3.0 METHODOLOGY

3.1 Materials

Palm Kernel Oil was from seeds or from kernel and obtained from Malaysia Palm Oil Board (MPOB). The obtained seeds were washed in the water, dried in the air, weighed and dehulled. The resulting kernels were weighted and ground using a blender, then sieved to fine particles. The oil was extracted from the ground kernels using hydraulic pressing.

1) Palm Kernel Oil (PKO) and Palm Oil (PO) were brought from FPG Oleochemical in Gebeng
2) Sodium hydroxide (caustic soda) / Iye
3) Ethylenediaminetetraacetic acid (EDTA)
4) Distilled water
5) Phosphoric acid
6) Sodium carbonate
7) Sodium perborate (borax)

3.2 Auxiliary raw materials used in making liquid detergent

The major raw materials used to produce liquid detergent are palm oil (PO) and palm kernel oil (PKO), caustic soda, phosphoric acid, sodium carbonate and sodium perborate. Caustic soda can be obtained locally while the other raw materials are supposed to buy. However, there is a possibility to get sodium carbonate locally as the chemical is locally available in the laboratory while sodium perborate is order from industry of manufacturing of chemical.

Generally, builders fall into phosphate, silicates and carbonates category and it serve several functions in a laundry detergent:

- **Phosphates**
  - Reduce water hardness
  - Help emulsify oily soils
  - Help disperse and suspend clay soils
  - Aid in soil anti re-deposition
 Buffer wash water at an alkaline pH to help cleaning

- **Silicates**

  Sodium silicates are multi-functional detergent ingredients. In addition to the builder properties, silicates help to prevent corrosion of washing machine parts. While silicates are relatively inexpensive, their calcium binding capacity is substantially less than that of STPP. However, silicates have higher magnesium binding capacity than STPP.

  Layered silicates are a relatively new class of silicate builder. The structure consists of extended crystalline di-silicate layers separated by sodium ions. These materials are slowly water soluble, and function through ion exchange, where sodium in the layered silicate is replaced by calcium and magnesium. In addition, layered silicates can help to stabilize oxygen bleaches by absorbing moisture and binding heavy in processing powder detergents by absorbing non-ionic surfactants (J. J. Grecsek, 1996).

- **Carbonates**

  Sodium carbonate is the most common builder of this class. Carbonates are very effective in providing alkalinity to wash water to help in stain removal. Carbonate builders remove hardness ions through precipitation of calcium carbonate, which can build up on washing machine parts or on fabrics, causing dinginess or greying. The main advantages of carbonates are their low cost and high degree of safety to the environment.
3.3 Equipments

3.3.1 Stirrer Motor

![Figure 3.3.1 IKA RW 20 Digital Dual-Range Stirrer Motor](image)

This affordable mixer can be used for liquid volumes up to five gallons and high viscosity liquid solution precision with stable mixing. The viscosity is up to 10,000 cps (approximately the viscosity of honey). The speeds are from 60 to 2000 rpm in two ranges for a variety of applications.

In this research, the stirrer motor was used for mixing of palm kernel oils and palm oils with other chemicals such as Sodium Hydroxide, Sodium Carbonate, Sodium Perborate and ethylenediaminetetraacetic acid (EDTA).

3.3.2 Homogenizer

![Figure 3.3.2 Homogenizer](image)