PRODUCTION OF DETERGENT POWER USING LOCALLY SOURCED POTASSIUM HYDROXIDE

BY

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CERTIFICATION

I hereby certify that this project little "production of Detergent powder using locally sourced potassium hydroxide" was carried out by BABALOLA OLAWALE with Registration Number 2003/17499EH. It was supervised, read, and approved for the partial fulfillment of the requirement for the award of Bachelor's degree in Chemical Engineering.

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PROJECT SUPERVISOR ENGR. M.U. GARBA	DATE
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HEAD OF DEPARTMENT DR. M.O. EDOGA	DATE
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EXTERNAL SUPERVISOR	DATE

DECLARATION

This project was carried out by BABALOLA OLAWALE under the supervision of Engr. Garba in the department of Chemical Engineering Federal University of Technology Minna.

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BABALOLA OLAWAE
2003/17499EH

DEDICATION

This work is dedicated to the almighty God for his benevolence, Kindness, love and mercy toward me since the beginning of my academic pursuit till date.

ACKNOWLEDGEMENT

With a heart of gratitude, I wish to thank the Almighty God for always being by my side.

I also appreciate my amiable supervisor Engr. Garba for his support towards the successful completion of this work.

My appreciation also goes to my Head of Department Dr. Edoga for his support academically.

My unflinching gratitude goes to my parents for their parental support.

My sincere gratitude goes to my love, Titilope and my brothers and sister, Tunde, Kunle, Deji and Remi.

My appreciation also goes to all my able lecturers in Chemical Engineering Departments Federal University of Technology Minna.

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ABSTRACT

In this work, detergent powder was produced using KOH (obtained from banana leaves), palm kernel oil and linear alkyl benzene sulphonate as base stock. The resultant detergent powder produced has lather volume test of $3.8cm^3$ lower than Global soap and detergent plc. Specification of 4 - 4.5. The % active detergent 35.2 was higher than the industrial standard of 20 – 24% and the percentage moisture of 28 was higher than the standard of 18 – 20%.

CHAPTER ONE

1.0 INTRODUCTION

Detergent is one of the essential commodities required daily for domestic and industrial needs in the laundry services sector and for cleaning utensils, toilets, floors and industrial plants.

Detergent is a substance that aid in the removal of dirt. It is also known for enhancing the cleansing action of water. According to the dictionary, a detergent is defined as a compound or a combination of compounds, that is put to use for cleaning process.

Detergent is used for removing dirt in fabric and other materials and may be in the powder or liquid form. A detergent is an emulsifier which penetrates and breaks up the oil film that bind dirt particles and wetting agent which helps to float off.

Emulsifier molecules have an oil- like non -polar portion which is drawn into the oil, and a polar group that is water soluble; by bridging the oil- water interface, they break the oil into dispersible droplets (emulsion). As a surfactant, a detergent decreases the surface tension of water and helps it penetrate soil.

Soap, the sodium salt of long- chain fatty acids is a good detergent although it has some disadvantage, e.g. it forms insoluble compounds with certain salts found in hard water thus diminishing its effectiveness and in acid solutions, frequently used in it is decomposed (thus precipitating the free fatty acid of the soap).

Soap was the principal detergent until superseded in 1954 by Synthetic detergents (Syndets) which unlike soap, do not form insoluble products with the calcium in hard water.

Most Syndets are of the anionic type, that is, sodium salts, of alkyl sulphonates or sulphates. Alkyl benzene sulphonates (ABS) with branched Carbon chains were found to persist in waste water and have been replaced by linear alkyl benzene sulphonates (LAB) which are biodegradable by bacterial action.

Anionic detergents are best for water –absorbing fibres such as cotton, wool, and silk. Non-ionic detergents are polyethers made by combination of ethylene oxide and a 12-carbon lauryl alcohol. They are used for water – repelling "permanent press" fabrics, and their low – foaming property is desirable for automatic washes.

Cationic syndets are quarternary base compounds. They are more expensive, but some are germicidal; some are used as fabric softeners and as good metal cleaners.

