Optimizing Catalysts for the Hydrogenolysis of Polyethylene

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Over 350 million tons of plastic waste are produced annually while less than 10% is recycled. Through catalytic hydrogenolysis, plastic waste can be converted into diesel with strontium titanate and aviation fuel with platinum on carbon (Pt/C). However, Pt/C is very expensive. This study investigates alternative catalysts to determine cost-effective options with comparable performance to Pt/C while also attempting to produce fuel from oil and waste products. To make plastic fuel, hydrogen gas, a catalyst, and plastic waste were combined in a sealed reactor and run at 300? for 6 hrs. GC-MS analysis showed that cobalt, lanthanum, rhodium, and Pt/C with silica alumina were not statistically significant, meaning they are comparable to Pt/C. Lanthanum, cobalt, and rhodium all showed higher percent yields than Pt/C, but rhodium was costly, over two times the cost of Pt/C. Considering prices and quality, lanthanum and cobalt are the most promising and cost-effective catalysts. In investigating different reactants, most of them had high percent yields but were too heavy aside from liquid waste which was comparable to aviation fuel. Currently, the processes for diesel and aviation fuel are complete, clean, cost-effective, and efficient, but must be scaled up to be used by society. Plastic fuel will also become cheaper than current fuel prices when scaled up. Widespread use of plastic fuel would provide a cheaper and more environmentally friendly alternative to fossil fuels while reducing plastic pollution and greenhouse gas emissions.

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