SUPPLIMENTRY INFORMATION

Catalyst Characterization method

Different sophisticated techniques were used for the characterization of fresh and used catalysts.

The nitrogen adsorption isotherm of the prepared samples was measured at 77K with ASAP 2010 instrument, Micromeritics, USA after degassing the samples at 300°C for 6 h.

The XRD pattern of magnetic catalyst and prepared samples were recorded with Bruker AXS, D8 Discover powder X-ray diffractometer using Cu Kα radiation in the range of $10<2\theta<80°$ with 0.2° step size.

FT-IR spectra of different prepared samples were collected on Perkin Elmer instrument using pellets made of sample and KBr in 1:100 (by wt proportion) and using high pressure instrument. The IR spectra were recorded by averaging 65 scans in the range of 400 to 4000 cm^{-1} wave number.

TGA analysis of different samples were done on NETSCH instrument by using appropriate amount of samples under nitrogen atmosphere from temperature range of 100°C to 700°C with scan rate of 20 °C/min.

The surface morphology of the prepared samples was analysed by SEM images obtained from JEOL –JSM-6380 LA (Japan) instrument.

The acidity of different prepared samples was measured by using ammonia –TPD on AutoChem II 2920 TPD/TPR, Micromeritics, USA instrument by taking approximately 50 mg of samples in a quartz tube and pretreated at 650°C under helium gas for 1 h. The pretreated samples were then subjected to ammonia adsorption at 100 °C by flowing 10% ammonia in Helium at flow rate of 50 ml/min for 1 h and then flushed with helium to remove the physically adsorbed ammonia for next 60 min. The sample then subjected to temperature programmed ammonia desorption from 100°C to 650°C at ramp of 30°C/min. The acidity is calculated by integrating the area under peak.

TEM micrographs of samples were obtained using a PHILIPS CM200 transmission electron microscope having 2.4 A° resolution and operating voltage range between 20 – 200kV. The catalyst samples were dispersed in ethanol by means of sonication and then deposited on Cu grid coated with carbon film.

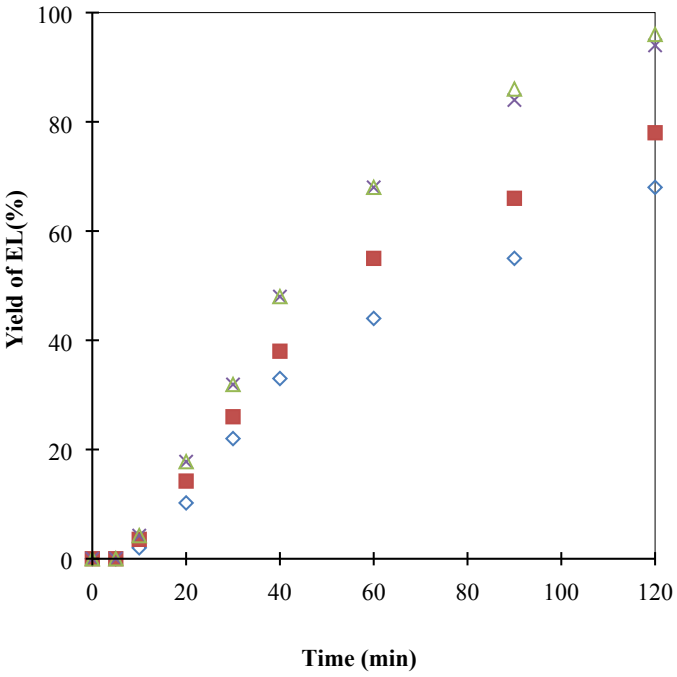

Fig. S1: Effect of speed of agitation on yield of Ethyl levulinate (EL). Furfuryl alcohol 0.048mol, ethanol 0.72 mol, catalyst loading 7.5 g/L, temperature 120°C, total volume 0.041 L, (◇) 200rpm, (■) 500rpm, (△) 800rpm, (x) 1000rpm