Detergents must contain alkaline "builders" to blind dissolved metal ions and support emulsification. Sodium pyrophosphate or polyphosphate were preferred because of low cost and high cleaning effectiveness. However, when discharged with laundry waste water, these compounds supply nutrient to phosphate – deficient lakes and streams and thus lead to eutrophication; and their use is now banned by law. Less harmful, but less effective builders such as sodium carbonate are now widely used in detergents.

Many additives are use in detergents to provide scent, brightening (using through fluorescent action), or bleaching action. Biodegradability is essential for detergents; it ensures that components of detergents will be broken down by bacterial action before undesirable after – effects can occur. Non biodegradable detergents can prevent effective bacterial action in septic tanks and swage treatment plants, and can cause undesirable persistent foaming in rivers.

Any of various surfactants (substances that reduces surface tensions) used dislodge dirt from soiled surfaces and retain it in suspension, allowing it to be rinsed away. The term usually refers to synthetic substances and excludes soaps.

The characteristics features of a molecule of any detergent are a hydrophilic (water – attracting) end and a hydrophilic (oil attracting) end. In ironic detergents, the hydrophilic property is conferred by the ionized part of the molecule. In non- ionic detergents, hydrophilicity is based on the presence of multiple hydroxyl groups or other hydrophilic groups. Besides those used in water to clean dishes and laundry, detergents that functions in other solvents are used in lubricating oils, gasolines, and dry – cleaning solvents to prevent or remove unwanted deposits. They are also used as emulsifying agents.

1.1 AIM AND OBJECTIVE

The aim of this work is to produce detergent powder.

1.1.2 OBJECTIVE

The objective of this work is to produce detergent powder using potassium hydroxide from banana leaves instead of an industrially produced sodium hydroxide.

1.2 JUSTIFICATION

Much work has been done on the production of detergents using locally sourced potassium hydroxide but those works have been limited to the production of liquid detergents. In view of this, a work on the production of detergent powder using a locally sourced potassium hydroxide is justifiable

Besides, the production of potassium hydroxide is cheap and easy. The raw material for the production of potassium hydroxide locally is plant and is readily available.

1.3 SCOPE OF WORK

The scope of this work is to produce detergent powder using forty percent potassium hydroxide solution obtained from the ash of banana leaves and also using linear alkyl benzene sulphonate, palm kernel oil and additives.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 HISTORY OF DETERGENT

Synthetic detergents were produced experimentally in France before the middle of the 19th century and were further developed in Germany during World War 1. however, not until the 1930s were chemical processes developed that made production in quality feasible in any country. Synthetic detergents were first developed for commercial use in the 1950s. (www.niacet.com)

2.2 TERMINOLOGY

Sometimes the word "detergent" used in distinction to "soap". For a while during the infancy of other surfactants as commercial detergent products, the term "syndet" short for "synthetic detergent" was promoted to indicate this, but never caught on very well, and is incorrect in any event because soap is itself synthesized through the process of saponification of glycrides. The term "soapless soap" also saw a brief vogue. Unfortunately, there is no accurate term for detergents not made of soap other than "soapless detergent" or "non –soap detergent".

Also, the term "detergent" is sometimes used for surfactants in general, even when they are not used for cleaning. As can be seen above, this too is a terminology that should be avoided as long as the term "surfactant" itself is available.

Technically, plain water, if used for cleaning, is a detergent. Probably the most widely used detergents other than water are soaps or mixtures composed chiefly of soaps. However, not all soaps have significant detergency. Often the word "soap" is used to indicate any detergent, especially those that have characteristics similarly to those of Soap. (http://www.detergents. In/).

