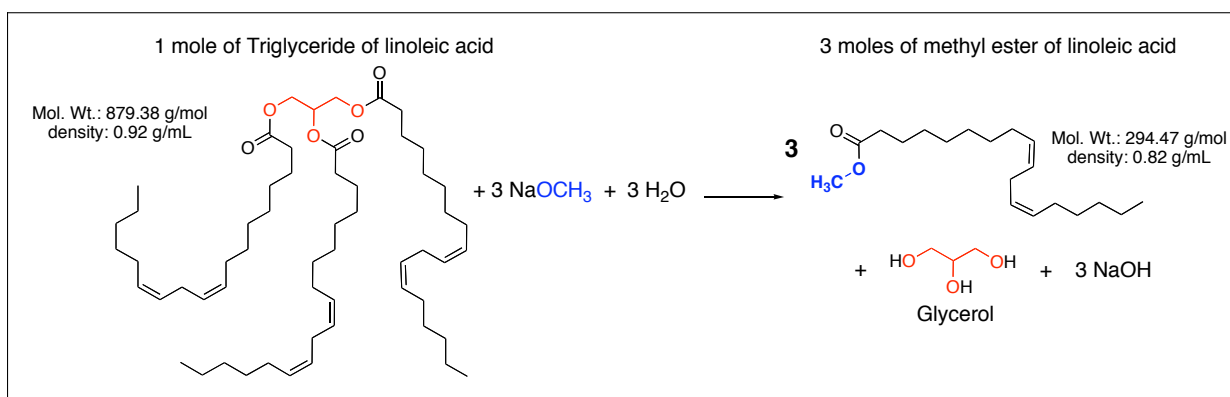


## CHEM 110L, Lecture 8 Experiment 4 - Biodiesel Synthesis & <sup>1</sup>H NMR Analysis



**Scheme 1.** Synthesis of biodiesel from corn oil via "transesterification."

What **vegetable oil** will you 'bring to lab' this week?

Draw the structure of its major **triglyceride** component.

**Table 27.2** Composition of Some Fats and Oils

Source	Saturated fatty acids (%)				Unsaturated fatty acids (%)	
	C <sub>12</sub> lauric	C <sub>14</sub> myristic	C <sub>16</sub> palmitic	C <sub>18</sub> stearic	C <sub>18</sub> oleic	C <sub>18</sub> linoleic
<i>Animal fat</i>						
Lard	—	1	25	15	50	6
Butter	2	10	25	10	25	5
Human fat	1	3	25	8	46	10
Whale blubber	—	8	12	3	35	10
<i>Vegetable oil</i>						
Coconut	50	18	8	2	6	1
Corn	—	1	10	4	35	45
Olive	—	1	5	5	80	7
Peanut	—	—	7	5	60	20

**Table 27.1** Structures of Some Common Fatty Acids

Name	No. of carbons	Melting point (°C)	Structure
<i>Saturated</i>			
Lauric	12	43.2	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>10</sub> CO <sub>2</sub> H
Myristic	14	53.9	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>12</sub> CO <sub>2</sub> H
Palmitic	16	63.1	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>14</sub> CO <sub>2</sub> H
Stearic	18	68.8	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>16</sub> CO <sub>2</sub> H
Arachidic	20	76.5	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>18</sub> CO <sub>2</sub> H
<i>Unsaturated</i>			
Palmitoleic	16	-0.1	(Z)-CH <sub>3</sub> (CH <sub>2</sub> ) <sub>5</sub> CH=CH(CH <sub>2</sub> ) <sub>7</sub> CO <sub>2</sub> H
Oleic	18	13.4	(Z)-CH <sub>3</sub> (CH <sub>2</sub> ) <sub>7</sub> CH=CH(CH <sub>2</sub> ) <sub>7</sub> CO <sub>2</sub> H
Linoleic	18	-12	(Z,Z)-CH <sub>3</sub> (CH <sub>2</sub> ) <sub>4</sub> (CH=CHCH <sub>2</sub> ) <sub>2</sub> (CH <sub>2</sub> ) <sub>6</sub> CO <sub>2</sub> H
Linolenic	18	-11	(all Z)-CH <sub>3</sub> CH <sub>2</sub> (CH=CHCH <sub>2</sub> ) <sub>3</sub> (CH <sub>2</sub> ) <sub>6</sub> CO <sub>2</sub> H
Arachidonic	20	-49.5	(all Z)-CH <sub>3</sub> (CH <sub>2</sub> ) <sub>4</sub> (CH=CHCH <sub>2</sub> ) <sub>4</sub> CH <sub>2</sub> CH <sub>2</sub> CO <sub>2</sub> H

Draw **diagrams / comic strip** of the **Part A** procedure (making sodium methoxide). What are the **safety concerns** and how will you **prevent chemical exposure** accidents?

Draw the **reaction** and **mechanism** for **Part A**.

Draw **diagrams / comic strip** of what you'll be doing in **Parts B & C**. Highlight the **safety concerns** and **preventative measures**.

Draw the **reaction** and **mechanism** for the first cycle of **Part B** (one mole of methoxide performs one *trans*-esterification reaction - nucleophilic acyl substitution).

Draw **your biodiesel** product from oil-of-choice to incorporate the major fatty acids present.

What  **$^1\text{H}$  NMR peaks** should stand out in the **spectrum of your biodiesel** product?