

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.