

Supporting Information for
**Mechanism of Promoter-Induced Zeolite Nanosheets Crystallization under Hydrothermal
and Microwave Irradiation Conditions**

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Table of Contents

S.1. Synthesis of organic surfactant	2
S.2. XRD patterns of ZNS-HT-0	2
S.3. GC-MS conditions for alkylation products analysis	2
S.4. Comparison of catalysts activity	3
S.5. Analysis of products of catalytic measurements	3

FIGURE CAPTIONS

Fig. S1. Small-angle (A) and wide-angle (B) powder XRD patterns of the ZNS-HT-0 sample

Fig. S2. Comparison of catalysts activity

Fig. S3. Alkylation of toluene with 1-decene on ZNS-HT-48

Fig. S4. Alkylation of toluene with 1-decene on ZNS-HT-36

Fig. S5. Alkylation of toluene with 1-decene on ZNS-HT-24

Fig. S6. Alkylation of toluene with 1-decene on ZNS-HT-12

Fig. S7. Alkylation of toluene with 1-decene on ZNS-MW-6T

Fig. S8. Alkylation of toluene with 1-decene on ZNS-MW-6

Fig. S9. Alkylation of toluene with 1-decene on conventional ZSM-5

S.1. Synthesis of organic surfactant

$C_{22-6-6}Br_2$ was synthesized as follows: 39.0 g (0.100 mol) 1-bromodocosane and 172 g (1.000 mol) N,N,N',N' -tetramethyl-1,6-diaminohexane were dissolved in 1,000 ml acetonitrile/toluene mixture (1:1 vol/vol) and heated at 80 °C for 8 h. After cooling to room temperature, the product was filtered, washed with diethyl ether, and dried in a rotary evaporator at 70 °C. 56.2 g (0.100 mol) of the product and 24.6 g (0.200 mol) 1-bromohexane were dissolved in 300 ml acetonitrile and refluxed for 10 h. After cooling to room temperature, the product was filtered, washed with diethyl ether, and dried in a rotary evaporator at 70 °C. The yield of the main product is ~ 94%. The product was identified as $[C_{22}H_{45}-N^+-(CH_3)_2-C_6H_{12}-N^+(CH_3)_2-C_6H_{13}]Br_2$ by 1H NMR.

S.2. XRD patterns of ZNS-HT-0

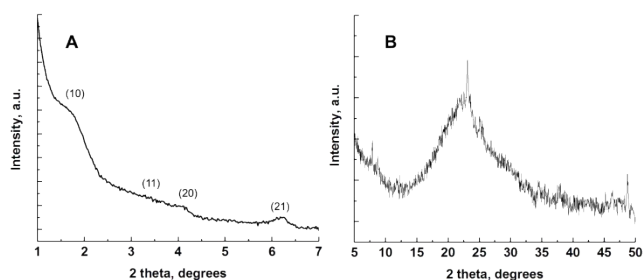


Fig. S1.

S.3. GC-MS conditions for alkylation products analysis

The qualitative composition of the liquid products was determined by gas chromatography–mass spectrometry using a Leco Pegasus GC-HRT

Hydrocarbon products were analyzed using two-dimensional gas chromatography with parallel detection on a time-of-flight mass spectrometer and flame ionization detector (GC × GC-TOFMS-FID) on a Leco Pegasus® GC-HRT 4D instrument. The device includes an Agilent 7890A gas chromatograph with an integrated second furnace, a flow separator and a flame ionization detector and a Leco Pegasus 4D time-of-flight mass analyzer.

Analysis conditions:

Injector: Temperature 300 °C, sample volume 0.2 µl, helium carrier gas, flow rate through the column 1 ml / min,

Chromatographic separation: Primary column is polar, Rxi-17Sil phase (30 m × 0.25 mm × 0.25 µm), Secondary column is non-polar, Rxi-5Sil phase (1.7 m × 0.10 mm × 0.10 µm), carrier gas: helium. Primary oven program: 40 °C (2 min), then heating at a rate of 3 °C / min to 320 °C, for 5 minutes. The temperature of the secondary oven and the modulator is maintained at 6 and 21 °C higher than the temperature of the primary oven, respectively;

Mass detector: 280 °C, frequency 100 Hz, stored mass range 35–520, acquisition rate 100 spectra per second, electron ionization 70 eV.

The analysis results were processed using the CromaTOF software (Leco).

