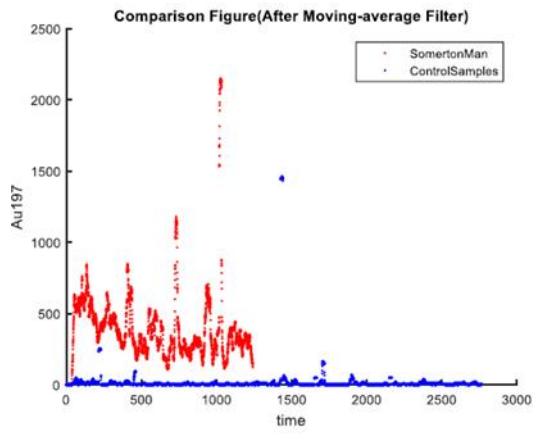


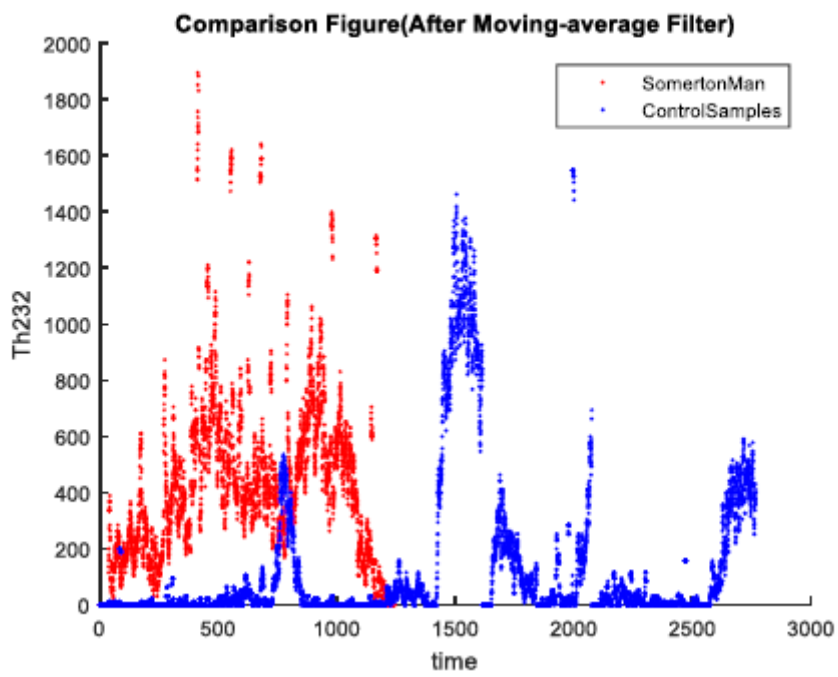
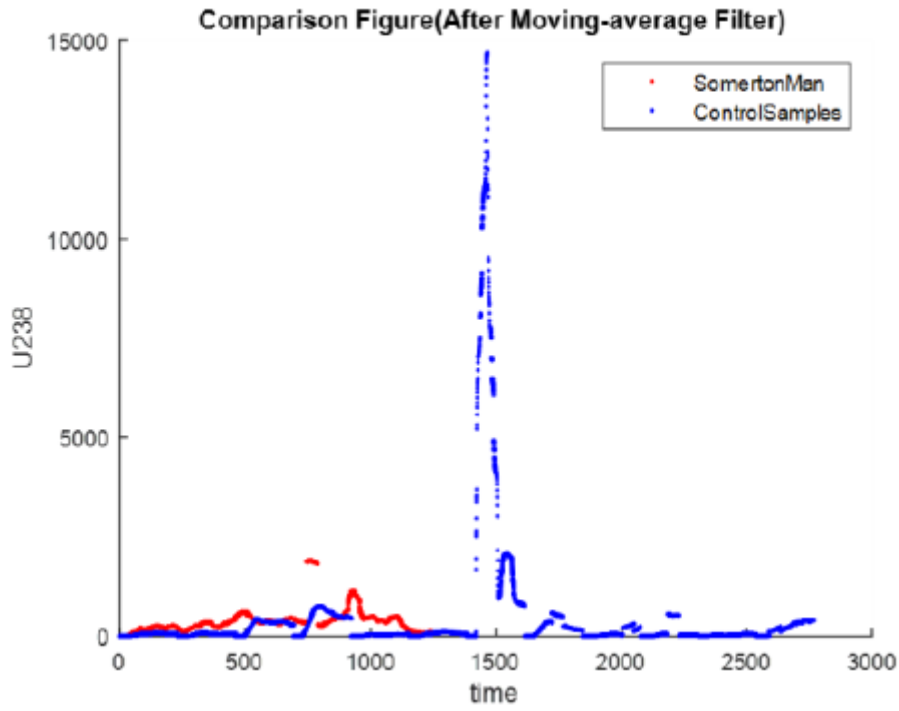














## Appendix C: The Timeline Gantt Chart

| Task Name                                    | Start Date      | End Date        | Duration    | % Complete | Assigned To | Comments |
|--|-----------------|-----------------|-------------|------------|-------------|----------|
| <b>Master project</b>                        | <b>02/29/16</b> | <b>11/04/16</b> | <b>180d</b> | <b>0%</b>  |             |          |
| <input type="checkbox"/> <b>Semester A</b>   | <b>03/01/16</b> | <b>05/27/16</b> | <b>64d</b>  | <b>20%</b> |             |          |
| Project Reaearch                             | 03/01/16        | 03/11/16        | 9d          | 100%       |             |          |
| Research Information and Background          | 03/07/16        | 03/11/16        | 5d          | 100%       |             |          |
| Understand the project                       | 03/14/16        | 03/18/16        | 5d          | 100%       |             |          |
| Prepare Proposal Seminar                     | 03/21/16        | 03/28/16        | 6d          | 100%       |             |          |
| Literature review                            | 03/28/16        | 04/04/16        | 6d          | 68%        |             |          |
| Proposal Seminar                             | 04/05/16        | 04/06/16        | 2d          | 20%        |             |          |
| Plot figures                                 | 03/21/16        | 05/13/16        | 40d         | 0%         |             |          |
| 1st thesis Draft                             | 04/04/16        | 04/22/16        | 15d         | 0%         |             |          |
| Analysis Glass Test Data                     | 03/14/16        | 05/20/16        | 50d         | 0%         |             |          |
| Certification of report for Examination form | 05/20/16        | 05/27/16        | 6d          | 0%         |             |          |
| <input type="checkbox"/> <b>Semester B</b>   | <b>07/25/16</b> | <b>11/04/16</b> | <b>75d</b>  | <b>0%</b>  |             |          |
| Review                                       | 07/25/16        | 07/29/16        | 5d          | 0%         |             |          |
| Plot Figures                                 | 08/01/16        | 10/20/16        | 59d         | 0%         |             |          |
| Analyaia Quartz Test Data                    | 08/15/16        | 10/20/16        | 49d         | 0%         |             |          |
| Compare Glass Test and Quartz Test Data      | 09/26/16        | 11/01/16        | 27d         | 0%         |             |          |
| Final Report                                 | 10/10/16        | 10/31/16        | 16d         | 0%         |             |          |
| Creat Youtube Video                          | 10/24/16        | 10/31/16        | 6d          |            |             |          |
| Project Exhibition Poster                    | 10/17/16        | 10/24/16        | 6d          |            |             |          |
| Final Seminar                                | 10/31/16        | 11/04/16        | 5d          |            |             |          |

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<<http://www.gizmodo.com.au>>

## Glossary and Symbols

**ICP-MS:** Inductively Coupled Plasma Mass Spectrometer