CH5: Synthesis and the environment

ACTIVITY 1 : KITCHEN SCIENCE, MAKING FUEL FROM VEGETABLE OIL

Part 1: Study of a recording

Scientists at Bath University, UK, have a found a simple way to use vegetable oil as fuel for car engines for example.

Source : http://commons.wikimedia.org/wiki/File:Biofuels.jpg

Here is an interview at Bath University by Azi, reporter from the Naked Scientists.

STEP 1: Discover the recording

Listen to the mp3 without looking at the transcript at least two or three times. STOP at "glycerol, which is just a waste product of the biodiesel process »

Write down the keywords that you hear, then write them on the board:

_____

STEP 2: Rephrasing

Get into groups of 4-5 students. Using the keywords selected by the class, rephrase the main ideas in the mp3 :

_____

After having written your summary, one student from each group should read it or explain it to the rest of the class.

STEP 3: Assisted listening

After a couple of listenings without the text, you may listen to the mp3 again but this time, read the text at the same time. Note that the main keywords appear in ***bold lettering****.*

Kitchen Science - Making Fuel from Vegetable Oil

Prof. Matthew Davidson, Prof. Gary Hallway & Chris Chuck, University of Bath

Prof. Matthew Davidson, University of Bath
Source:
http://www.thenakedscientists.com/HTML/content/interviews/interview/760/

Azi - Hello, welcome to **Kitchen Science**. This week, I've come to the historic city of Bath and I'm actually standing at the university of **Bath's Chemistry Department**, I'm joined by Professor [Matthew] Davidson and also Christopher Chuck who is a PhD student here. The question I've come to you guys with, and I'm really hoping you can help me out here, is: "can you run your car on cooking **vegetable oil** ?"

Matthew - That's an interesting question as to whether you can run your car on **vegetable oil**, what's chemically called a **triglyceride**, a molecule with three long fatty arms on it. What happens is they all just get **entangled** together, and that means it has a very high **melting point**. The two most important problems are : firstly the stuff would **freeze** in your **tank**, so on a slightly cold morning you would have a **solid mess** and the second problem is that it simply **doesn't burn** very well.

Azi - Okay, so what's the solution?

Matthew – Well, the solution is actually quite a simple **chemical process**, and I can show you exactly how we do it. Before we do, I want you to put on some **goggles**, just to make sure we're **safe**.

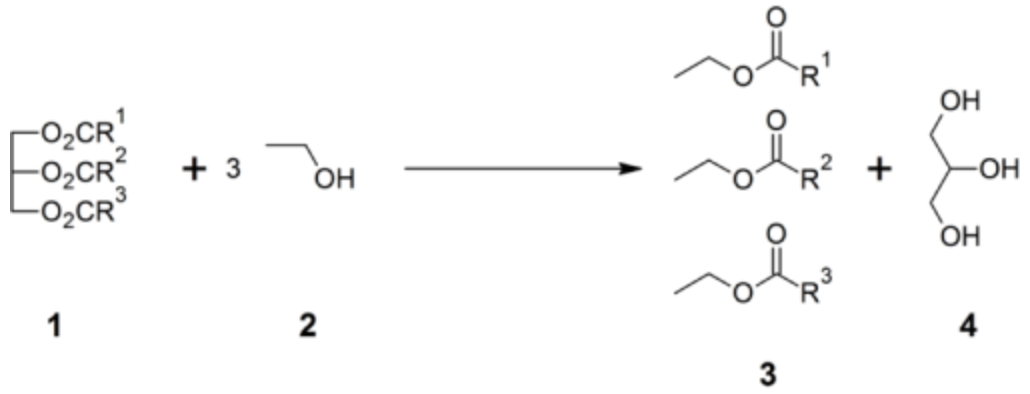
Azi - Okay, I've got my **goggles** on.

Matthew – Right. Well, what we're going to do is we're just going to take some **vegetable oil** that we bought at the **supermarket**, and we're going to take this **mixture** here, which is **methanol** and **sodium hydroxide**. We're just going to **mix** it with **vegetable oil**, you can see that the vegetable oil is **stirring** away with a stirrer in it, it's **heated up** to about **60** or **70 degrees** centigrade.

Azi - Okay, so you've got the **vegetable oil** in a **flask**, and you're putting **sodium hydroxide** which is mixed with **methanol**, in the **measuring cylinder** and you're going to **tip** it **in**…

Matthew - Yeah, we need to wait about half an hour and what we will see is the separate components; the biodiesel will **separate out** from the **by-product** which is called **glycerol**, which is the other part of the **fatty molecule** that we started off with.

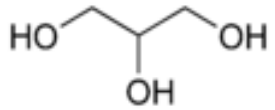
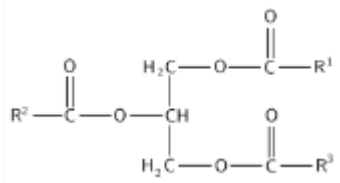
Azi – So, what's the **chemical process** that is happening inside that **flask**?