2.3 COMPOSITION

Detergent, especially those made for use with water often include different components such as:

1. Surfactants which are added to remove grease from cloth.
2. Abrasive which rubs off the dirt from the fabric.
3. Substances that modify P^H (P^H substance). They are compounds that have a high ph factor to stabilize that other harder substances being used.
4. Water softness which counteract the effect of "hardness" ions on other ingredients.
5. Oxidants (oxidizers) which are used for bleaching and destruction of dirt.
6. Non – surfactant materials which keep dirt in suspension.
7. Enzymes to digest proteins, fats or carbohydrate in dirt or to modify fabric feel.
8. Ingredients that affect the aesthetic properties, such as optical brightness, fabric softeners, colours, perfumes etc.
9. Ingredients that affect the aesthetic properties, such as optical brighteners fabric softeners, colours, perfumes etc
10. Washing agents which may contain soap for the purpose of reducing foam rather than cleaning fabric (http://www.detergent.in/)

2.4 DETERGENT CHOICE

There are several factors which dictate what composition of detergent should be used, namely, the materials to be cleaned, the apparatus to be used and tolerance for dirt. For instance, all of the following are used to clean glass. The sheer range of different detergents which can be used demonstrates the importance of context in the selection of an appropriate glass- cleaning agent

1. A chronic acid solution is used to get glass very clear for certain precision demanding purposes, namely in analytical chemistry.
2. A high foaming mixture of surfactants with low skin irritation – for hand washing of drink glasses in a sink or dish pan.
3. Any of various non- foaming composition – for glasses in a dish washing machine.
4. An ammonia – containing solution for cleaning windows with no rinsing
5. Ethanol or methanol in wind shield, washier fluid is used for a vehicle in motion. (http://www.detergents.in/)

2.5 TYPES OF DETERGENTS

Generally, detergent means any substance which has the ability to clean and object scientifically, it covers both soap and synthetic detergents.

Detergents are of two main types.

1. Soapy detergent
2. Soap-less detergent

2.5.1 Soapy detergents

They are simply soaps and are the sodium salts of fatty acids. They are saponification products of fats and oils.

2.5.2 Soapless detergents

They are more favoured all purpose cleansing agents nowadays. They are available as liquids or solids. The most widely used ones are alkyl benzene sulphonate (ABS). Like the soaps, they are sodium salts of an acid, e.g. a sulphonic acid in the case of ABS. They are known as synthetic detergents and do not form scum or react with hydrogen ions. (Osei Yaw Ababio, New school Chemistry, Senior Secondary Sciences series (2005) page 542 – 546).

2.6 RAW MATERIALS FOR DETERGENTS

Active organic compounds or surfactant, that is any compound that affects (usually reduces) surface tension when dissolved in water or water solutions or which similarly affects interfacial tension between two liquids, e.g. linear alkyl benzene sulphonates (LAS) and fatty alcohol sulphate.

Inorganic are oleum, caustic soda and various sodium phosphate and other additives such as sodium silicate (corrosion inhibitor).

Fluorescent, perfume, dye or pigments (to improve product characteristics) and water as filler and binders.

2.7 FUNCTION OF RAW MATERIALS

1 Sodium sulphate acts as a builder and as a weight controller.

2. Sodium silicate acts as a weight controller, drying agent and aids atomization.

3. Blue dye is the colourant which makes the product aesthetic .

4. Caustic soda supports forming and washing ability. Also, neutralizes the acid present

5. Kaolin acts as a filler

6. Soda ash acts as a builder and acids foaming.

7. Sulphonic acid acts as the active detergent after reacting with sodium hydroxide. It increases foaming and washing ability.

(Global soap and Detergent Ilorin).

2.8 CLEANING ACTION

1 Thoroughly wetting the dirt and the surface of the article being washed with the soap or detergent solution.

2. Removing the dirt from the surface and

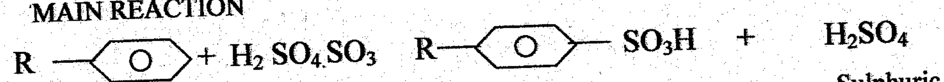
3. Maintaining the dirt in a stable solution or suspension (detergency)

In wash water, soap or detergents increase in wetting ability or the water so that it can more easily penetrate the fabrics and reach the soil. Then soil removal begins (Osei Yaw Ababio, New Certificate Chemistry for senior Secondary School, 2005, pages. 542 – 546)

