



Colorado Science and Engineering Fair

2025 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: Going Nuts Over Biochar: Pistachios vs. PFAS

Finalist's Name: Cameron Kempisty

School and City: Eagleview Middle School, Colorado Springs

Sponsor's Name: David Kempisty

Category: Earth & Environmental Sciences

Division: Junior (grades 6 - 8)

Abstract (250 words or less):

Per- and poly-fluoroalkyl substances (PFAS), widely known as “forever chemicals”, are man-made chemicals used by industrial companies for their non-stick, water-repellant, and stain-resistant properties. During the industrial processes, these PFAS can be washed into our water. They pose a significant health risk to humans, plants, and animals.

Currently, a leading way to remove these chemicals from water is using Granular Activated Carbon (GAC). Although it is effective, it isn't sustainable. The goal of this project was to find if environmentally-friendly biochar made from pistachio shells or unused trees from the logging industry can remove PFAS from water as well as, or better, than GAC.

To test this, a first experiment included 4 types of activated biochar, a non-activated biochar, and 1 type of GAC to test the effectiveness of filtering out Total Organic Carbon (TOC). Two different adsorbent doses were tested; quadruplicates were performed in most conditions.

The biochar created from unused trees performed statistically similar to GAC. This eliminated the pistachio biochar from experiment 2.

For experiment 2, a similar procedure was followed, except PFAS was used instead of TOC. Two PFAS, PFOA and PFOS, were used. These are common types of PFAS. Triplicates were performed in most conditions. Results showed biochar activated with H₂SO₄ was statistically comparable to GAC in PFOA removal. For PFOS, biochar samples were statistically comparable to GAC.

This shows that there is a more sustainable option for filtering out hazardous chemicals such as PFAS and TOC to provide clean water to the world.

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature:

Date:

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. **A signed copy of this form must be included in your notebook.**