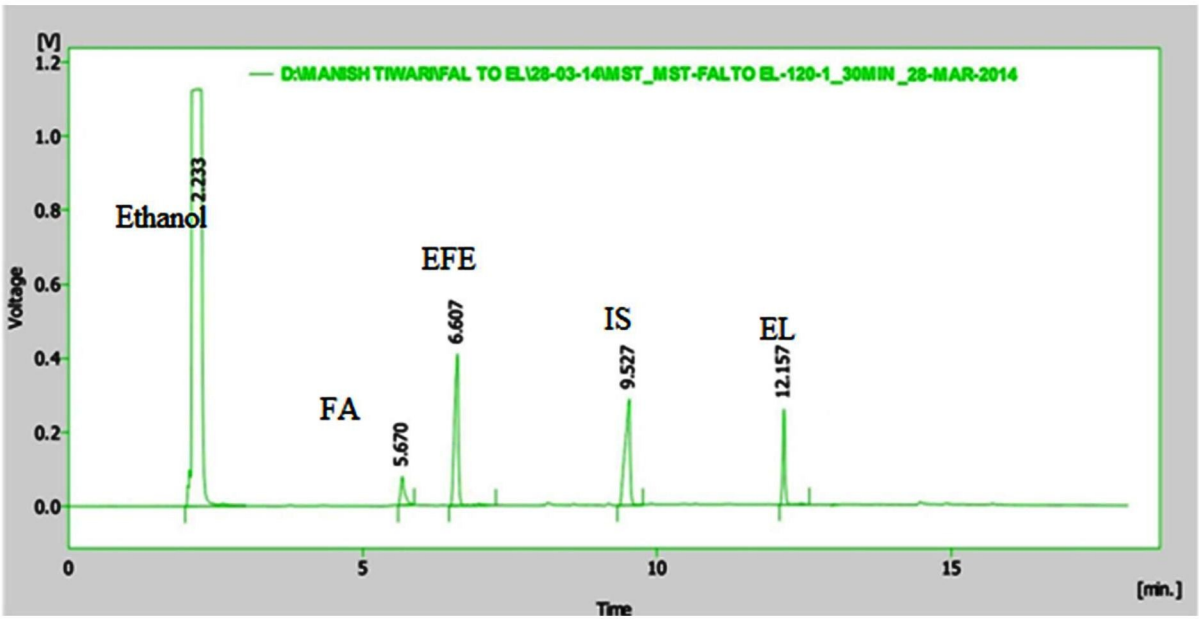

Fig. S2 GC graph of the reaction mixture after 30min. Furfuryl alcohol 0.048mol, ethanol 0.72 mol, catalyst loading 7.5 g/L, speed of agitation 900 rpm, temperature 120°C, total volume 0.041L.

Arrhenius plots:

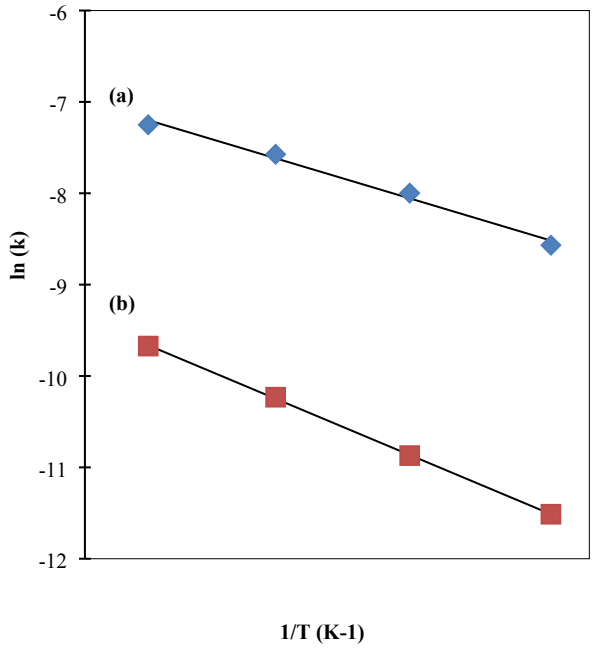

Figure S3: Arrhenius Plot for forward reaction (a) Step1, (b) step2

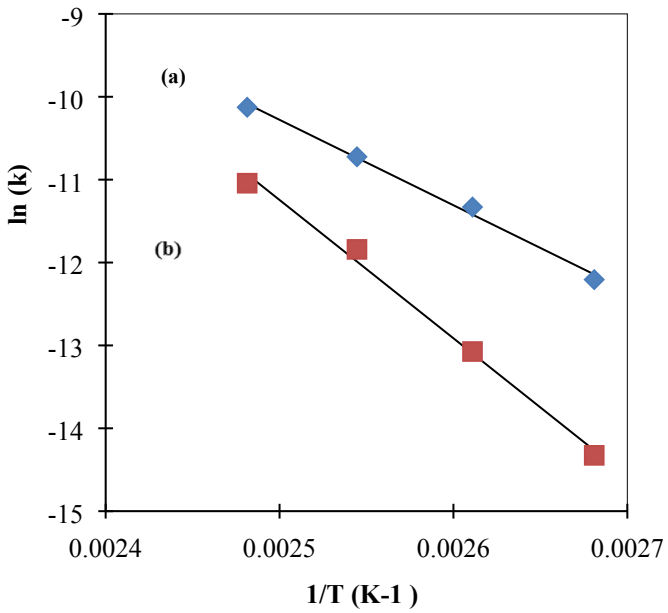

Figure S4: Arrhenius Plot for backward reaction (a) Step1, (b) step2.