S.4. Comparison of catalysts activity *

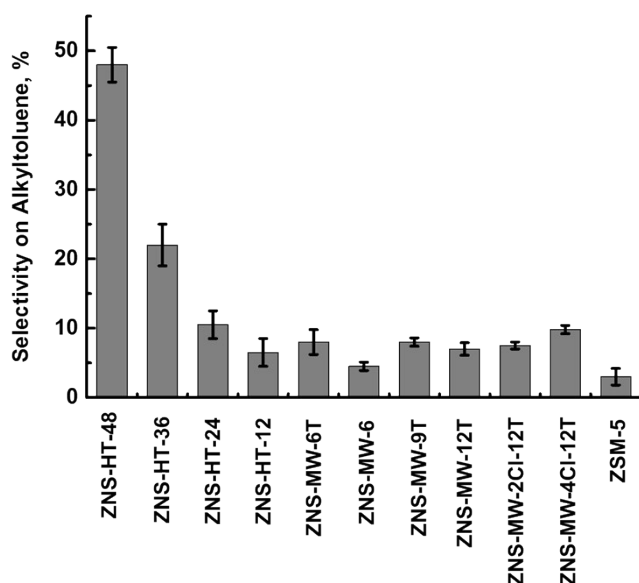


Fig. S2.

*the error bars are based on triplicate experiments.

S.5. Analysis of products of catalytic measurements

The GC × GC high-resolution surface plots in Fig. S2-S8 demonstrate the higher peak capacity of two-dimensional chromatography in the determination of complex composition of the alkylation products, which resolves compounds due to the difference in their volatility and polarity. Therefore, the GC × GC chromatographic separation allows more qualitative

determination of alkylation products in comparison with the conventional method and highlights where each compound locates on the two dimensional chromatographic plane, especially for hydrocarbons that have similar response factors.

