GASEOUS EMISSIONS CHARACTERIZATION FROM POTASSIUM NITRATE-BASED ROCKET COMPOSITE PROPELLANT COMBUSTION

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ABSTRACT

This paper reports the gaseous compositions produced from the combustion of a laboratory-synthesized potassium nitrate (KNO_3)-based rocket composite propellant. The exhaust emissions produced from the combustion of 10 different propellant formulations were analyzed using an E8500 portable industrial emission analyzer. The concentrations, emission factor, and emission rates of the gaseous pollutants were computed. The measured concentrations were then compared with the stationary source limit by the Federal Ministry of Environment standard (Nigeria) to establish their impact on air quality. The obtained concentrations were as follows: hydrocarbon (HC) ranged from 56 to 290 mg/m^3, with an the average concentration of 145.72 ± 20.12 mg/m^3; carbon monoxide (CO) ranged from 234 to 2030 mg/m^3, with an average concentration of 1177.3 ± 154.2 mg/m^3; nitrogen oxides ranged from 19.8 to 53.7 mg/m^3, with an average concentration of 33.9 ± 4.18 mg/m^3; sulfur dioxide ranged from 8.2 to 156.8 mg/m^3, with an average concentration of 25.4 ± 14.67 mg/m^3; and hydrogen sulfide ranged from 1 to 6 mg/m^3, with an average concentration of 2.44 ± 0.50 mg/m^3. The results indicate that HC and CO emissions from the combustion of KNO_3-based composite propellant represent a great threat and concern in relation to air quality. Thus, the proper management and control of rocket launches using KNO_3-based composite propellants needs to be immediately addressed; otherwise, such emissions could have negative effects on the atmospheric environment of rocket routers.

KEY WORDS: combustion, composite rocket propellant, E8500 portable industrial emission analyzer