Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Eletronic supplementary Information

Low temperature pyrolysis.

The jatropha *curcas* seed samples were subjected to a low temperature conversion process at 380 °C. Each experiment was repeated seven times, using 400 g of material each time, and results for the seven repeats were averaged. Each sample was placed in the central region of a cylindrical glass tube, which was then introduced to the reactor coupled with the condensing system. Nitrogen gas was continuously applied at 500 ml/min, before the start and during the course of the process. After 10 min of gas purging, heating was initiated at a rate of 10 °C/min and was then maintained at 380 °C for 2 h. After passing through the condenser (condensable gases) the pyrolysis oil and water fractions were collected in a graduated tube and separated by the difference in density. The char was retained in the middle of the reactor and collected after cooling.

Scanning Electronic Microscopy

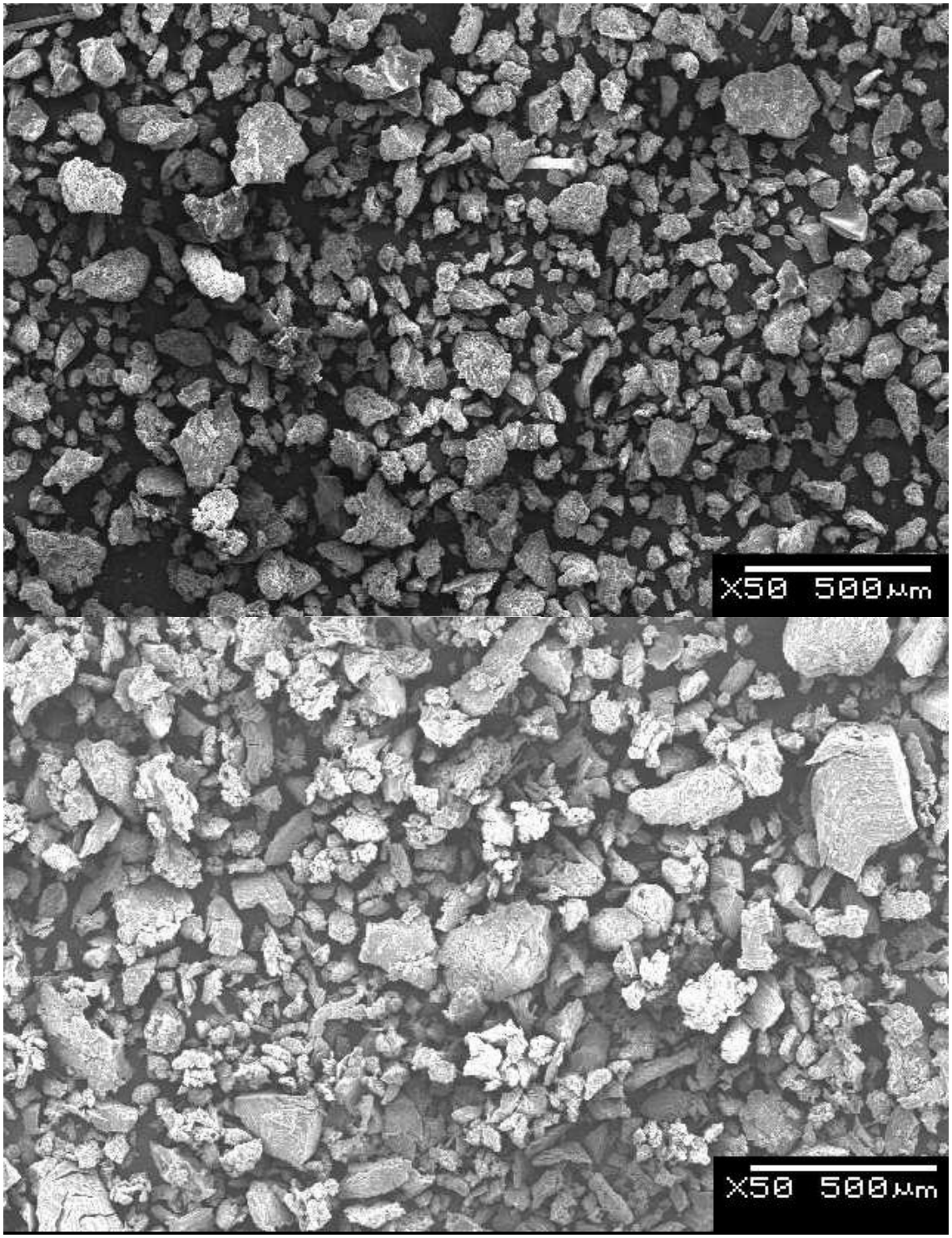

Figure S1- Scanning electronic microscopy biochar before sulphonation process (upper) and after sulphonation process(lower picture)

