

Supporting Information

For

**Influence of Molten Salts on Soybean Oil Catalytic Pyrolysis with/without a
Basic Catalyst**

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The detailed reaction process of soybean oil in CSTR

In the present study, when the first drop of soybean oil was pumped in the molten salts, it would react soon and generate the products of vapors (bio-oil, water), coke and gas. In this reaction, the react temperature was so high (varied from 430–505 °C) that the liquid product would turn into gas phase, and out flowed together with the gas product. As there had some space (about 1.2 L, nearly 4/5 of the reactor) up the molten salts, the gas phase products out flowed only when the space were full of products. This result could be verified by the wet gas flow meter, we observed that when the first drop of liquid product generated in the outlet, the volume of gas product was nearly 1.2 L. Moreover, the gas flow rate was 0.12–0.19 L/min, varied with the increase of temperature in the range of 430 °C to 505 °C.

The equation for calculating the residence time of soybean oil in the molten salts is as follows:

$$\tau = \frac{V}{q}$$

where τ is used as the variable for residence time, V is the capacity of the system, and q is the flow for the system. In this study, V is 0.306 L, q is 0.12–0.19 L/min, so the residence time was 1.6–2.6 min.

The choice of the concentration of molten salt mixture

The choice of the concentration of molten salt mixture was an experimental value, it's based on the CSTR volume (1.5 L). Theoretically, the available reaction volume is 306 ml (nearly 1/5 of the CSTR volume) in CSTR for pyrolysis of oil. Which was appropriate to be stirred by the stirrer and could prevent the molten salts mixture from spilling out from the outlet.

Bio-oil refining by hydrogenation reaction

In the previous studies, which was submitted to another publication in China, we have refined the bio-oil by hydrogenation reaction, and the final products are similar in composition to that of diesel fuel. The TIC of bio-oil before and after hydrogenation was as follows:

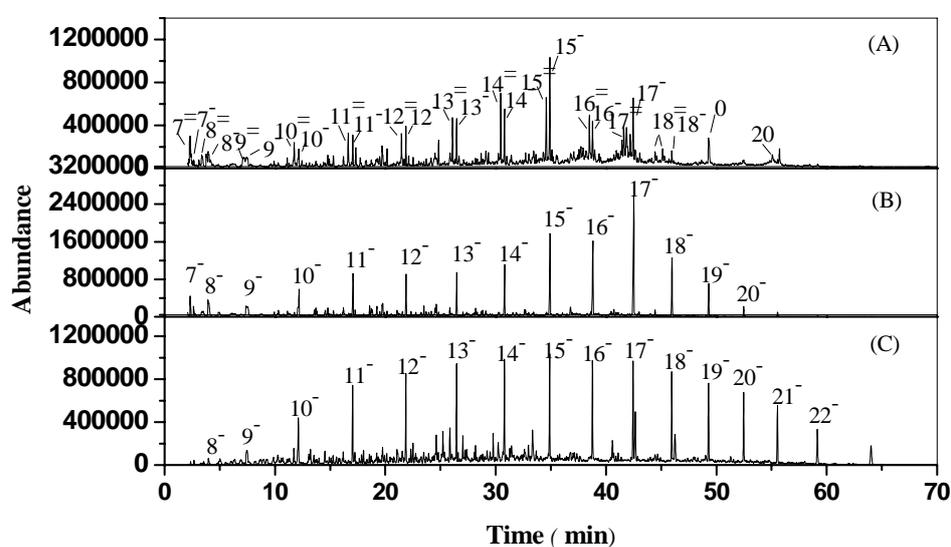
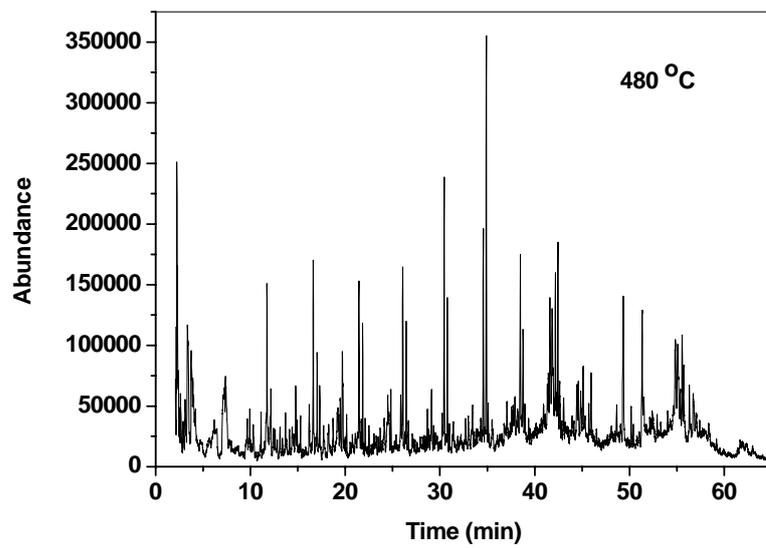
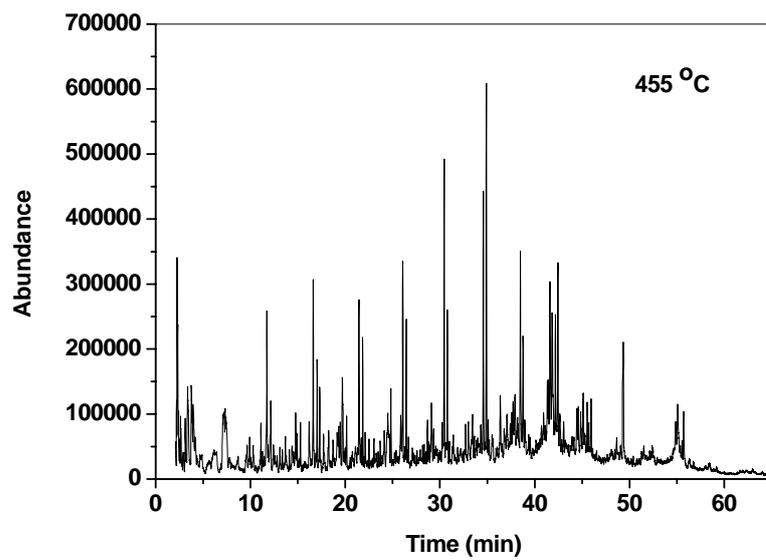


Figure S1. TIC of bio-oil before (A) and after (B) hydrogenation, (C) was the TIC of 0[#] diesel in China.

