



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: Bio Guardians: Nature's Water Purifiers

Finalist's Name: Joaquin Romero

School and City: Rocky Ford High School

Sponsor's Name: Jason Bacolod

Category: Earth & Environmental Sciences

Division: Senior (grades 9 - 12)

Abstract (250 words or less):

The discovery of 14 million tons of microplastics in our oceans, affects marine ecosystems and food chains prompted an investigation into affordable filtration solutions. While industrial filters exist, their high costs limit accessibility for many communities. This research explored whether combining natural materials like sand, activated charcoal, coconut fiber, and banana peels could create an effective, low-cost (<\$20) water filtration system.

Four different filter combinations were tested in triplicate under controlled conditions (20-22°C, 100g material/layer, 1 g/L microplastic concentration). Each test processed 500mL of contaminated water through standardized filter containers. Water clarity improvement (scale 1-5), flow rate (mL/min), and volume recovery (%) were measured through direct observation and collection.

Statistical analysis ($p < 0.05$) showed sand as the most effective medium, improving clarity from rating 1 to 5, with 281.21 mL/min flow rate and 85% recovery rate. Activated charcoal performed poorly (clarity improved from 1 to 1.3, flow rate 0.47 mL/min), while the sand-coconut combination achieved moderate success (clarity improved from 1 to 4, flow rate 12.57 mL/min). Most combinations failed to reach the target 100 mL/min flow rate needed for practical implementation.

The research identified sand as an unexpectedly effective and economical filtration medium, though optimizing flow rates remains necessary for practical application. These findings suggest that simple, readily available materials could provide accessible solutions for water purification in resource-limited communities.

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.**