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Developing a Biologically-Inspired Molecular Solar Energy Conversion Device: Reaction of Solution and Protein-Bound Cobalamins with Carbon Dioxide and Halo-Organic Compounds WESLEY D. ROBERTSON, NATHAN M. ENNIST, KURT WARNCKE, Department of Physics, Emory University — Our aim is to design and construct protein-based artificial photosynthetic systems that reduce carbon dioxide (CO_2) and toxic halo-organic compounds within the robust and adaptable $(\beta\alpha)_8$ TIM-barrel protein structure. The EutB subunit of the adenosylcobalamin-dependent enzyme, ethanolamine ammonia-lyase (EAL), from *Salmonella typhimurium*, was selected as the protein template. The Co^I forms of the native cobalamin (Cbl) cofactor and a derivative, cobinamide (Cbi), possess relatively low redox potentials that are commensurate with reduction of CO_2 and halo-organic compounds. $Titanium^{III}$ citrate and pulsed laser-excited 5'-deazariboflavin (5'-DRF) were used to reduce Cbl or Cbi. UV/visible absorption spectroscopy was used to monitor the reaction kinetics of reduced Cbl and Cbi with CO_2 and halo-organics, and 13C-NMR was used for product analysis. The results provide fundamental information for development of an organocobalt-based protein-catalytic device for stable fuels generation and toxic chemical remediation.

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