Scanning Electronic Microscopy

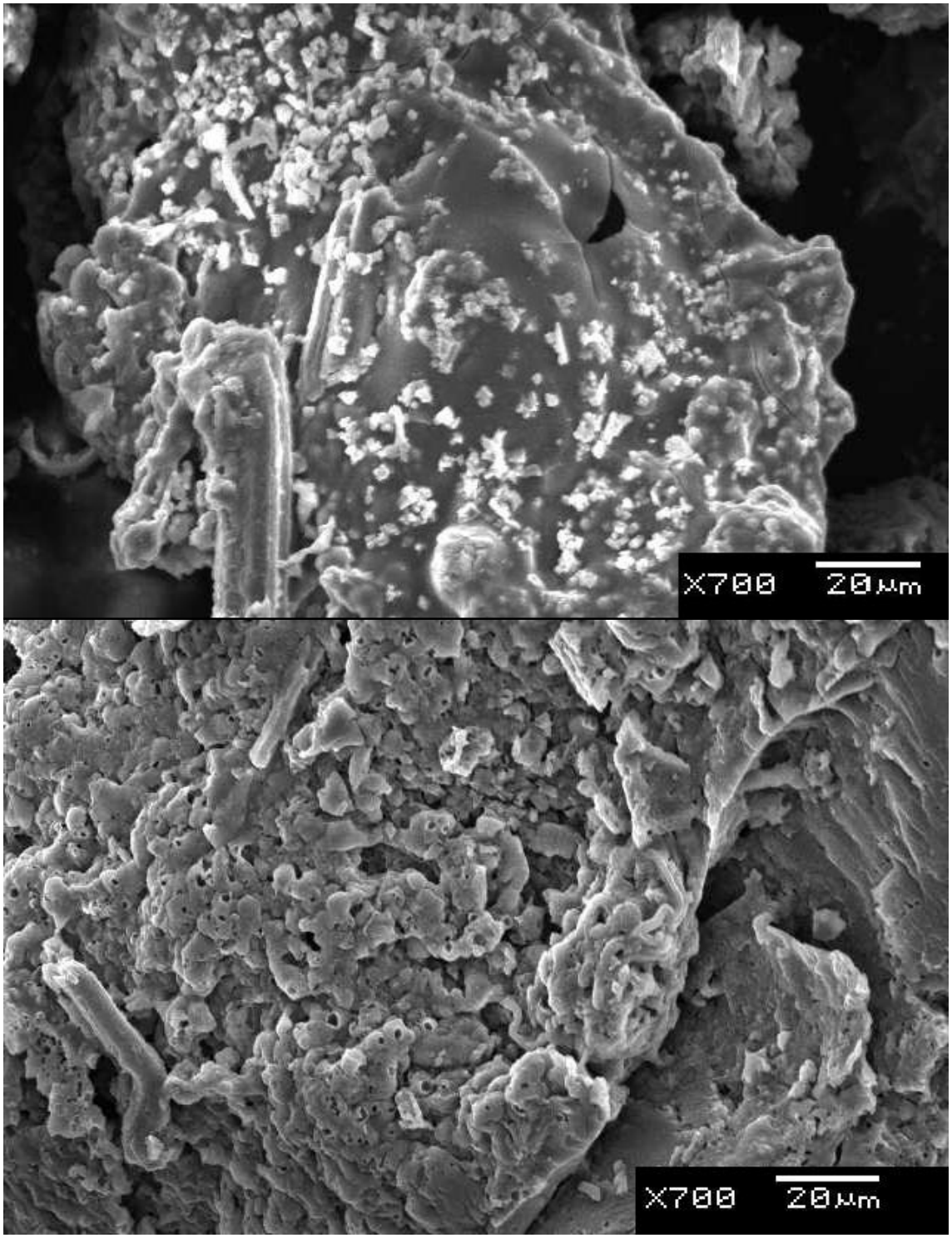

Figure S2- Scanning electronic microscopy biochar before sulphonation process (upper) and after sulphonation process(lower picture).Note the rough surface and small holes on biochar after sulphonation treatment(lower picture) whilst the biochar before treatment presents a flat surface with some agglomerations on the surface

