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Intensification of Process Kinetics for Conversion of Organic Volatiles into Syngas Using Non-Thermal Plasma

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Abstract : The entire world is skeptical towards a silver line technology of converting plastic waste into valuable synthetic gas. At this junction, besides an adequately studied conventional catalytic process for steam reforming, a non-thermal plasma is being introduced. Organic volatiles are produced in the first step, pyrolysing the plastic materials. Resultant lightweight olefins and carbon monoxide are the major components that undergo a steam reforming process to achieve syngas. A non-thermal plasma consists of ionized gases and free electrons with an electronic temperature as high as 10^3 K. Organic volatiles are, in general, endorganics inactive and thus demand huge bond-breaking energy. Conventional catalyst is incapable of providing the required activation energy, leading to poor thermodynamic equilibrium, whereas a non-thermal plasma can actively collide with reactants to produce a rich mix of reactive species, including vibrationally or electronically excited molecules, radicals, atoms, and ions. In addition, non-thermal plasma provides nonequilibrium conditions leading to electric discharge only in certain degrees of freedom without affecting the intrinsic chemical conditions of the participating reactants and products. In this work, we report thermodynamic and kinetic aspects of the conversion of organic volatiles into syngas using a non-thermal plasma. Detailed characteristics of plasma and its effect on the overall yield of the process will be presented.

Keywords : non thermal plasma, plasma catalysis, steam reforming, syngas, plastic waste, green energy
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