CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Ryan C. Fong

Project Number

J2004

Project Title

Coffee: Hazardous for Consumption? An Investigation of Polycyclic Aromatic Hydrocarbons in Various Coffee Roasts

Abstract

Objectives/Goals

The focus of my project is to determine if there are carcinogenic polycyclic aromatic hydrocarbons at harmful levels in brewed coffee. My hypothesis is that I believe that I will find detectable harmful levels of carcinogenic polycyclic aromatic hydrocarbons (PAH) in various brewed coffees.

Methods/Materials

Ten different brewed coffees were subjected for polycyclic aromatic hydrocarbon analysis. One liter of each coffee was extracted with dichloromethane using a continuous liquid-liquid extractor. After 18 hours, the dichloromethane coffee extracts were separated from the aqueous coffee part and concentrated. The samples were also cleaned using silica gel to remove non-polycyclic aromatic hydrocarbons compounds. The final sample extracts were analyzed using a gas chromatography mass spectrometer.

Results

All of the brewed coffees contained polycyclic aromatic hydrocarbons. Although there are many polycyclic aromatic hydrocarbons, only the high EPA profile compounds PAHs were analyzed for. Benzo(a)pyrene is one of the most potent PAH. Benzo(a)pyrene was detected between 0.017ug/L and 0.026ug/L. I also evaluated the total PAHs that I analyzed for. The total PAHs ranged from 0.048ug/L to 0.211ug/L.

Conclusions/Discussion

The results did support my conclusions, but levels were not high enough to exceed the maximum contamination level of Benzo(a)pyrene for drinking water criteria of 0.2ug/L. Although the coffee blends that were analyzed did not exceed 0.2ug/L Benzo(a)pyrene maximum contaminant drinking water limit, they did exceed California's Public Health Goal limit, which is 0.004ug/L. Moreover, in Europe the standards are usually more stringent. For example, the limit for Benzo(a)pyrene in consumer's tap water is 0.01ug/L. At that level, all of the brewed coffee roasts are above the European water threshold. For future project research possibilities, I may look at espresso type drinks since they are brewed at higher temperatures and pressures. I would also like to evaluate people who process coffees. Are they exposed more since they touch the coffee beans and can possibly inhale PAHs?

Summary Statement

My project investigated the presence and levels of polycyclic aromatic hydrocarbons in coffee.

Help Received

Used lab equipment at Agriculture & Priority Polluants Lab with father's supervision. Starbucks donated coffee.