

# Recycling of waste coffee grounds into porous carbon blocks: fabrication and property evaluation

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Approximately 6 million tons of coffee are produced worldwide each year, and most of the resulting coffee grounds are discarded as waste by cafes, restaurants, and individuals. These waste coffee grounds are typically disposed of in landfills, contributing to environmental pollution. Coffee grounds are mainly composed of hemicellulose (37 wt%), lignin (29 wt%), protein (13 wt%), and cellulose (9 wt%), which undergo thermal decomposition during carbonization, releasing volatile gases and forming pores within the carbon matrix.

In this study, waste coffee grounds were utilized as a biomass precursor for fabricating porous carbon blocks. Dried coffee grounds were subjected to primary heat treatment, pulverized, and classified according to particle size suitable for molding. The powders were mixed with resin at an optimized ratio and uniaxially pressed at 20 MPa to produce green bodies (5 × 5 × 25 mm). The molded samples were carbonized at 1000 °C and subsequently activated in a CO<sub>2</sub> atmosphere to develop porosity.

The resulting carbon blocks were characterized in terms of apparent density, porosity, and specific surface area to evaluate their feasibility as functional porous carbon materials. The results are expected to demonstrate that waste coffee grounds can be effectively recycled into porous carbon-based materials with potential applications in energy storage and environmental technologies.

## References

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