Used Vegetable Oil Titration

When vegetable oil is heated extensively during the cooking process it causes the formation of free fatty acids (FFA's). These FFA's when combined with a base catalyst such as Potassium Hydroxide (KOH) or Sodium Hydroxide (NaOH) will form soaps. This process reduces the amount of KOH available to perform the Biodiesel reaction, thus it is often the case with waste vegetable oil, that additional KOH or NaOH will need to be added. The following titration will determine this amount. The basic principle involves adding KOH or NaOH (a strong base) to the oil to determine the exact amount required to neutralise the FFA's (weak acid).

Note: It is important to perform the titration using the same KOH or NaOH that you will use for the biodiesel reaction.

1. Using a graduated 1mL Syringe measure 1mL of used vegetable oil into the 100mL conical flask supplied.
2. With a 10mL Syringe measure 10mL of the Isopropanol/Indicator solution and add to the oil in the beaker.

CAUTION: **Isopropanol is flammable. Please read the safety label before use. Keep away from sources of ignition.**

3. Carefully swirl the flask until the oil has fully dissolved.
4. Prepare the "titration solution" by adding a 0.5g of KOH or NaOH to the 500mL Volumetric Flask supplied and filling to the 500mL mark with distilled water. Make sure all of the solids dissolve.
5. Place the Pipump firmly onto the pipette and withdraw precisely 5mL of "titration solution".
6. Carefully add single drops of the "titration solution" to the beaker by carefully tapping the release button on the Pipump. After every few drops swirl and allow to properly mix.
7. You are looking for the colour of the solution to turn light pink indicating neutralisation of the FFA's with the "titration solution". Keep adding drops and swirling the beaker to ensure proper mixing occurs. If you require more than the 5mL of "titration solution", record the amount used and refill the pipette as before. When the solution changes colour to pink for 15 -30 seconds while stirring the titration is complete and all of the FFA's in the oil have been neutralised.
8. Record the total amount of "titration solution" used.
9. The number of mL's of "titration solution" required equates exactly to the additional number of grams of KOH that is needed to be added to the Biodiesel reaction per 1L of oil. In Table 1 look up your purity of KOH (the supplied KOH is 90%) and the volume of titration solution used. This will give you the total amount of KOH to add per litre of oil.

TABLE 1 – Titration Table

Volume (mL)	99% NaOH (g)	95% NaOH (g)	99% KOH (g)	95% KOH (g)	90% KOH (g)	85% KOH (g)
0.0	3.5	3.7	4.9	5.2	5.5	5.8
0.2	3.7	3.9	5.1	5.4	5.7	6.0
0.4	3.9	4.1	5.3	5.6	5.9	6.2
0.6	4.1	4.3	5.5	5.8	6.1	6.4
0.8	4.3	4.5	5.7	6.0	6.3	6.6
1.0	4.5	4.7	5.9	6.2	6.5	6.8
1.2	4.7	4.9	6.1	6.4	6.7	7.0
1.4	4.9	5.1	6.3	6.6	6.9	7.2
1.6	5.1	5.3	6.5	6.8	7.1	7.4
1.8	5.3	5.5	6.7	7.0	7.3	7.6
2.0	5.5	5.7	6.9	7.2	7.5	7.8
2.2	5.7	5.9	7.1	7.4	7.7	8.0
2.4	5.9	6.1	7.3	7.6	7.9	8.2
2.6	6.1	6.3	7.5	7.8	8.1	8.4
2.8	6.3	6.5	7.7	8.0	8.3	8.6
3.0	6.5	6.7	7.9	8.2	8.5	8.8
3.2	6.7	6.9	8.1	8.4	8.7	9.0
3.4	6.9	7.1	8.3	8.6	8.9	9.2
3.6	7.1	7.3	8.5	8.8	9.1	9.4
3.8	7.3	7.5	8.7	9.0	9.3	9.6
4.0	7.5	7.7	8.9	9.2	9.5	9.8
4.2	7.7	7.9	9.1	9.4	9.7	10.0
4.4	7.9	8.1	9.3	9.6	9.9	10.2
4.6	8.1	8.3	9.5	9.8	10.1	10.4
4.8	8.3	8.5	9.7	10.0	10.3	10.6
5.0	8.5	8.7	9.9	10.2	10.5	10.8
5.2	8.7	8.9	10.1	10.4	10.7	11.0
5.4	8.9	9.1	10.3	10.6	10.9	11.2
5.6	9.1	9.3	10.5	10.8	11.1	11.4
5.8	9.3	9.5	10.7	11.0	11.3	11.6
6.0	9.5	9.7	10.9	11.2	11.5	11.8
6.2	9.7	9.9	11.1	11.4	11.7	12.0
6.4	9.9	10.1	11.3	11.6	11.9	12.2
6.6	10.1	10.3	11.5	11.8	12.1	12.4
6.8	10.3	10.5	11.7	12.0	12.3	12.6
7.0	10.5	10.7	11.9	12.2	12.5	12.8
7.2	10.7	10.9	12.1	12.4	12.7	13.0
7.4	10.9	11.1	12.3	12.6	12.9	13.2
7.6	11.1	11.3	12.5	12.8	13.1	13.4
7.8	11.3	11.5	12.7	13.0	13.3	13.6
8.0	11.5	11.7	12.9	13.2	13.5	13.8

8.2	11.7	11.9	13.1	13.4	13.7	14.0
8.4	11.9	12.1	13.3	13.6	13.9	14.2
8.6	12.1	12.3	13.5	13.8	14.1	14.4
8.8	12.3	12.5	13.7	14.0	14.3	14.6
9.0	12.5	12.7	13.9	14.2	14.5	14.8
9.5	13.0	13.2	14.4	14.7	15.0	15.3
10.0	13.5	13.7	14.9	15.2	15.5	15.8