2.9 PRODUCTION PROCESS

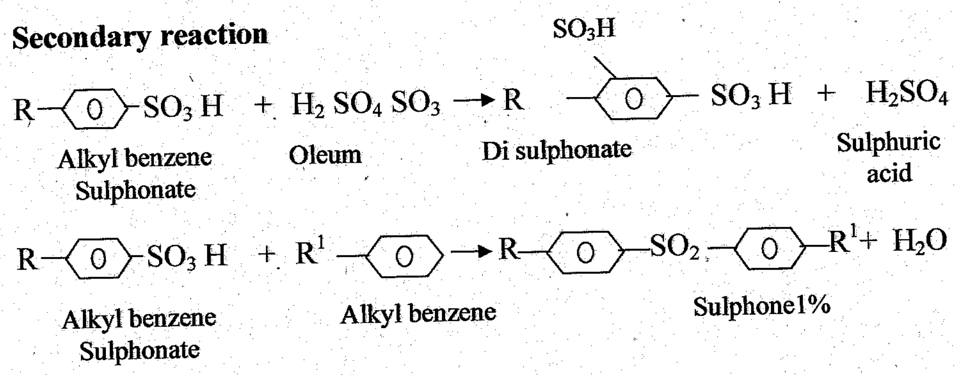
2.9.1 Linear alkyl benzene sulphonate

MAIN REACTION



Alkyl benzene | Oleum | Alkyl benzene sulphonate | Sulphuric acid

Secondary reaction



(Global soap and Detergent Ilorin)

2.9.2 **Summary of prodution process**

Alkyl benzene + Oleum ⟶ Alkylbenzene sulphonate

Sulphonate + Sulphate + Sodium hydroxide ⟶ Sodium salts

Sodium Salts + Builders etc. ⟶ Detergents.

2.10 STRUCTURE OF DETERGENTS

1. Soapless detergents are organic substances with a structure made of

(i) Hydrocabon tail

(ii) Ionic head of textraoxosulphate VI ion

(- OSO_3-)

```
          O
          ||
 - O -    S  -  O -
          ||
          O
```

Or the trioxosulphate (iv) ion, - SO_3 -

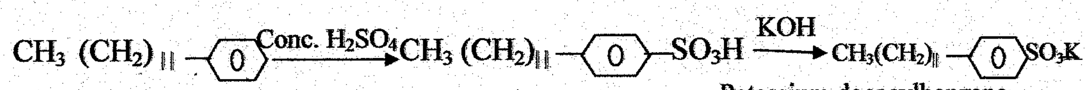
```
      O
      ||
  -   S  - O -
      ||
      O
```

(2) Soapless detergents and soapy detergents have the common structural property of a hydrophobic, hydrocarbon tail and a polar or ionic head.

(3) Soaps have the - COO - ionic head while detergents have the $-SO_3$ or

$- OSO_3$ – ionic head.

2.10.1 Reaction structure



Docecylbenzene (alkyl benzene)

Potassium docecylbenzene (soapless detergent)

K. Ameyior and M. B. Wiredu (1992)

Ghana Association of Science Teachers Chemistry for Senior Secondary Schools,

2nd edition pp (540 – 545)

CHAPTER THREE

3.0 MATERIALS, EQUIPMENT AND METHOD

3.1 MATERIALS /REAGENT

1 0.1 Normal tetraoxosulphate VI acid (0.1 NH_2SO_4)

2. Phenolphthalin indicator

3 Distilled water

4 Methanol

5. Soda ash

6 Linear alkyl benzene sulphonate

7 Potassium hydroxide (Caustic potash)

8 Palm kernel oil

9. Blue dye

10 Kaolin

11 Sodium sulphate

12 Hydrogen peroxide

3.2 EQUIPMENT

1 Mortal and pestle

2. Tray for drying

3. Furnace

4 Distillation apparatus (A kettle, a stove, a hoze and a bucket)

5. Filter

6. Burrette

7 Pipette

8 Conical flask

9 Hard gloves

10 Hydrometer

11 Stirrer

12 Mould

13 Grinder

3.3 PROCEDURE

3.3.1 Ashing of banana leaves

A large collection of fresh banana leaves was assembled and dried.

Drying lasted for three days. After drying the fresh banana leaves, it was pounded to a powdery form. The powdery banana leaves was then ashed in the furnace.

