**Colorado Science and Engineering Fair**

**2024 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: Waste to Watts: Converting Locally Sourced Organic Waste Material into Activated Carbon Based Supercapacitors

Finalist's Name: Shrey Rohilla

School and City: The Classical Academy North High School, Colorado Springs

Sponsor's Name: Paritosh Rohilla

Category: Energy (ERGY)

Division: Senior (9th - 12th grades)

Abstract (250 words or less):

The world's increasing demand for energy and concerns over the environmental impacts of current battery production methods highlight the need for more sustainable and environmentally friendly energy storage solutions. Supercapacitors are one such energy storage solution. These devices store energy electrostatically, eliminating the need for environmentally harmful materials like those used in batteries. In response, I created a supercapacitor out of activated carbon (AC) processed from locally sourced brewer's spent grain (BSG), a common waste byproduct of the brewing process, and salt water.

The BSG AC was produced as environmentally friendly as possible, through the activation of carbonized BSG via superheated steam during pyrolysis. An iodine absorbance test showed the BSG AC absorbing 972.06 mg of iodine per gram, 870% more than regular carbon, and only 4% less than commercial AC, confirming successful activation.

The BSG AC was then used to create a supercapacitor with a saltwater electrolyte, chosen for its relatively low environmental impact compared to other popular electrolytes. This supercapacitor was tested against a commercial AC supercapacitor of identical construction.

The tests revealed that the BSG AC supercapacitor achieved a maximum voltage of 1.2V, capacitance of 158.64 F, specific capacitance of 453.26 F/g, energy density of 0.0052 Wh/g, and a power density of 0.2654 W/g. Although the commercial AC supercapacitor showed 20% greater performance in some areas, the results are promising. They demonstrate the potential of supercapacitors made from low-value waste materials like BSG and salt water as viable, environmentally friendly energy storage solutions, that pave the way for the future of clean energy storage devices the world desperately needs.

*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: Shrey

Date: 3/2/24

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 o 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.