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CHEMICAL COMPARATIVE ANALYSIS OF THE LABORATORY PREPARED MULTI-ACTIVE DETERGENT FROM LOCAL RAW MATERIALS AND COMMERCIAL SAMPLE FOR IDUSTRIALISATION

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Abstract: Multi-active detergents are products that contain a surfactant and other ingredients to clean fabrics in the wash, which is a substance (surfactant) that is added when one is washing to get the multi - active cleaner, which has traditionally been a powdered or granular solid, but the use of liquid multi - active detergents has gradually increased over the years. The chemical components of detergents are often called surface-active agents or surfactants because they act upon surfaces. Two stages were involved in this analysis; the first stage was the preparation of two differentiated colourant laboratory detergents, while the second stage was the both the invitro and invivo investigation of the toxicity and carcinogenicity effects of these detergents on living organisms. The results shown that, all detergents samples were toxic and have harmful effect on every exposed organism. Therefore, the laboratory prepared specimen shared similar toxic effects with the commercial samples, which needs to be handled carefully.

keywords: ***Carcinogenicity, Detergents, Fabrics, Industrialization, Invitro, Invivo, Multi-Active, Surfactants, Toxicity,***

1.0. INTRODUCTION

Detergents are materials which aid in the removal of dirt or other foreign matters from contaminated surfaces. Until the 1940s, soap was the only important detergent in the market but today, soap is one of the numerous detergent products. According to one ancient Roman legend, soap derives its name from Mount 'Sapo' in Italy where animals were sacrificed to appease the gods. The mixture of the melted animal fats and wood ashes that ran down to the clay soil near Tiber River at Mount 'Sapo' was found to make washing easier than ordinary water for women inhabiting the area *(Ronni, 2004)*.

But another report from a medical document Papyrus, said that soap-making dates back to about 1500BC when a combination of animal vegetable oils and alkaline salt was used to form a soap-like material. However, modern technology has led to the creation of synthetic detergents that have gradually replaced soaps in the laundry. The first detergent was used chiefly for hand dish-washing and fine fabric laundering. This was followed by the development of multi-purpose laundering detergent introduced in the United States of America in 1946. Today, detergent market is a highly competitive one where different brands compete with one another to get customers *(Khurana, 2002).*

The chemical components of detergents are often called surface-active agents or surfactants because they act upon surfaces. A common feature of detergents is that they are made up of comparatively large molecules (Molecular weight over 200 g). One part of the molecules is soluble in organic material and the other part is soluble in water. Before, synthetic detergents were made by treating an aromatic or benzene-type compound with sulfuric acid, followed by neutralization with alkali to convert the product to its sodium salt. These detergents, however, became a public nuisance because they were neither soluble nor biodegradable. The aromatic compound was later replaced with a so-called linear alkyl-type compound in the process described

above and the detergent produced was as effective as the former kind in its detergent action and was more biodegradable and soluble *(Redmond, 2011).*

Detergents are widely used in both industrial and domestic premises to wash cloths, equipment, installations, heavy-duty machines and vehicles. They are also useful in pesticide formulations for agricultural purposes and dispersing of spills at sea *(Lightowlers, 2004; Chun and You, 2009).*

However, the increasing domestic health hazards and environmental pollution arising from detergent exposure are reducing the popularity of its usefulness *(Ezemonye and Enuneku, 2005).* But most of the health hazards are caused by dearth of information on the toxicity of detergents which makes people to handle or dispose detergents carelessly. Therefore, a thorough investigation on the health risks and ecological disorders that may arise from improper handling and disposal of detergents needs to be done. This has become necessary because presently, there is no alternative to detergent *(Rejeki, Desrina, Mulyona 2006; and N.T de Oude 2013)*.

Worldwide, governments are making concerted efforts to keep environments free of pollutants through policies, environmental conferences and conventions. In Nigeria, Federal Government is emphasizing the needs for adequate human and environmental protections in any technological and socio economic development by strictly asking industrial operators to control the effects of their wastes *(DPR, 1991)*. But in Nigeria and other countries, only few chemicals have been ecologically tested for safety despite their alleged environmental and ecological impacts *(Ogundiran et al., 2010)*. There is no doubt that detergent exposure posed health risks to man and other animals but the doubt lies in what it actually does to them and how dangerous it really is *(Easy Essay, 2007).*

Although some researchers have described the effects of detergents on animals and plants, most of the works were done on the basis of spirometry or radiology, or both. An in-depth analysis of the effects of detergent exposure on different organs and systems in human or animal has not been published. Therefore, the present study was aimed at investigating the toxicity and general health problems that may arise from detergent exposure.

