

Comparative Performance Evaluation of Matribhumi Improved Cook Stove (ICS) with Traditional Cooking Stove (TCS)

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Abstract

Nepal is a developing country with its cooking energy highly inclined towards biomass and the use of TCS remains dominant. Due to limited access to modern energy systems people in rural communities use TCS despite their recognized health and environmental implications. Predominantly, TCS emit high levels of indoor air pollutants and contribute significantly to deforestation due to its low combustion efficiency and excessive fuel consumption. The concept of Matribhumi ICS, a two-pot hole biomass stove with a chimney made of clay, rocks, and a burner operating on a natural draft, has been introduced as a cost-effective and efficient alternative, promising reduced fuel consumption, decreased emissions, and improved health outcomes. User safety of ICSs has not been prioritized in their design nor have studies been done to see the immediate safety of these ICSs for users. The study aims to evaluate the comparative performance of ICS against TCS in terms of thermal performance, fuel consumption, and user safety. The latest version of the Water Boiling Test (WBT) and Biomass Stove Safety Protocol (BSSP) developed collaboratively by alliance partner of Clean Cooking Alliance (CCA) was performed in 10 ICS and TCS stoves. The overall performance of both stoves was studied based on both on-site testing and lab testing performed in Air Pollution and Health Research Lab (APHR). In accordance with the WBT test, the thermal efficiency of the ICS was double than that of the TCS with a drastic reduction of smoke when operating. The specific fuel consumption in grams per liter of ICS is 62% less than that of TCS. In contrast to TCS, which received a score of 50.5 and an overall rating of "poor," ICS received an average score of 87.5 out of 100 for its BSSP test. The use of ICS not only has a substantial beneficial effect on health and the environment, but it also reduces the risk of scalds and burn injuries. These kinds of tests will help the designer to develop efficient and safer stoves for the community.

Keywords—*Improve cook stove, Water Boiling Test, Biomass Stove Safety Protocol, Thermal Efficiency*