The furnace automatically switched off when ashing was completed.

3.3.2 Water distillation

Water was poured in a kettle. The kettle was fitted with a rubber hoze at the spout of the kettle. The kettle was then placed on a stove for the water to boil.

The hoze was made to pass through a cold water kept in a plastic container.

A bottle was kept at the end of the hoze to get the water that was distilled from the kettle.

3.3.3 Making an ash slurry

The ash was kept in a clean container distilled water was poured on the ash and mixed properly.

The solution formed from the ash and water was kept for three days. At the third day, the solution was stirred again. That solution was the ash slurry.

The slurry was filtered using a clean scarf. The filtrate was a solution of potassium hydroxide. Finally, the solution was concentrated by evaporation on the heating solution

3.3.4 Percentage of potassium hydroxide present in the solution.

0.25G of potassium hydroxide solution was weighted into a conical flask.

100ml of distilled water was added and shaken properly.

2 drops of phenolphthalein indicator was added. 0.1 Normal sulphuric acid ($O.INH_2SO_4$) solution was poured into a burette. The acid in the burette was titrated against the potassium hydroxide solution in the conical flask.

The result of the titration was taken according to the format. [Osei Yaw Ababio New School Chemistry (2005)]

3.3.5 Detergent preparation

A. 1 litre of water was poured in a bowl

¼ litre of soda ash was added to the water and stirred.

B ¼ litre of linear alkyl benzene sulphonate was poured into a plastic bowl. ¼ litre of potassium hydroxide was added and stirred.

¼ litre of pal kernel oil was poured into a non aluminum bowl and blue dye was added till the oil changed to light blue then ¼ litre of potassium hydroxide and linear alkyl benzene mixture prepared in "B" above was added and stirred.

Further more ¼ litre or 62.5ml of kaolin was added and stirred vigorously.

$^{1}/_{16}$ litre of sodium sulphate was also added, then stirred.

Finally, 5ml of hydrogen peroxide was added and stirred.

The mixture was stirred continuously till it became solidified, then, it was left to cool and dry. It was then ground to a powder form. The ground detergent was further dried and packaged.

3.3.6 Product analysis

A. Specific gravity of potassium hydroxide

The relative density bottle was weighed empty and had mass "M". It was then filled with potassium hydroxide solution and weighed and had mass "M_1". Finally, it was emptied, dried and refilled with water and weighed again, when it had mass "M_2".

$$\text{relative density} = \text{specific gravity} = \frac{\text{mass of liquid}}{\text{mass of equal volume of water}}$$

$$= \frac{M_1 - M}{M_2 - M}$$

(M. Nelkon and P. Parker, 1979, Advance Level Physics 3rd edition); (P.N. Okeke and M.W. Anyakoha, Senoir Secondary Physics, 2000)

B. Percentage moisture content of detergent produced

An empty can was weighed and had mass M_1 10g of the detergent powder was poured into the can and recorded as (M_1 + 10g). The can and its content was placed on a moisture balance for 10 minutes and weighed again.

Percentage moisture content was calculated using:

$$\frac{\text{(Weight of can + sample) – Final weight}}{\text{Weight of sample}} \times 100$$

C. **Lather volume**

2 gram of the produced detergent powder was weighed into 2 litres beaker marked at four different sides. 200ml distilled water was added. It was left to dissolved for 2 minutes, then stirred for 4 minutes.

Readings were taken from the four labeled paints on the beaker and the average was taken. (Global soap and detergent Ilorin 2007, quality control laboratory).

D. **Non dissolved organic matter**

5g of the produced detergent was weighed into a beaker and 500ml of methanol (CH_3OH) was added and shaken to dissolve. The mixture was titrated against a distilled water to form a cloudy (milky) solution. Non dissolved organic matter present in the newly produced detergent was calculated as follows: N. D. O. M = 6 .6 – (0 . 3 x T . V)

(Global Soap and detergent Ilorin quality control laboratory)

E. **Active detergent**

1g of the detergent produced locally was weighed into a beaker, then dissolved with 50ml of hot water. The solution was then cooled in water bath. The sample was transferred into 100ml volumetric flask. 10ml was pipetted into the titrating reagent. It was then, titrated against hyamine to give a blue colour as the end point. The formula employed was as follows:

A . D = T . V x N (hyamine) x 342

342 = Equivalent weight of sodium sulphonate

N = Normalty of hyamine (0.00 41904)

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

4.1 RESULTS

Table 4.1.1: Titration Of 0.1n H_2so4 solution against potassium hydroxide.

