CH5: Synthesis and the environment

1. KITCHEN SCIENCE, MAKING FUEL FROM VEGETABLE OIL

### Part 1: Study of a recording

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

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

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

*STEP 1: Discover the recording*

http://www.thenakedscientists.com/HTML/content/interviews/interview/760/

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/*](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**.

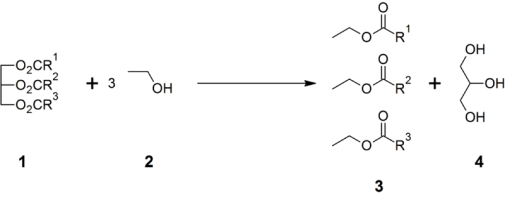
Azi - Okay, I’ve got my **goggles** on.

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.

Biofuel :

1)

2)

3)

 = 

Temperature =

### 

### 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 |