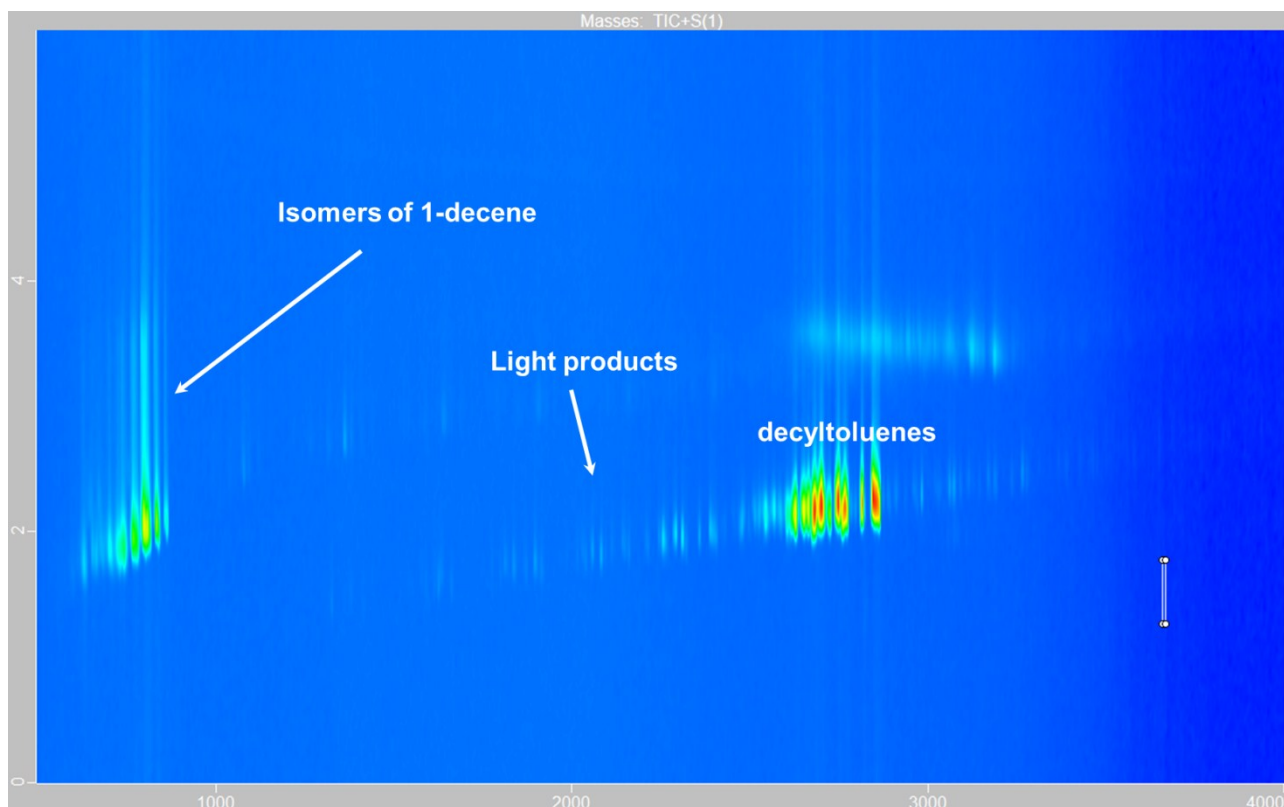


Fig. S3.

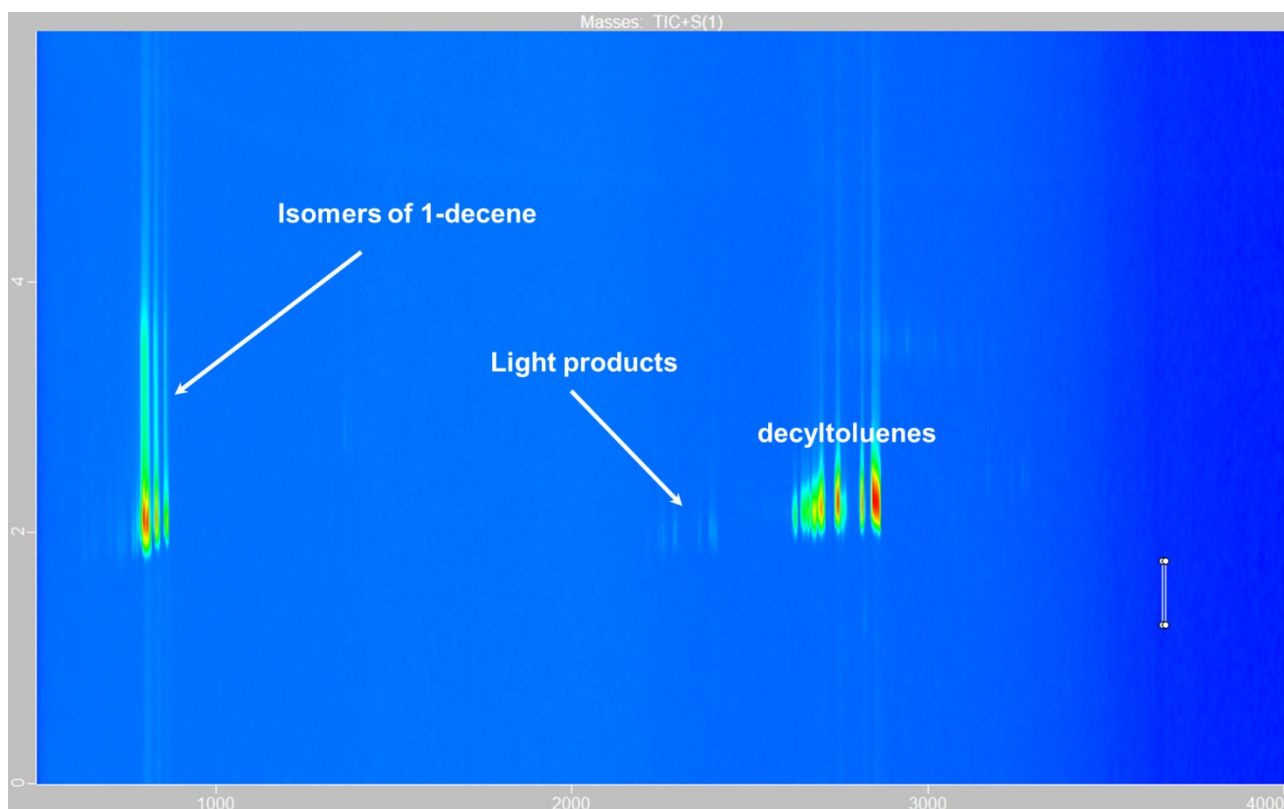


Fig. S4.