BURRETTE READING	1^{ST} CM^3	2^{ND} CM^3	3^{RD} CM^3
INITIAL READING	40.00	38.00	45.00
FINAL READING	22.00	19.80	27.50
TITRE VALUE	18.00	18.20	17.50

Table 4.1.2: Determination of percentage active detergent of detergent produced.

BURRETTE READING	1^{ST} CM^3	2^{ND} CM^3	3^{RD} CM^3
INITIAL READING	40.00	46.00	40.00
FINAL READING	16.00	21.40	15.00
TITRE VALUE	24.00	24.60	25.00

Table 4.1.3: Non- dissolved organic matter of detergent produced.

BURRETTE READING	1^{ST} CM^3	2^{ND} CM^3	3^{RD} CM^3
INITIAL READING	40.00	28.00	40.00
FINAL READING	28.00	17.00	27.00
TITRE VALUE	12.00	11.00	13.00

4.1.1: Potassium hydroxide analysis

SAMPLE	TITRE VALUE (CM^3)	% ACTIVE DETERGENT	SPECIFIC GRAVITY
POTASSIUM HYDROXIDE	17.9	40.2	1.25

4.1.2: Active detergent analysis

SAMPLE	TITRE VALUE (CM^3)	% ACTIVE DETERGENT
ACTIVE DETERGENT	24.53	35.2

4.1.3 Non dissolved organic matter (N.D.O.M)

SAMPLE	TITRE VALUE (CM^3)	% N.D.O.M
N.D.O.M	12.00	3.0

4.1.4 Moisture content = 28%

4.1.5 Lather volume = 3.8 CM^3

4.1.6 Standard values

Lather volume	4 – 4.5
Specific gravity	1.25
% Active detergent	20 – 24 %
% Moisture content	18 – 20 %

4.2 DISCUSSION OF RESULTS

To enhance the aesthetic property of the detergent powder, blue dye was chosen as the colourant. It was ensured that the detergent powder had a light blue colour which made it very attractive.

The result of the lather volume test (3.8 cm^3) which was close to the value obtained at Global soap and detergent company with (4 - 4.5) cm^3 was relatively low. What accounted for the relatively low lather volume was the washing agents which contained soap for the purpose of reducing foaming rather than cleaning fabric.

Potassium hydroxide was obtained from banana leaves ash. It was ensured that not more than 40.2% KOH solution was obtained by concentrating its solution on heating to prevent the detergent powder from damaging the skin and fabric, because potassium hydroxide is more reactive than sodium hydroxide, this can be attested to by comparing potassium which is stronger than sodium in the electrochemical series.

The specific gravity of potassium hydroxide (1.25) was the same as the standard value.

The percentage active detergent (35.2%) was relatively high when compared with industrial standards of 20 to 24%. That was due to the introduction of potassium hydroxide and fatty acid (i.e. palm kernel oil), instead of sodium hydroxide and linear alkyl benzene sulphonate alone.

The percentage non dissolved organic matter (3.0%), was a good result because it showed how effective the reaction was. Percentage moisture content of the detergent (28%) was relatively good when compared with industrial values of 18 – 20%. The powder should not be too dry not too humid.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Potassium hydroxide is cheaper than sodium hydroxide and it is readily available. Besides, it could give a result as good as that, that could be gotten from sodium hydroxide provided large collection of banana leaves is assembled and ashed appropriately in the furnace and processed correctly.

5.2 RECOMMENDATION

Readily available and cheap materials like cassava starch in place of sodium carboxyl methyl cellulose, and potassium hydroxide in place of sodium hydroxide are recommended for use in the production of detergent powder.

