From Environmental Waste to Value-Added Product: Using Carbon-Encapsulated Copper Nanoparticles for Catalytic Conversion of Carbon Dioxide to Methanol

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Carbon dioxide (CO2) is the number one greenhouse gas emitted from human activities through the combustion of fossil fuels from transportation vehicles and industry factories. Recent increase in CO2 levels, causing rapid climate change and dangerous acidity levels in oceans, has become a primary concern worldwide. The purpose of this project is to develop a procedure to use an efficient and cost-effective way to turn this harmful excess of carbon dioxide gases into value-added products such as methanol. The procedure involved developing a simple process to produce carbon encapsulated copper-core nanoparticles (CECNs) using biomass waste and thermal treatment, and then applying the CECNs as a catalyst for the conversion of carbon dioxide and hydrogen gas into methanol. The data collected shows that the CECNs demonstrated remarkable activity and stability as a catalyst for the conversion, yielding an over 10% CO2 conversion and over 50% methanol selectivity. The value-added product that resulted from this catalytic conversion, methanol, is commonly used as a primary feedstock for chemical manufacturing.