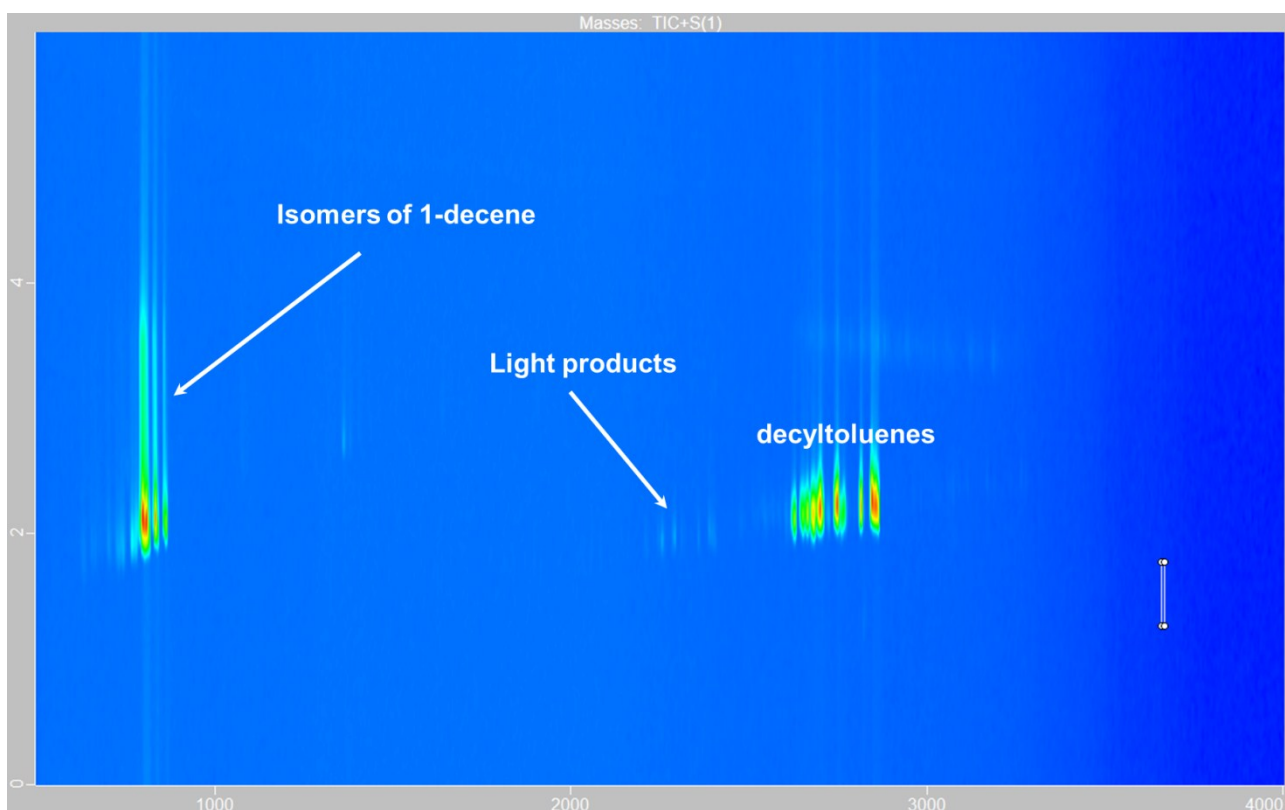


Fig. S5.

