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Titration

By Phillip Hill

Titration is a process used to determine exactly how much catalyst is needed to process a specified batch of waste vegetable oil (WVO). It can be an indication of how well used the oil is. The more worn out the oil is the more catalyst will be required to convert it and the less Biodiesel you will get from it. Titration is not necessary for processing fresh virgin vegetable oils.

What you need:

A pH Indicator (Any pH indicator suitable to indicate accurately in the range of 8-9)
Alcohol 99% pure (Isopropyl, Methyl, Ethyl)
Catalyst 99% pure (Sodium Hydroxide, Potassium Hydroxide)
A sample of your WVO
A couple small jars or test tubes
A dropper graduated in .1 ml divisions

The Process

Mix 1gram Sodium Hydroxide with 1 liter distilled water (This is your reagent solution)
Mix 10ml of alcohol with 1ml WVO at process temperature (This is your test sample)
Add recommended amount of indicator to the test sample.

Next, we need to test the dropper to see how many drops it take to make 1 milliliter. Suck up some reagent and begin dispensing it drop by drop back into its container. Count how many drops it takes to dispense 1 ml (you should get anywhere from 10 to 20). You will need to know this in the calculation step.

Next begin adding reagent solution to your test sample, stirring well after each drop or two. Keep track of exactly how much reagent you add to the sample (count the drops). Keep adding and stirring until the sample turns the appropriate color (indicating 8.0pH) then STOP.

The Calculation:

- Determine how much excess catalyst per liter you will need.

$$\left[\frac{\text{Dr ops added}}{\text{Drops per ml}} = \text{grams of excess catalyst per liter} \right]$$

- Determine total catalyst per liter needed.

$$\left[\text{Excess catalyst per liter} + 3.5 = \text{total catalyst per liter} \right]$$

- Multiply that by the number of liters in your batch.

$$\left[\text{Total catalyst per liter} \times \text{liters in the batch} = \text{total catalyst} \right]$$

In other words the number of ml you added to your sample to change the pH to 8.0 is the number of grams of Catalyst per liter you need over and above the amount needed to convert virgin vegetable oil (3.5g/l).

ec = excess catalyst per liter in grams
 sc = standard catalyst per liter in grams
 tc = total catalyst per liter in grams
 lt = batch size in liters

Total grams of Sodium Hydroxide needed for this batch of oil:

$$(ec + sc) \times lt = tc$$

Example:

You are processing 100 liters of oil.
 It took 1.8ml to get the sample to pH 8.

$$\begin{aligned} (1.8 + 3.5) \times 100 \\ 5.3 \quad \times 100 \\ 530 \text{ grams} \end{aligned}$$

That's 530 grams of Sodium Hydroxide that you will need for this batch

That's it!

Now you know how to properly determine the amount of catalyst needed to process oils of unknown quality and composition.

Note: If you use WVO, you should titrate each batch to determine how much catalyst you will need. It's best to titrate to eliminate the risk of having a failed batch due to incomplete conversion. You never know how badly used the oil will be when you get it from a restaurant waste oil bin.