

Figure 1 Scheme of one reactor conversion

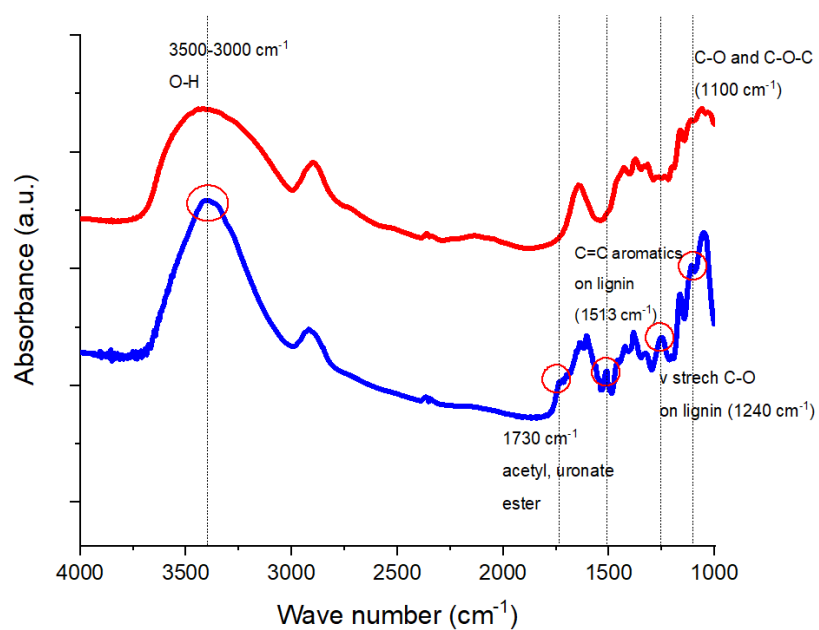


Figure 2 FTIR of sorghum stems before (blue line) and after (red line) delignification.

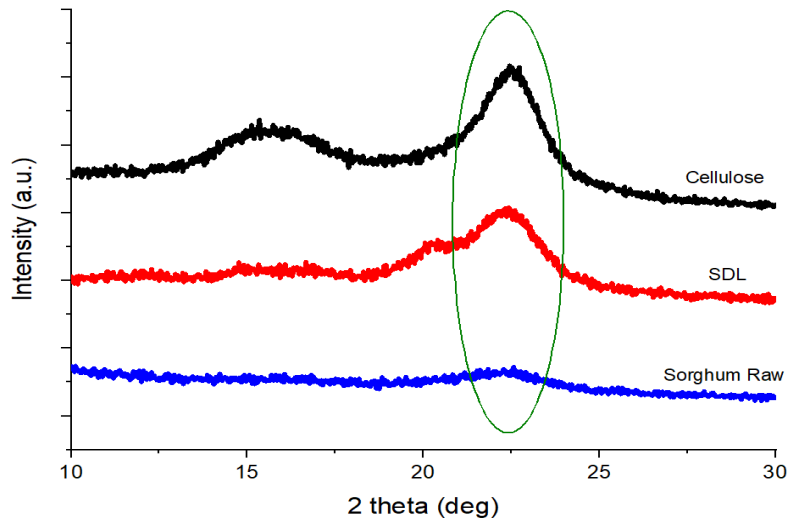


Figure 3 XRD pattern of sorghum stems before (blue line) and after (red line) delignification compared to cellulose (black line)

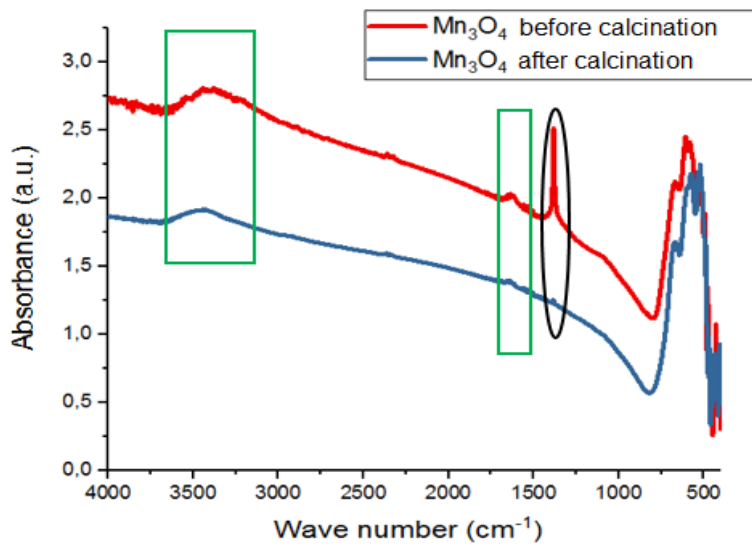


Figure 4 Mn_3O_4 infrared spectra of: (red line) before & (blue line) after calcination.

