

## Supplementary Information

# Sodium Silicates Modified Calcium Oxide as a High-Performance Solid Base Catalyst for Biodiesel Production

### 1. Method of Synthesizing $\text{Na}_2\text{CaSiO}_4$

$\text{Na}_2\text{CaSiO}_4$  was synthesized using the sol-gel method. First, 8.5 g  $\text{NaNO}_3$ , 11.8 g  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ , and 13.4 g L-alanine were dissolved in 50 mL of deionized water. Then, 10.4 g of TEOS (tetraethyl orthosilicate) was added to the above solution. Next, 600  $\mu\text{L}$  of  $\text{HNO}_3$  (~65%) was added to the mixture and then stirred at 37 °C for 18 h and 70 °C for 5 h to produce a gel-like product. The gel was then put in a drying oven at 60 °C for at least 40 h. The dried gel was ground into powder and subjected to calcination with a 2 °C/min temperature rising program to 1050 °C and kept for 2 h. Figure S1 shows the SEM picture of the as-synthesized  $\text{Na}_2\text{CaSiO}_4$ . Figure S2 shows the XRD results of the as-synthesized  $\text{Na}_2\text{CaSiO}_4$  with the standard PDF card (No. 00-03-0831). Figure S3 depicts the crystal structure of  $\text{Na}_2\text{CaSiO}_4$ .

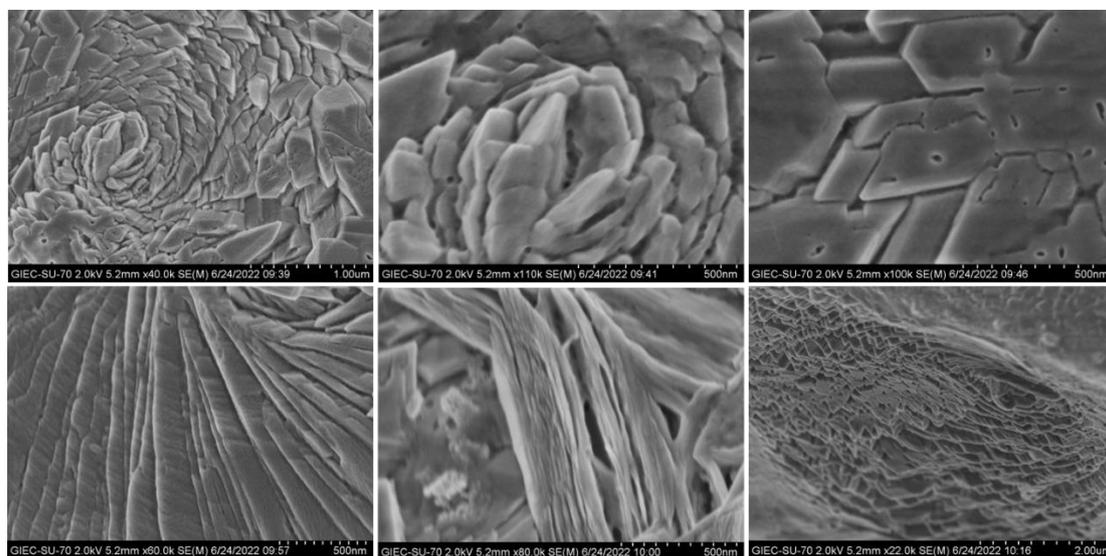


Figure S1. SEM picture of the as-synthesized  $\text{Na}_2\text{CaSiO}_4$ .

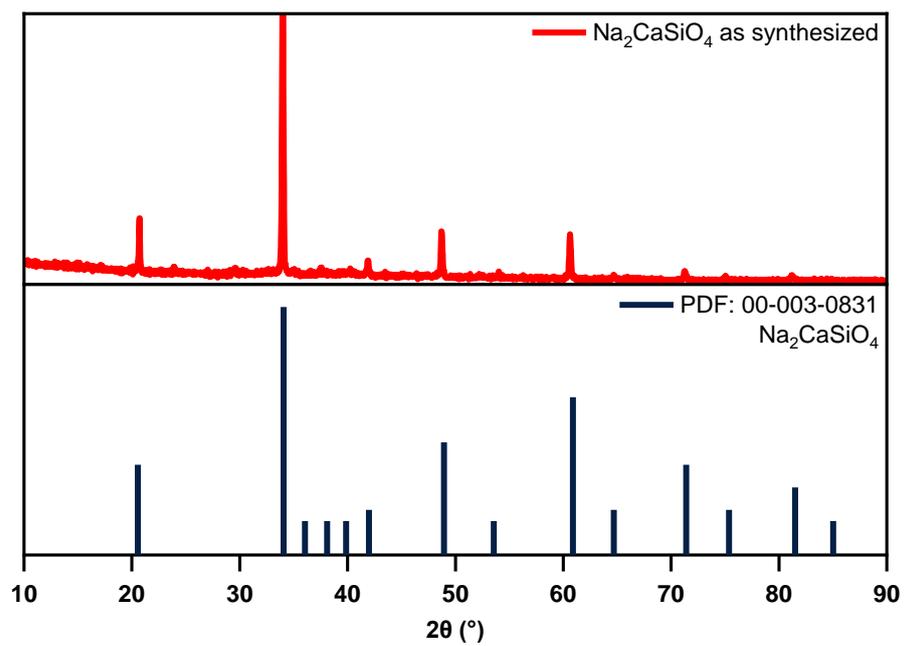


Figure S2. XRD results of the as-synthesized  $\text{Na}_2\text{CaSiO}_4$ .