X-Rays diffraction

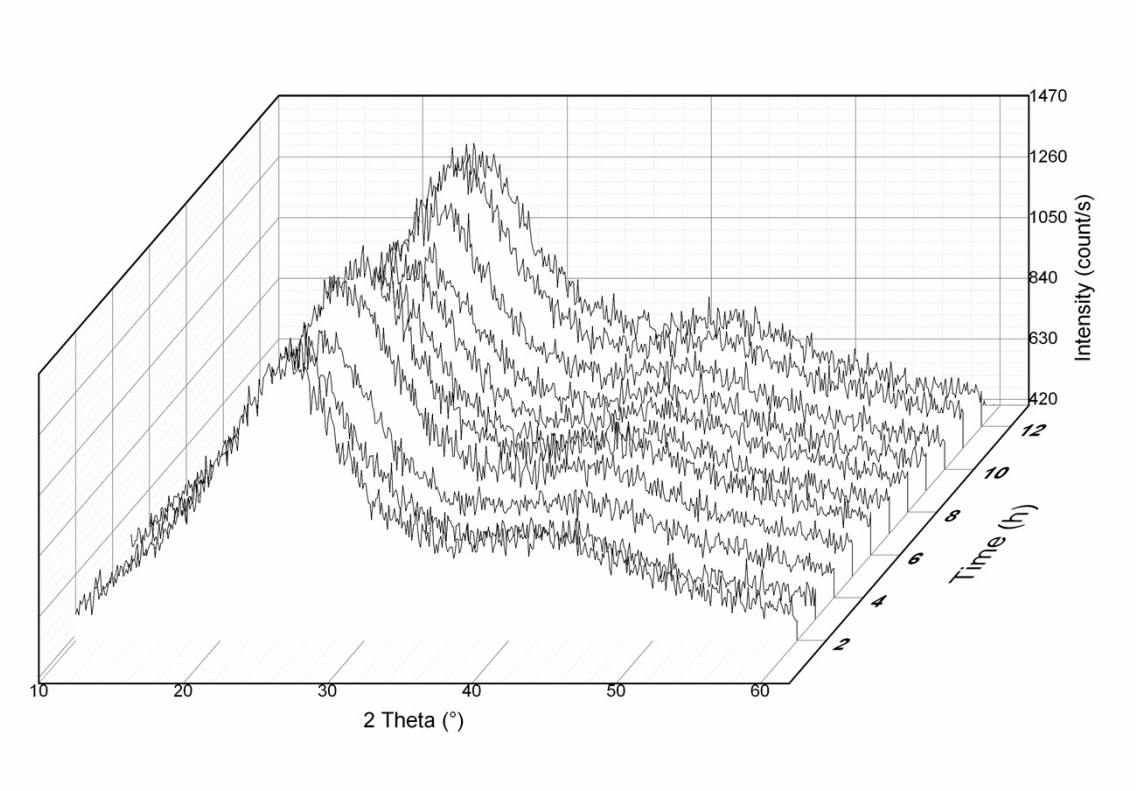

Figure S3- X-rays diffraction of biochar over time sulphonation process. There were not meaningful changes over hours

Fatty acid composition of biodiesel.

The biodiesel samples composition were determined by GC-MS carried out on a Shimadzu Gas chromatograph equipped with Quadruple Mass spectrometer using electron impact ionization. A capillary polar PEG wax column (30 m length, 0.25 mm diameter, 0.25 μm film thickness) keeping injector and column temperature at 265°C and 250°C respectively was used for separation of FAMEs. Heptane solutions containing 3-5 mg of FAMEs were injected in split ratio of 10:1 applying the ramp: 70°C for three minutes, 10°C per minute from 70 to 240°C, hold time 13 minutes and finally 5°C per minute up to 250°C and held it for 10 minutes.

Table S1 – Main components of methyl biodiesels

Fatty acid methyl esters	Sunflower Biodiesel (%)	Jatropha curcas Biodiesel %
Methyl hexadecanoate (C16:0)	6.56	14.36
Methyl Octadecanoate (C18:0)	4.65	8.04
∑ (unsaturated ester)	11.21	22.40
Oleic Methyl ester (C18:1)	22.12	43.30
Linoleic Methyl ester (C18:2)	65.77	33.98
Linolenic Methyl ester (C18:3)	--	--
∑ (saturated ester)	87.89	77.28

Determination of oxidative stability by Rancimat®

The oxidation stability was measured according to EN 14112, in which a small sample (3 g) of biodiesel samples were heated at 110°C and bubbled air flow at 10 L/h. Outside air ,dragging the volatile carboxylic acids (breakdown products), was collected in a distillation water bath with continuous conductivity monitoring until it dropped to 200μS. The response is a curve of conductivity versus time in which two tangents intersect at a point, corresponding in time scale, the induction period (IP) or oxidation stability.