ABSTRACT

The first time this research work reports emission factor of $PM_{2.5}$, carbonaceous aerosol (organic, elemental, and water-soluble organic carbon), ions, trace elements, and optical properties of aerosol, and gases emitted from the infield burning of mixed biomass fuel in traditional cookstoves. The fuel-based emission factors were measured primarily for four generic cooking process categories: boiling, baking, frying, and curry making. The average fuel mixture percentage of the three types of fuel, namely fuelwood (FW), dung cake (DC), and crop residues (CR) that the residents used for combustion as mixed power, was found to be-$39\pm6. 3\%$ FW, $49. 5\pm2.7 \%$ DC and $12\pm5.3\%$ CR. The particles were collected and analyzed for climate-relevant constituents of aerosol. The process of boiling emitted higher $PM_{2.5}$ ($3.0\text{-}12.4$ gkg^{-1}) and CO ($22\text{-}125$ gkg^{-1}) with a large fraction of organic carbon (OC) ($37\text{-}66\%$), while emissions from frying and curry making were moderate ($2.8\text{-}7$ gkg^{-1}) and the process of baking had a low emission ($2.2\text{-}7$ gkg^{-1}) with a comparatively high EC ($13\text{-}29\%$). This study reveals that the emission of gases and aerosols do vary significantly with the type of cooking event and fuel mix, even if a single type of fuel/cookstove combination is used. The emissions estimates of $PM_{2.5}$, EC, and OC and gaseous pollutants (CO, CO_2, $SO_2,$ and NO_X) were calculated using new emission factors and fuel use data for Uttar-Pradesh for the base year 2017. The Global warming commitments of the pollutant aerosol and gases were determined for 100 years and a 20 year lifetime.