2.0 MATERIALS AND METHOLOGY

2.1.0 MATERIALS

2.1.1 REAGENTS

The following chemical reagents were used; Hydrochloric acid, Methylene blue indicator, Chloroform, Silver nitrate, Ammonia, distilled water, among others were; Sodium lauryl sulphate, Ferrous sulphate, Tetraoxosulphate, Sodium hydroxide, Sodium carbonate, palm kernel Oil, soda Ash, caustic Soda, and hydrogen peroxide as Lightening agent for production of soap detergent. Alternatively; Surfactants, optical brightener, phosphate, poly-carboxylates, dyes, fragrance can also be added.

2.1.2 APPARATUS

The following apparatus were used; Analytical balance, Beaker, Pipette, Conical flask, Stirrer, Test tube, PH indicator paper, Test tube holder, Spatula, bucket, stirrer, sterilized platinum wire, and measuring cylinder.

2.1.3 SAMPLE COLLECTION

Four detergents sample were used. Two were produced in the laboratory with different colourants and the other two were purchased randomly from Oje Market in Ede which was labelled A, B, C and D respectively.

2.1.4 SAMPLE PREPARATION AND TREATMENT

1 liter of palm kernel oil was poured into a ½ litre of Soda ash solution, and stirred. After which ½ litre of caustic soda was also added and continuously stirred. ¼ litre of Foam boaster was also added and 30ml of ammonia solution was added as a Preservative and drying agent. While, hydrogen peroxide was added as a lightening agent, and perfume was also added, the whole assemblage was stirred for about five minutes, and allowed to stand for about five hours for setting to take place. After which the mixture was dried. Two samples were produced, differentiated with their colors. After setting, the mixture was allowed to dry.

2.2 METHODOLOGY

2.2.1 RESEARCH DESIGN

The study was observational experimental design with invitro and invivo analysis carried out on the samples: two laboratory prepared samples, purchased Good Mama and So Easy detergents.

2.2.2 TOXICITY TEST

The aim of this test is to determine the toxic effect of the four samples (laboratory prepared detergent, Good mama and So easy detergents) on earthworms in 24 hours.

Procedure: 4 beakers were provided and labelled A, B, C and D respectively. 400ml of distilled water was poured into each of the beakers. 40g of each of the detergent samples, laboratory prepared detergent, Good mama and So Easy detergents, were measured and added to each of the beakers respectively. 3 prepared earthworms were cleaned, weight and measured. The 4 earthworms were transferred from their holding container with a sterilized platinum wire into each of the already prepared detergent solutions respectively. They were kept in the laboratory for 24 hours and all observations were recorded.

2.2.3 CARCINOGENICITY TEST

This test aimed at identifying the effect of each of the detergent samples; two laboratory prepared, Good Mama and So Easy detergents on human skin.

Procedure: 50g of each of the three samples, laboratory prepared detergent, Good Mama and So Easy detergents, were dissolved in 1 litre of water in three different containers. Hands were soaked by three volunteers into each of the solutions 3 times in a day for 15 minutes at 37°C over a period of 3 days. The effect of each solution on the hands of each volunteers were observed and recorded.

3.0 RESULTS AND DISCUSSION

3.1 RESULTS

Below were the results of the chemical analysis carried out on the samples.

3.1.1. TOXICITY TEST

Table 1: Effect of toxicity of sample A, B, C, and D on the Earthworm at high concentration

SAMPLES	PH	WEIGHT (g)		LENGTH(cm)		COLOUR	MORTALITY
		Before	After	Before	After		
A	10. 00	0.75	1.37	11	13	Change	1
B	10.00	0.60	0.71	5.5	6.5	Change	1
C	10.00	0.60	0.81	8.8	10	Change	1
D	10.00	0.55	0.67	8	10	Change	1

Key: A = Laboratory prepared detergent
B = Laboratory prepared detergent
C = Good Mama detergent
D = So Easy detergent

Table 2: Effect of toxicity of sample A, B, C, and D on the Earthworm at low concentration

SAMPLES	PH	WEIGHT (g)		LENGTH(cm)		COLOUR	MORTALITY
		Before	After	Before	After		
A	10. 00	0.75	0.75	11	11	No change	0
B	10.00	0.60	0.60	6.5	6.5	No change	0
C	11.00	0.60	0.60	8.8	8.8	No change	0
D	11.00	0.55	0.55	8	8	No change	0

