ABSTRACT

This study aims to investigate and demonstrate the feasibility and sustainability of producing municipal solid waste briquettes from sugarcane bagasse as an alternative fuel source. To fulfill the desired objectives of the study, a detailed and systematic methodology was adopted based on site selection, raw material collection and pre-treatment, quality optimization, briquetting, and qualitative and quantitative analysis. These analyses included study of various physical, proximate, thermal and ultimate parameters for briquette quality and performance assessment, air quality analysis for assessing eco-friendliness, and cost analysis by evaluating production cost of the fuel briquettes for assessing cost-effectiveness. For quality optimization of briquettes, five types of briquettes were prepared A, B, C, D, and E in combination with orange peels with different composition ratios i.e., 0%, 25%, 50%, 75%, and 100% respectively. The results showed that briquette types A, B, and C exhibited exceptional quality, meeting or exceeding established ISO standards. Additionally, all briquette types displayed substantial calorific values, with type A having an impressive 25.52 MJ/kg, confirming their efficacy as an energy source. The study quantified significant reductions in pollutant emissions of NO_2, SO_2, CO, and O_3 during the combustion of sugarcane bagasse-based briquettes. This quantitative data underscores the potential for improved air quality and reduced environmental impact compared to conventional fuels. Moreover, the production cost of one kilogram (kg) of MSW fuel briquettes was calculated to be 95.04 PKR whi was 20% cheaper than that of coal, making briquettes a cost-competitive alternative and sustainable energy source. This study showed the potential and practicality of sugarcane bagasse-based briquettes for addressing cleaner energy and waste management challenges, enhancing air quality, and offering a localized and economically competitive solution in urban areas of Pakistan.