**Supplemental material**

|  |  |  |
| --- | --- | --- |
| D:\catalyts synthesis method\1 Catalytic activity_INPT_May2016\catalyst in two phases\IMG_20171031_103227.jpg(a) | D:\catalyts synthesis method\1 Catalytic activity_INPT_May2016\catalyst in two phases\IMG_20171031_103227.jpg(b) | D:\catalyts synthesis method\1 Catalytic activity_INPT_May2016\catalyst in two phases\IMG_20171031_103227.jpgD:\catalyts synthesis method\1 Catalytic activity_INPT_May2016\Catalysts photos_twoPhases\IMG_20170914_112526_HDR.jpg(c) |

Figure S1: Sample photos of catalyst dispersed in toluene (top) and water (bottom): (a) Me&Et-PhSO3H-SiO2-ZrO2, (b) Amberlyst 15 and (c) Aquivion

|  |
| --- |
|  |

**Figure S2:** Chromatogram peaks for group of GMO and OA in 80ACN20H20 0.1%TFA mobile phase catalysed by ZrO2-SiO2-Me&Et-PhSO3H

|  |
| --- |
|  |

**Figure S3:** Chromatogram peaks for group of GDO and GTO in 40ACN40MeOH20THF mobile phase catalysed by ZrO2-SiO2-Me&Et-PhSO3H

Table S1: Comparison of the textural properties of ZrO2-SiO2-Me&EtPhSO3H catalyst with those of commercial Amberlyst 15 and Aquivion catalyst

|  |  |  |  |
| --- | --- | --- | --- |
| **Catalysts** | **BET** | **Acidity** | **Particle size distribution (µm)** |
| **Area (m2/g)** | **Pore volume (cm3/g)** | **Average pore diameter (nm)** |
| ZrO2-SiO2-Me&Et-PhSO3H | 79.75 | 0.0247 | 3.77 | 0.62 mmol/g | 5.01 |
| Amberlyst 15 | 42.5 | 0.290 | 28.8 | 4.7 mequiv./g | 300 |
| Aquivion PFSA- superacid\* | <0.1 | - | - | 0.98- 1.06 mmol/g | 660 |

\*The characterization data of Aquivion was obtained from [30]