Matthew - Well the chemical process is something called **transesterification**, which is a bit of a complicated term for simply just changing the end of the long **fatty molecule** *(molecule 1)*. So instead of just having 3 of the fatty molecules attached to one end, a bit like a piano stool with three legs, we're changing the end, just capping off the fatty molecule with **ethanol** *(molecule 2)*. That gives us individual fatty molecules, and that's what is actually called **biodiesel** *(molecule 3),* that we could use in an **engine**; and another molecule called **glycerol** *(molecule 4)*, which is just a **waste product** of the biodiesel process.

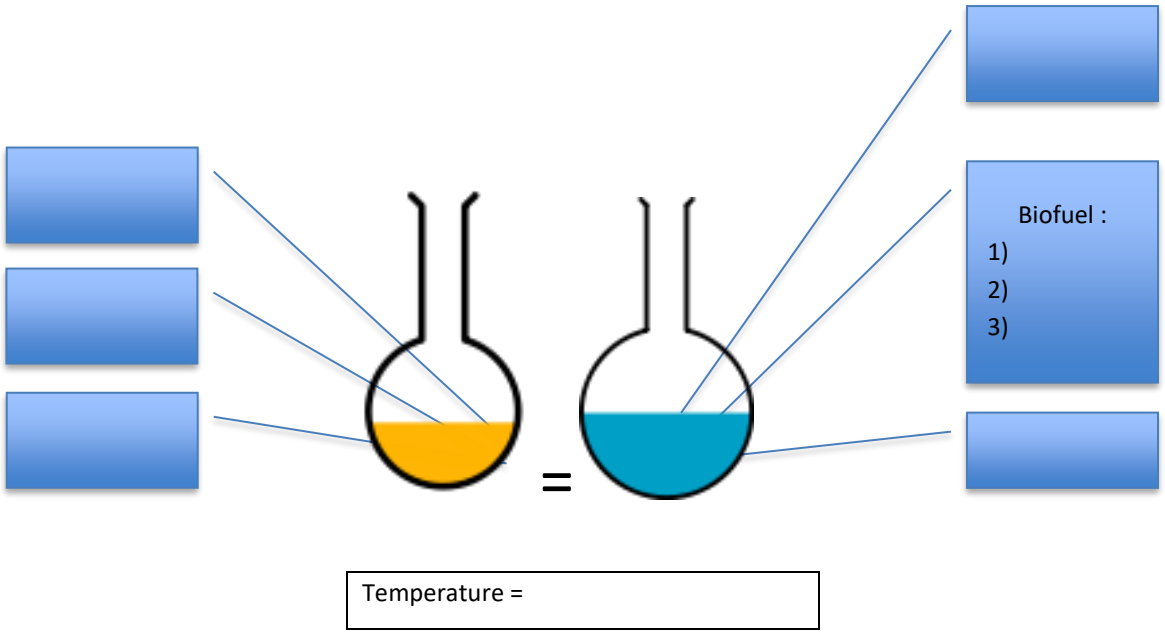
Part 2: Vocabulary work

Get into pairs. Here are some words or formulae, try to match them with the correct words found in the text above :

French or formula	**English**
moteur	
produit secondaire	
résidu, déchet	
corps gras	
éprouvette graduée	
agiter, mélanger	
lunettes de protection	
geler	
réservoir de voiture	
emmêlé	
	
	

Part 3: Reaction

Fill in the blanks : on the left handside, the reactants, and catalyst ; on the right handside, the products and catalyst.



PART 4 : PLAYING TABOO TO REVIEW THE ESSENTIALS

On the next page, you will find taboo cards that will help you review the important vocabulary.

Objective: you have to make your team guess the word on the card you randomly pick without using the word itself or three additional words listed on the card. A team that guesses a word gets one point.

How to play:

- Get into two teams, decide on the teams' names.
- Cut out the cards and place one set on the teacher's desk.
- A student who gets a right answer gets to come to the front and make the others guess a word. He must first randomly pick a card from the pile.
- Students take turns to come to the front to make the others guess one word.
- The game stops after all 12 cards have been used.

Activity summary

What you must remember :

- vocabulary associated with transesterification using vegetable oil

Skills linked to the curriculum :

Compétences	Capacités à maitriser
– ANA – COM	– Citer les exigences en matière de chimie « verte » ou durable, en ce qui concerne les choix des matières premières, des réactions et des procédés, ainsi que d'éco-compatibilité du produit formé.
– APP – ANA – COM	– Citer quelques utilisations importantes des agroressources en synthèse organique et exploiter des documents pour illustrer leur part croissante en tant que matières premières

biofuels

energy

algae

plants

engine

car

energy

fuel

glycerol

alcohol

molecule

esterification

transesterification

reaction

glycerol

triglyceride

triglyceride

reaction

glycerol

methanol

goggles

eye protection

lab

projections

Self sustaining

renewable

wind

solar

Greenhouse gases

Earth

Carbon dioxide

Heat

Fuel

petrol

coal

energy

Energy

nuclear

electricity

power

Global warming

Earth

Green house

Heat

Algae

green

plant

water