Key: A = Laboratory prepared detergent
B = Laboratory prepared detergent
C = Good Mama detergent
D = So Easy detergent

3.1.2. CARCINOGENICITY TEST RESULTS

Table 3: Effects of Sample A, B, C and D on the skin of volunteer 1

SAMPLES	DAY 1	DAY 2	DAY 3
A	Dryness	Dryness, itching	Dryness and itching
B	Dryness	Dryness, itching	Dryness and itching
C	Dryness, itching	Dryness, itching	Dryness, itching and scaling
D	Dryness, itching	Dryness, itching	Dryness, itching and scaling

Table 4: Effects of Sample A, B, C and D on the skin of volunteer 2

SAMPLES	DAY 1	DAY 2	DAY 3
A	Dryness	Dryness, itching	Dryness and itching
B	Dryness	Dryness, itching	Dryness and itching
C	Dryness, itching	Dryness, itching	Dryness, itching and scaling
D	Dryness, itching	Dryness, itching	Dryness, itching and scaling

Table 5: Effects of Sample A, B, C and D on the skin of volunteer 3

SAMPLES	DAY 1	DAY 2	DAY 3
A	Dryness	Dryness, itching	Dryness and itching
B	Dryness	Dryness, itching	Dryness and itching
C	Dryness, itching	Dryness, itching	Dryness, itching and scaling
D	Dryness, itching	Dryness, itching	Dryness, itching and scaling

Table 6: Effects of Sample A, B, C and D on the skin of volunteer 4

SAMPLES	DAY 1	DAY 2	DAY 3
A	Dryness	Dryness, itching	Dryness and itching
B	Dryness	Dryness, itching	Dryness and itching
C	Dryness, itching	Dryness, itching	Dryness, itching and scaling
D	Dryness, itching	Dryness, itching	Dryness, itching and scaling

Key: The volunteers were 4 healthy students
A = Laboratory prepared detergent
B = Laboratory prepared detergent
C = Good Mama detergent
D = So Easy detergent

3.2. DISCUSSION

3.2.1 TOXICITY

From the results obtained, the detergents were found to be significantly detrimental to earthworms at higher concentrations. When different samples of detergent (laboratory prepared, Good Mama and So Easy) were administered to each of the beakers containing the earthworms, after 24 hours of observation, there were significant changes in the weight, length and color of vendrathe tested earthworms after exposure to each detergent solutions, which was in accordance with the work of Faremi *et, al* (2010).

The weight of the earthworms exposed to high concentration of sample A, B, C and D detergent decreased steadily. The sharp decrease in the weight of these earthworms revealed that high concentration of the detergent was detrimental to those worms and to every living organism at large. However, when exposed to low concentration of each detergent samples, there was no significant change in the morphological parameters like weight, length and color of the earthworms. Subsequently, death occurred at high concentration of the detergent

while at low concentration, no death was recorded, which was in accordance with the work of Faremi *et, al* (2010).

3.2.2 CARCINOGENICITY

In testing for the carcinogenicity of the samples, from table 3 to 6, the over exposure of human skin to those detergent samples results in dryness of hands of each volunteers in the three days of testing. It shown that these detergents contain toxic chemicals that can result in harmful health effect if exposed to the skin. However, the symptoms in the hands of each volunteers revealed the carcinogenicity effect of each samples. It was therefore imperative that careful handling and disposal of detergent should be ensured.

4.0 CONCLUSION AND RECOMMENDATION

4.1 CONCLUSION

The results of this research shown that the detergent was toxic to the exposed earthworms and have negative effect on human skin. It was presumed that all other living organisms including human will suffer similar fate as that of the earthworms if exposed to the detergent solution uncontrollably. Finally, it was hoped that the results of this investigation will enlighten people on the health risks posed by indiscriminate detergent exposure.

4.2 RECOMMENDATION

Ordinarily, a matured man will not ingest detergent except by accident but children especially infants, who are not conscious of their actions are the endangered population. Therefore, extra care should be taken to monitor the activities of these infants and they should not be left alone. Detergents should be kept out of reach of children and spilled detergent should be packed immediately. In addition, careful handling and disposal of detergent should be ensured and also lipases such as microbial lipase can be introduced to the detergent during production to reduce toxicity associated.

Another test which could have been of very great assistance to this work was chromatographic analysis of the samples which due to non-availability of the dye proacrytol yellow, the test could not be carried out. All attempts to get this dye from places like Lever brothers Plc and PZ Plc failed. A successful work on the project could lead one to the production of detergents of the best quality having determined the constituents.

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