

Process for Preparation of Nano-Zirconia Embedded Carbon Catalyst and its Uses Thereof

1. Technology:

This invention pertains to heterogeneous catalysis, discusses the development of a highly dispersed ZrO_2 carbon catalyst for the efficient and selective conversion of furfural into furfuryl alcohol, via a simple one pot hydrothermal process using sustainable starting materials. The invented method produces nano- ZrO_2 particles that are strongly anchored to the carbon support via Zr-C bond formation. The resulting material functions as a Meerwein–Ponndorf–Verley type transfer hydrogenation catalyst for selective conversion of furfural to furfuryl alcohol while using isopropyl alcohol as a solvent as well as hydrogen source. Under optimized conditions, 93% conversion of furfural and 93% selectivity of furfuryl alcohol (83% yield) was obtained with isopropyl furfuryl ether as the other product. Further the catalyst was recycled for three times without major loss in catalytic activity.

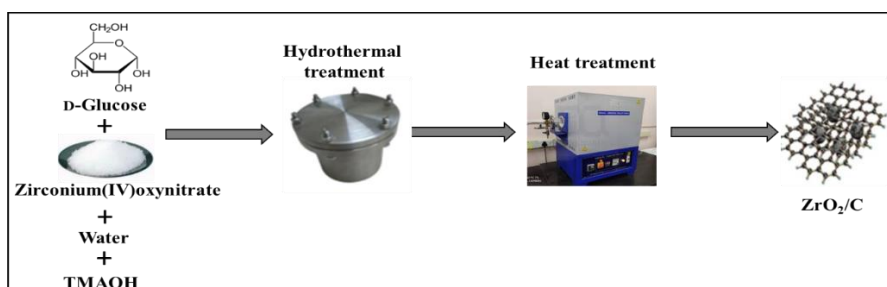


Fig. 1 Illustration of the preparation of nano-zirconia embedded on carbon

2. Problem Addressed:

The invention addresses the limitations of conventional methods for the preparation of the catalyst, particularly it avoids the use of toxic solvents and templates. The method also addresses the problems related to the use of toxic chromium and costly noble-metal catalysts and use of highly inflammable hydrogen gas used in conventional furfural reduction methods.

3. Industrial Applications:

The invention provides a catalyst to produce value-added chemical, furfuryl alcohol from biomass derived platform chemical, furfural. Furfural is one of the platform chemicals obtained by hydrolysing hemicellulose-rich lignocellulosic biomass. Furfuryl alcohol finds uses such as, rocketry fuel, component for production of resins & polymers, in wood preservation, pharmaceuticals, industrial solvent and production of other chemicals (furfuryl ethers, levulinic acid). Hence, the developed invention will have good industrial and market potential. In 2020, the global furfuryl alcohol market size was estimated at USD 472.7 million. It is expected to grow at a compound annual growth rate of 7.2% from 2021 to 2028 to reach USD 821.6 million by 2028.

4. Patent Application Number: 202341080824