Energy Efficiency Optimization of Biochar Cook Stoves through Computational Simulation

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Abstract

Biochar cook stoves have high potential of solving socio-economic and environmental problems of community living in rural areas like south-west part of Ethiopia where there is large biomass resource polluting the environment. Technically, these stoves have two purposes: 1. Energy generation (energy conversion) and 2. Biochar production. The stoves can be best in either energy generation or Biochar production but not both. This work aims at optimizing the stoves for maximizing energy generation efficiency. The problem is shape and size optimization, with energy efficiency as objective function, of stoves that use saw dust, coffee husk, brewery waste and Qat residue as feed stocks using computational fluid dynamics (CFD) simulation to generate alternative solutions. The optimization is conducted for Anila and Elsa Biochar cook stoves. The optimization results show energy efficiency improvement up to 10 percent of the optimal stoves compared to classical ones.

Keywords: Biochar; Cook Stoves; Optimization; Energy; Efficiency; CFD

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