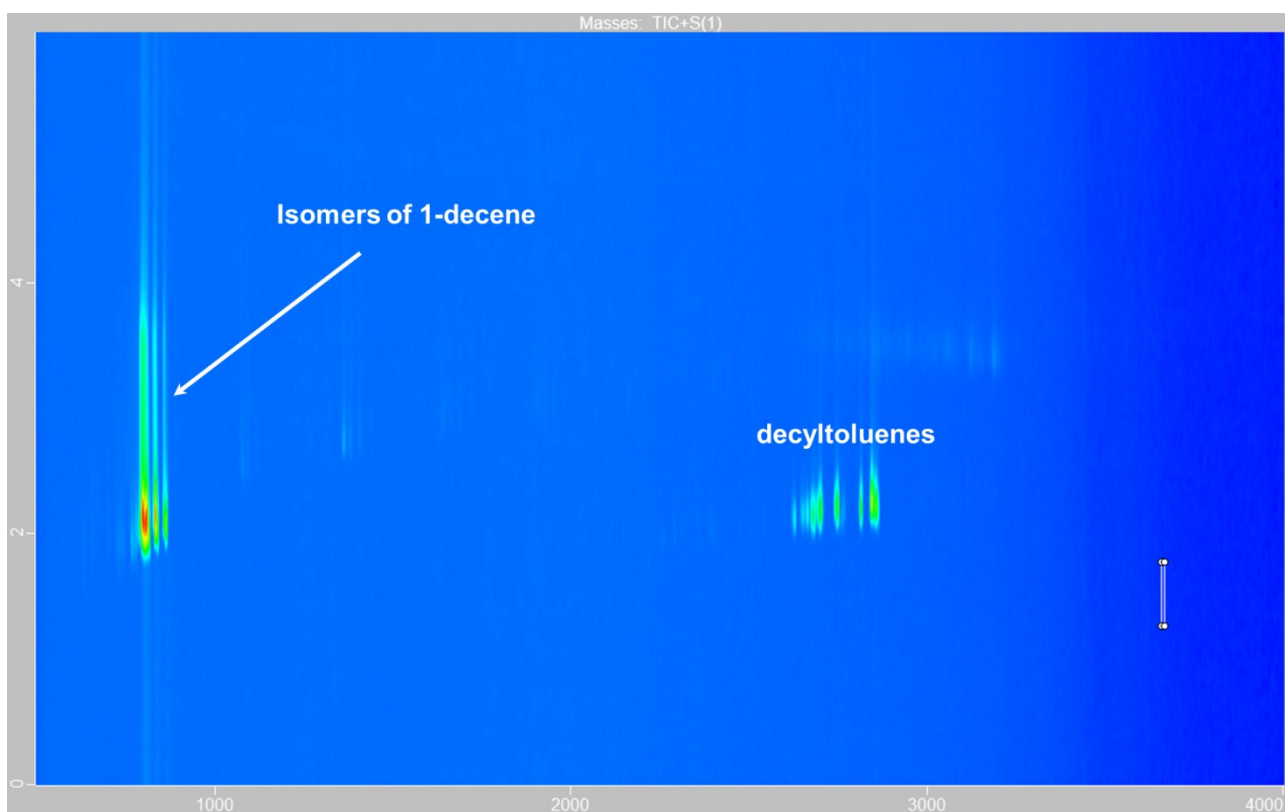


Fig. S6.



Fig. S7.