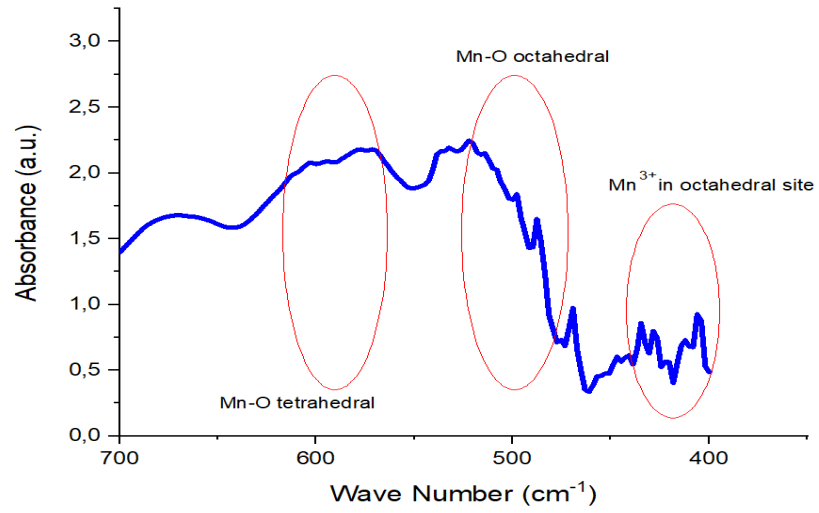


Figure 5 Mn₃O₄ fingerprint area of infrared spectrum after calcination

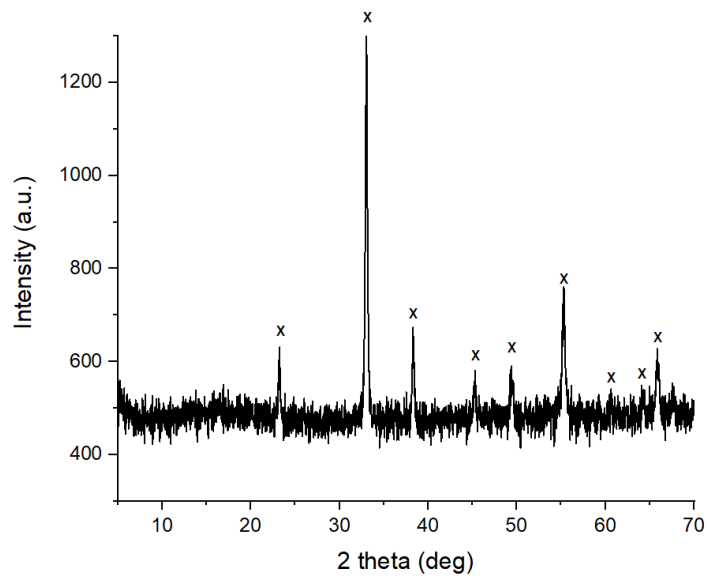


Figure 6 XRD pattern of as-prepared Mn₃O₄

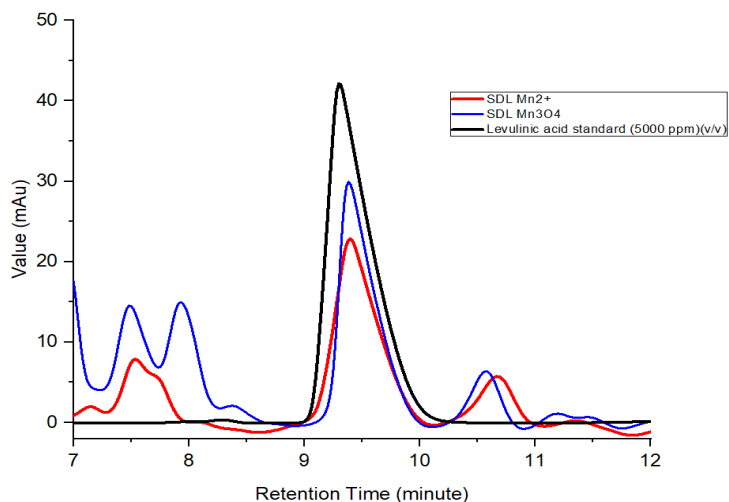


Figure 7 Chromatogram of the levulinic acid using Mn^{2+} , Mn_3O_4 catalysts for 8 h and chromatogram of the levulinic acid standard 5000 ppm (v/v) using HPLC

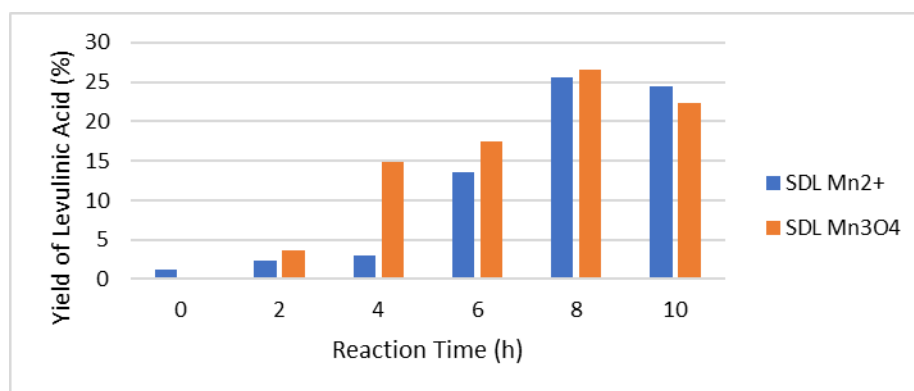


Figure 8 Yield (%) of levulinic acid on reaction time (h) with Mn^{2+} and Mn_3O_4 . In reactions such as Fenton, hydrogen peroxide utilized in the presence

Tabel 1 Peak Characteristics of Mn_3O_4 .

Observed Peak, 2θ (deg) =	Refrence (Dhaouadi et al., 2012)	Number of peaks	Peak Characteristic
23	Around 25	1	Small intensity
33	30-35	1	Highest intensity
38	35 - 40	1	High intensity
45, 49, 55	45 - 60	3	High intensity
64, 66, 67	60 - 70	3	High intensity