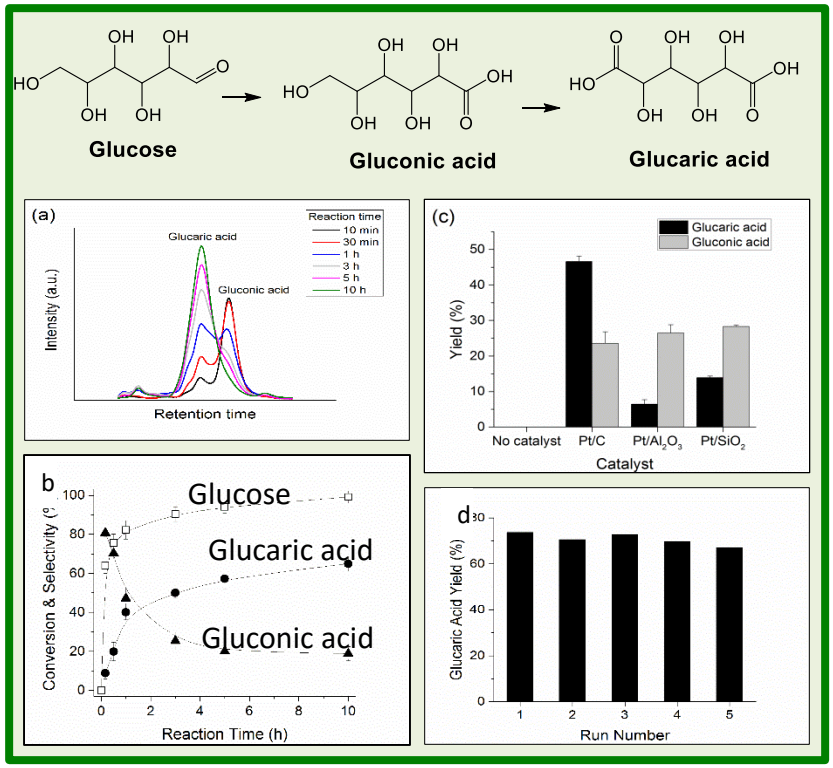
Pt Catalysts for Glucose Oxidation to Glucaric Acid

Scientific Achievement

Developed an efficient and optimized catalytic system for aerobic oxidation of glucose to glucaric acid with the highest yield reported to date (74%), in water using commercial catalyst.

Significance and Impact

- Glucaric acid is a versatile, renewable platform-chemical for nylon (polyhydroxypolyamides), plastics, detergents and food additives.
- Direct conversion of glucose to glucaric acid is difficult because of slow oxidation of the intermediate gluconic acid.
- Our scalable process may allow economic production of glucaric acid and pave the way for developing less expensive and more selective catalysts.



Research Details

- Pt/C is the most effective among Pt/C, Pt/SiO_2 and Pt/Al_2O_3.
- Base-free and slightly basic conditions give best yield of glucaric acid. Highly acidic solution forms gluconic acid while C-C cleavage of glucaric acid to low carbon carboxylic acid occurs in highly basic solutions.
- Maximum yield of glucaric acid is observed at 80 °C, 13 bar O_2 and a glucose/Pt molar ratio of 54.
- Oxidation of gluconic acid progresses via oxidative dehydrogenaton of its $–CH_2OH$ group to –CHO followed by oxidation to –COOH. Gluconic acid oxidation is slow because the second oxidative dehydrogenation of $–CH_2OH$ is slow.

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Work was performed in CCEI lab at the University of Delaware
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