Ultrafine particles raise concerns about improved cookstoves

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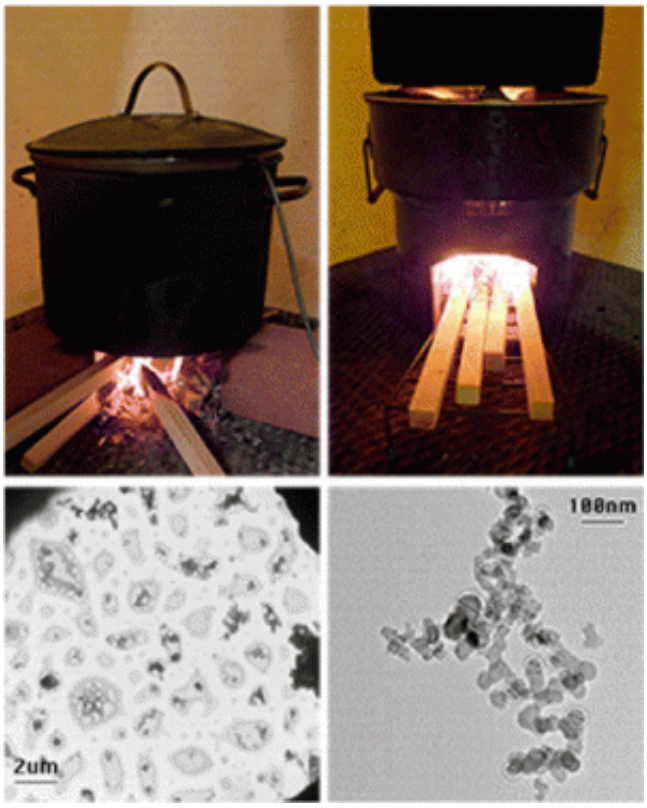

A new study raises concerns about possible health impacts of very small particles of soot released from the "improved cookstoves" that international aid agencies are promoting to replace open-fire cooking in developing countries. It appears in the ACS journal *Environmental Science & Technology*.

Brian Just and colleagues point out that 3 billion people worldwide still cook meals on stoves or open fires that burn wood, animal dung or other biomass fuel. These fires, which sometimes are indoors, release air pollutants linked to 3.5 million deaths annually. Soot, or so-called "black carbon" (BC), released in the smoke also is a factor in global warming. In an effort to remedy the situation, aid agencies plan the distribution of 100 million new, clean-burning cookstoves during the next 10 years. Concerns have arisen, however, about pollutants released by the stoves. Just's team focused on emissions of ultrafine soot particles linked to some of the most serious health problems.

They describe laboratory tests comparing two styles of improved cookstoves to a traditional three-stone open fire burning wood. Improved stoves did release much lower overall levels of soot. However, per quantity of fuel burned, they did not emit significantly smaller amounts of BC, and they produced three times the quantity of worrisome ultrafine particles that can penetrate deep into the lungs compared to the open fire. The tests included only a narrow range of operating conditions, but for these conditions, at least, it appears that new cookstoves are not automatic "fixes" to the health problems associated with cooking activities and that, "Given improved cookstoves' recent funding and attention, continued improvement in our understanding of emissions and end effects is important," they say.

More information: Characterization of Ultrafine Particulate Matter from Traditional and Improved Biomass Cookstoves, Environ. Sci. Technol., Article ASAP DOI: 10.1021/es304351p

Abstract
Biomass combustion in cookstoves has a substantial impact on human health, affects CO2 levels in the atmosphere, and black carbon (BC) and organic carbon (OC) affect the earth's radiative balance. Various initiatives propose to replace traditional fires with "improved"

(nontraditional) cookstoves to offset negative local and global effects. In this laboratory study, we compared the size, composition, and morphology of ultrafine particulate emissions from a "three-stone" traditional fire to those from two improved stove designs (one "rocket", one "gasifier"). Measurement tools included a scanning mobility particle sizer, PTFE and quartz filter samples, and transmission electron microscopy. In the improved stoves, particulate mass (PM) emissions factors were much lower although median particle size was also lower: 35 and 24 nm for the rocket and gasifier, respectively, vs 61 nm for the three-stone fire. Particles from improved stoves formed clearly defined chain agglomerates and independent spheres with little evidence of volatile matter and had a higher proportion of BC to total PM, although overall BC emissions factors were fairly uniform. The 3-fold increase in quantities of sub-30 nm particles from improved cookstoves warrants further consideration by health scientists, with due consideration to the higher combustion efficiencies of improved cookstoves.

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