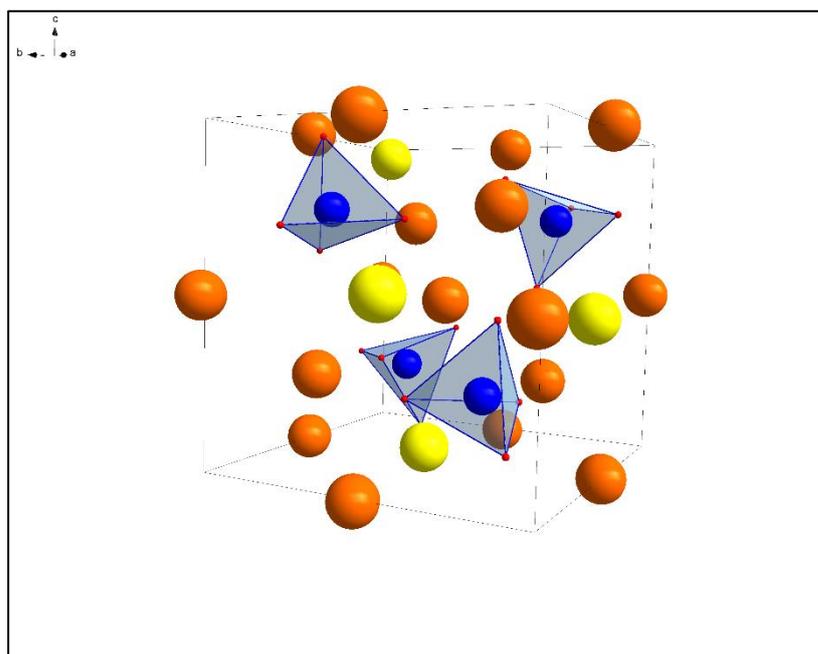


Figure S3. Crystal structure of  $\text{Na}_2\text{CaSiO}_4$ .

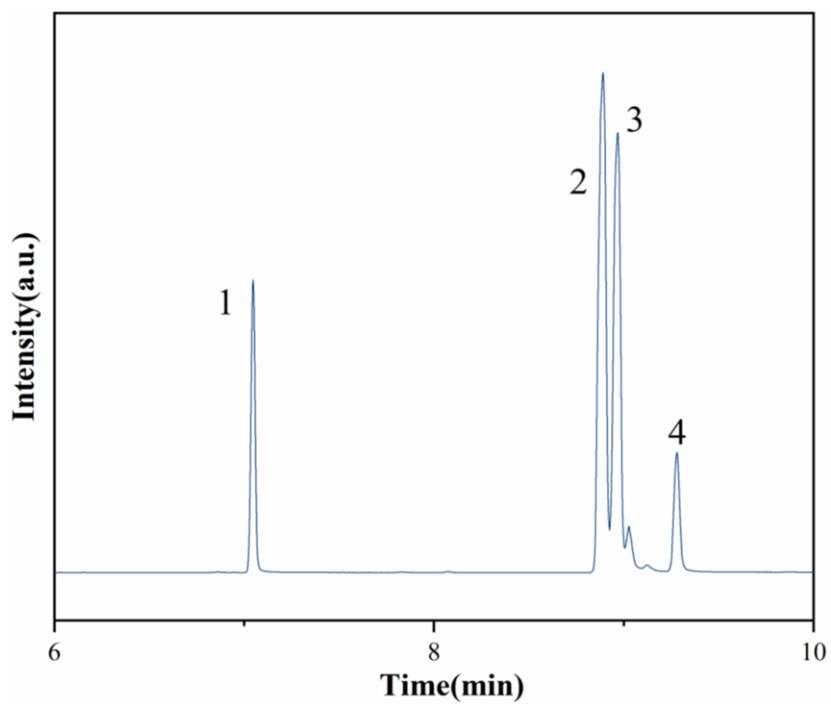
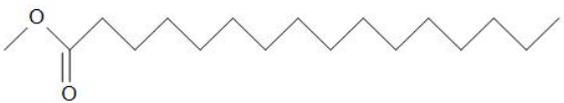
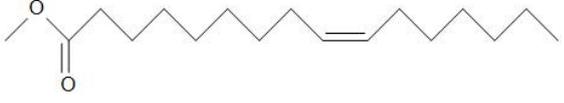
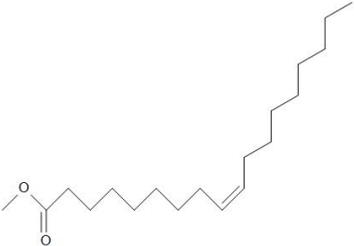


Figure S4. GCMS spectra of biodiesel.



Figure S5. Biodiesel product from soybean oil.

**Table S1.** Molecular structures for biodiesel by GCMS.

Numbers	Formula	Structural formula
1	$C_{17}H_{34}O_2$	
2	$C_{17}H_{32}O_2$	
3	$C_{19}H_{36}O_2$	
4	$C_{19}H_{38}O_2$	

**Table S2.** Key properties of biodiesel product from soybean oil.

Item	Values
Density (kg/L)	0.89
Acid value (mg KOH/g)	<0.05
Flash point (°C)	170
Calorific value (MJ/kg)	40.0
Sulfur content (mg/kg)	<1
Cetane value	55
FAME content (%)	98.1