((A): 7⁻–18⁻: olefins of C₇₋₁₈, 7⁻–18⁻: alkanes of C₇₋₁₈, 0: heptadecanone, 20: esters of C₂₀; (B): 7⁻–20⁻: alkanes of C₇₋₂₀; (C): 8⁻–22⁻: alkanes of C₈₋₂₂). The bio-oil was generated at 430 °C in molten salts catalytic pyrolysis.



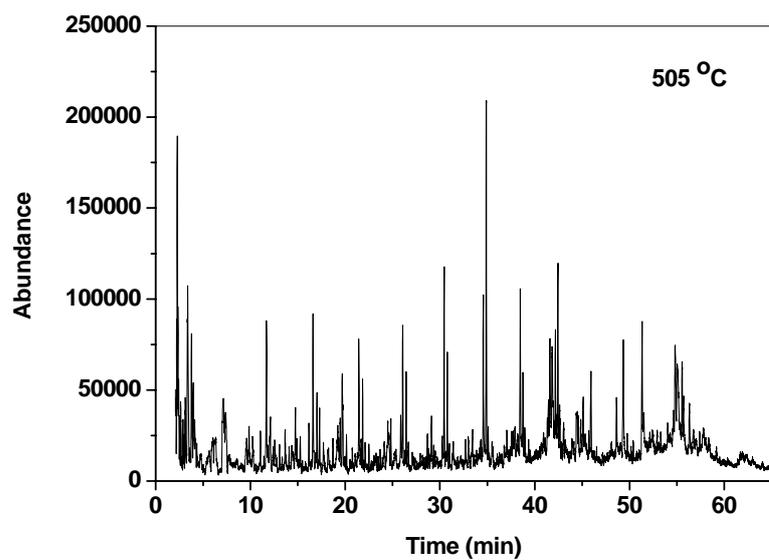


Figure S2. TIC of bio-oil generated in molten salts catalytic pyrolysis at 455 °C, 480 °C and 505 °C.

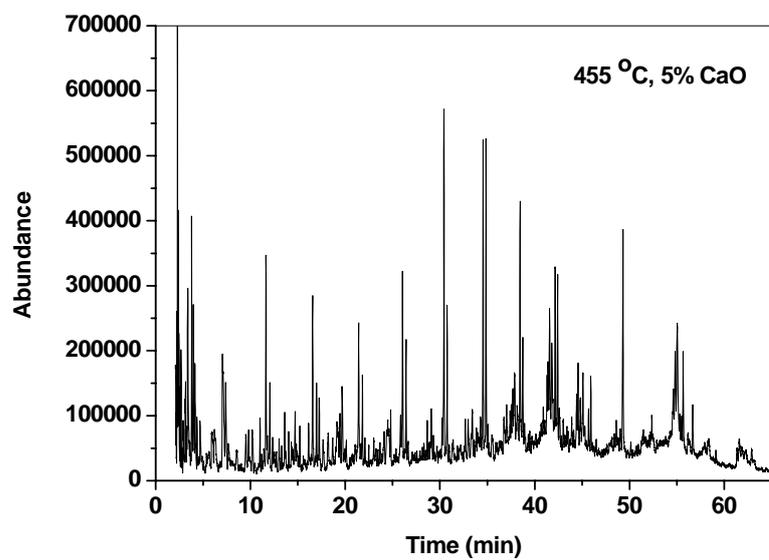
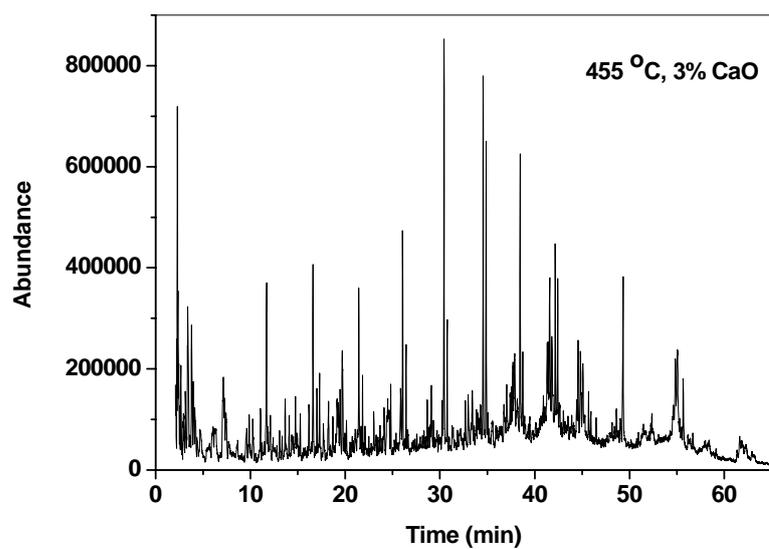


Figure S3. TIC of bio-oil generated in molten salts catalytic pyrolysis with 3% and 5% CaO catalyst at 455 °C.