5.3 REFERENCES

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APPENDIX A

SYMBOLS

Wt	=	Weight of a sample
W_{KOH}	=	Molecular weight of potassium hydroxide
T.V	=	Titre value
A.T.V	=	Average titre value
%KOH	=	Percentage potassium hydroxide
M_1	=	Mass of potassium hydroxide plus the mass of a relative density bottle
M	=	Mass of a relative density bottle
M_2	=	Mass of water plus the mass of a relative density bottle
A.D	=	Active detergent
N.D.O.M	=	Non – dissolved organic matter
r.d	=	Relative density
S.G	=	Specific gravity
%A.D	=	Percentage active
M.C.	=	Moisture Content
L.V.	=	Lather volume
%M.C.	=	Percentage moisture content
N	=	Normality.

APPENDIX B

CALCULATION

DETERMINATION OF THE PERCENTAGE POTASSIUM HYDROXIDE LOCALLY PRODUCED

$$\%KOH = \frac{T.V \times 0.1N(H_2SO_4) \times W_{KOH} \times 100}{Wt \times 1000}$$

Titration Results

1st titre value = $18.00cm^3$

2nd titre value = $18.20cm^3$

3rd titre value = $17.50cm^3$

$$A.T.V = \frac{18.00 + 18.20 + 17.50}{3}$$

$= 17.9\ cm^3$

$$= \%\ KOH = \frac{17.9 \times 0.1 \times 56.11 \times 100}{0.25 \times 1000}$$

$= 40.2\%$

DETERMINATION OF THE SPECIFIC GRAVITY OF THE POTASSIUM HYDROXIDE PRODUCED

r.d = S.G

$$r.d = \frac{\text{mass of liquid}}{\text{mass of equal volume of water}}$$

$$r.d = \frac{m_1 - m}{m_2 - m}$$

Measurement Results

M_1 = 9g

M_2 = 8g

M = 4g

$$r.d = \frac{9-4}{8-4}$$

$$= \frac{5}{4}$$

$= 1.25$

: S.G. = 1.25

Since, r.d = S.G

DETERMINATION OF THE PERCENTAGE ACTIVE DETERGENT OF THE DETERGENT PRODUCED

% A.D = T.V. x N(Hyamine) x 342

Normality of Hyamine = 0.0041904

Equivalent weight of sodium sulphonate = 342

Titration Results

1st T.V = 24.00cm3

2nd T.V = 24.60cm3

3rd T.V. = 25.00cm3

$$A.T.V = \frac{24.00 + 24.60 + 25.00}{3}$$

= 24.53

= % A.D. = 24.53 x 0.0041904 x 342

= 35.15

≃ 35.2%

DETERMINATION OF THE PERCENTAGE MOISTURE CONTENT OF THE DETERGENT PRODUCED

$$\% M.C. = \frac{(\text{Weight of can + sample}) - \text{final weight} \times 100}{\text{Weight of sample}}$$

Measurement Results

Weight of can = 4g

Weight of sample = 10g

Final weight = 11.20g

$$= \% M.C. = \frac{(4 + 10) - 11.2}{10}$$

= 28%

DETERMINATION OF THE PECENTAGE OF THE NON – DISSOLVED ORGANIC MATTER OF THE DETERGENT PRODUCED

% N.D.O.M = 6.6 – (0.3 x T.V)

Titration Results

1st T.V. = 12.00

2^{nd} T.V. = 11.00

3^{rd} T.V. = 13.00

A.T.V. = $\frac{12.00 + 11.00 + 13.00}{3}$

= $12.00cm^3$

= % N.D.O.M = 6.6 – (0.3 x 12)

DETERMINATION OF THE DETERGENT'S LATHER VOLUME

L.V. = $\frac{\text{Point 1} + \text{Point 2} + \text{Point 3} + \text{Point 4}}{4}$

Measurement Results

Point 1 = $3.9cm^3$

Point 2 = $3.8cm^3$

Point 3 = $3.6cm^3$

Point 4 = $4.0cm^3$

= L.V. = $\frac{3.9 + 3.8 + 3.6 + 4.0}{4}$

= $3.8cm^3$