# Green and Sustain Energy for Tomorrow: From Waste Vegetable Oil to Economical Iron Nanoparticles Embedded Carbon as Cathode Catalyst in Fuel Cell

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Zero-emission proton exchange membrane fuel cell (PEMFC) is promisingly considering as a great candidate promoting the alternative energy to overcome the pollution issues emitted by fossil fuel. PEMFC is still expensive, especially commercial platinum (Pt)/Carbon in cathode-side catalyst. This research has then been developed (1) to prepare economical PEMFC catalyst by synthesizing non-precious metal, iron (Fe), nanoparticles embedded in carbon particles, (2) to add value of waste vegetable oil as carbon precursor by converting into carbon particles and (3) to construct and utilize PEMFC prototype for minimizing consumption of electricity and fossil fuel. Considering the methodology, solution plasma process (SPP), a single-step discharge in solution, has been utilized to produce metallic nanoparticles embedded carbon nanoparticle. Fe nanoparticles-embedded carbon (FeNPs/Carbon) particles are simply obtained after applying high voltage from bipolar-pulsed power generator to Fe electrodes submerged in waste oil for 90 min under ambient condition and heat treatment process are further accomplished to improve its electrical conductivity. The morphology and chemical composition of FeNPs/Carbon are investigated by scanning electron microscope (SEM) and energy dispersive x-ray spectroscopy (EDS), respectively. The FeNPs/Carbon nanostructure is observed using x-ray diffraction measurement (XRD). FeNPs/Carbon catalytic activity is measured by cyclic voltammetry (CV) to evaluate oxygen reduction reaction (ORR) response. The prototype test is carried out to evaluate the feasibility of fuel cell as an alternative energy. Hence, it is capable to promote a great impact to the field of energy in near future.

**Awards Won:**