

Tin-Containing Silicates: Identification of a Glycolytic Pathway via 3-Deoxyglucosone - DTU Orbit (08/11/2017)

Tin-Containing Silicates: Identification of a Glycolytic Pathway via 3-Deoxyglucosone

Inorganic glycolytic systems, capable of transforming glucose through a cascade of catalytic steps, can lead to efficient chemical processes utilising carbohydrates as feedstock. Tin-containing silicates, such as Sn-Beta, are showing potential for the production of lactates from sugars through a cascade of four to five sequential steps. Currently, there is a limited understanding of the competing glycolytic pathways within these systems. Here we identify dehydration of glucose to 3-deoxyglucosone as an important pathway that occurs in addition to retro-aldol reaction of hexoses when using tin-containing silicates. It is possible to influence the relative carbon flux through these pathways by controlling the amount of alkali metal salts present in the reaction mixture. In the absence of added potassium carbonate, at least 15–30% carbon flux via 3-deoxyglucosone is observed. Addition of just a few ppm of potassium carbonate makes retro-aldol pathways dominant and responsible for about 60-70% of the overall carbon flux. The 3-deoxyglucosone pathway results in new types of chemical products accessible directly from glucose. Furthermore, it is argued that 3-deoxyglucosone is a contributing source of some of the methyl lactate formed from hexoses using tin-containing silicates in the presence of alkali metal salts. Further catalyst design and system tuning will permit even better control between these two different glycolytic pathways and will enable highly selective catalytic transformations of glucose to a variety of chemical products using tin-containing silicates.

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