



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

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Project Title Wanted: Safe and Healthful Water -- No Strings Attached (Phases II and III)	
Abstract Objectives/Goals The objective of Phase II was to determine the effect of temperature on the formation of trihalomethanes (THMs). The experiments in Phase III were conducted to utilize the factors in the formation of THMs found in Phases I and II to determine an effective method of THM removal using filters that were either hand-made or commercially processed. Methods/Materials For Experiment 1, water samples from 6 sources were spiked with 3 ppm of NaOCl and were stored at either 4 or 20 deg. C, to note the trend in THM formation based on temperature. Experiment 2 tested the effectiveness of coconut carbon, graphitized non-porous carbon, and a styrene divinylbenzene polymer base in the removal of THMs by filtering water spiked with 80 ppb of THMs. In Experiment 3, 8 hand-made filters, created using various types of adsorbents/absorbents, along with 5 commercially made filters, were tested for efficiency in the removal of THMs at pH levels of 4, 7, and 11. In Experiment 4, tests for the two most efficient filters from Experiment 3 were confirmed by filtering 8 types of water spiked with 80 ppb of THMs. The GC/MS was used to analyze the type and quantity of the THMs using 40mL samples. To ensure that the results for the THM analysis were accurate, a calibration curve was created using various concentrations of the THM standard on the GC/MS, and the ratios of the fluorobenzene internal standard were periodically checked. A total of 288 samples were tested, in addition to 0 ppb, 2 ppb and 10 ppb standards that were used to continuously check the calibration of the system. Results The samples stored at 20 deg. C formed more THMs in Experiment 1. Coconut carbon, recommended by the EPA for the removal of NDMA, proved to be the most successful in the removal of THMs. The styrene divinylbenzene polymer base was also quite effective in removing THMs, but it yielded a byproduct of benzene. Conclusions/Discussion THM formation is directly related to temperature and can successfully be eliminated using filtration by coconut carbon. THMs, especially chloroform, are easily produced in many water sources after chlorination. Known as toxins, significant amounts of THMs (over 60 ppb) can also cause large sores, and they have been linked to bladder, colon, and rectal cancer, diseases in the kidney, liver, lung, and nervous system, as well as miscarriages. Both hard chlorine tablets and liquid forms of chlorine can cause THM formation in water.	
Summary Statement Trihalomethane formation is positively associated with temperature, in addition to the incubation period and the presence of organic content and chlorine, and THMs could effectively be eliminated through the use of coconut carbon filters.	
Help Received I received prior training on running and interpreting the GC/MS from Supervising Chemist Lee J. Yoo during the past four years. Lab work for detection of trihalomethanes was done in the organic laboratory of OCWD under the supervision of Lee J. Yoo.	