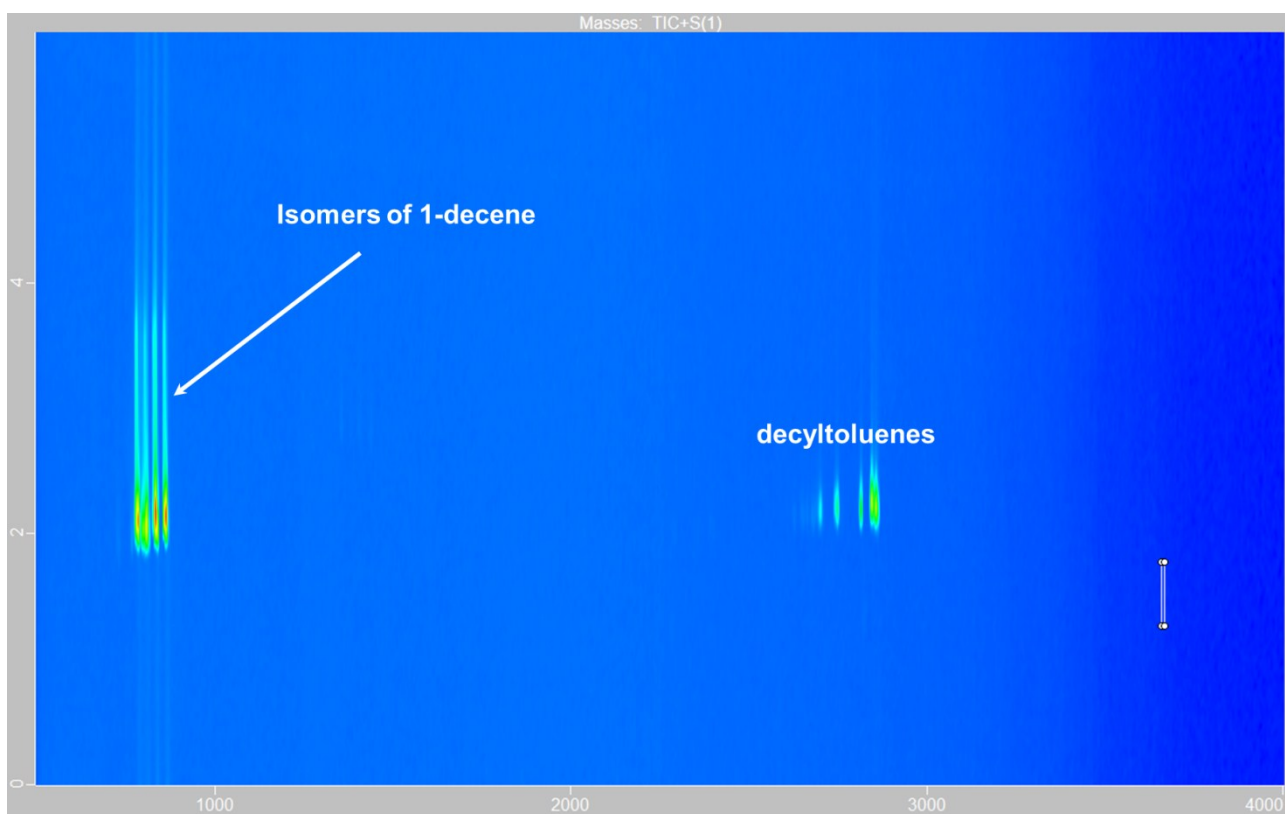


Fig. S8.

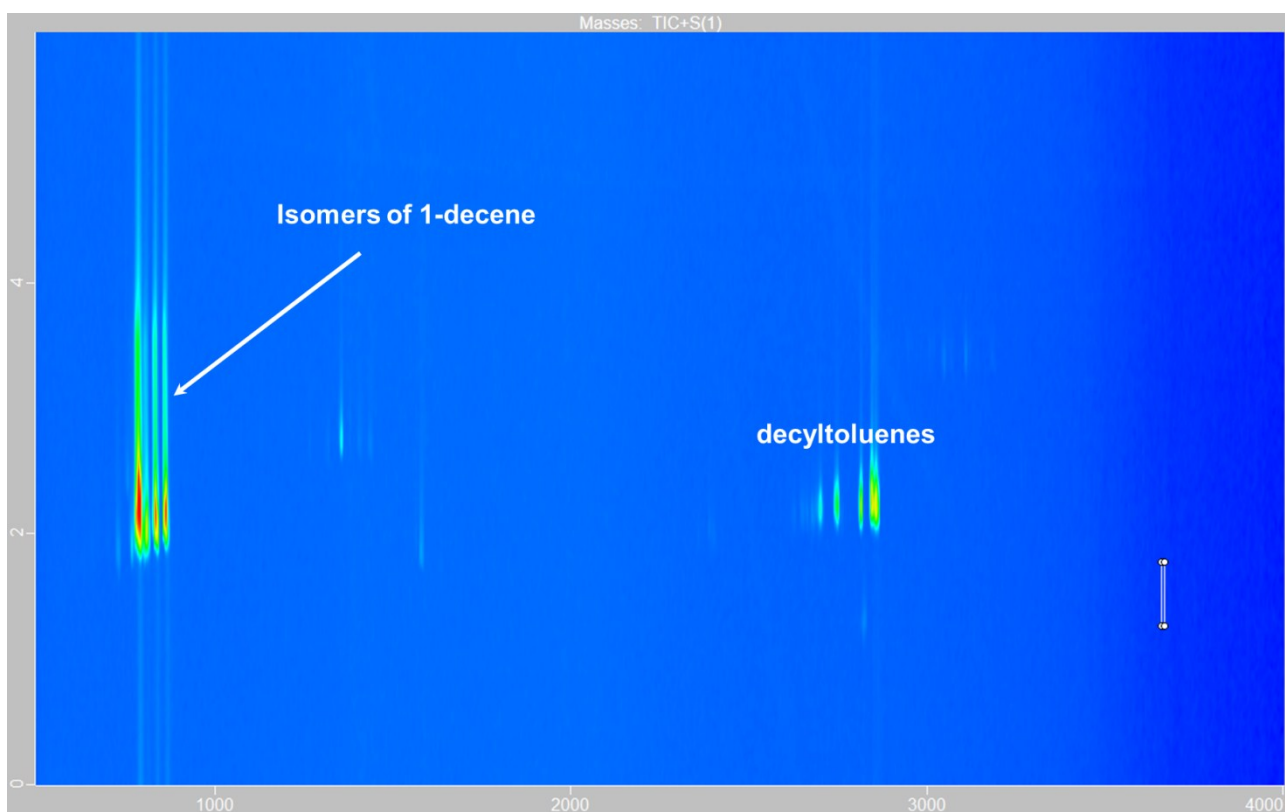


Fig. S9.