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Determination of pH and Hydroquinone Concentration in Selected Bleaching Creams Used By Some Students Of Delta State University Abraka

Ovie Benedict Enivwenae

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Abstract: *The study was aimed at evaluating the pH and the concentration of hydroquinone in selected skin bleaching creams used by some students in Delta State University Abraka with a view to ascertaining their safety. Seven different bleaching cream samples obtained from the students were used for the experiment. The pH was determined using a calibrated pH meter while the concentration of the hydroquinone was detected using a UV spectrophotometer. From the results obtained, three samples; recorded pH of 4.11, 5.70 and 6.20 respectively which fell outside the pH range of the skin. However, the other four samples, BCS 1, BCS 3 BCS 5 and BCS 7 recorded pH of 5.30, 4.53, 5,20 and 4.90 respectively and fell within the pH range of the skin. The concentrations of hydroquinone in the seven samples analysed, ranged from 1.00% to 2.15% with only one of the samples, BCS 2. having a concentration of 2.15% that is above WHO regulation. However, two of the samples, BCS 1 and BCS 5 did not record any concentration of hydroquinone in them despite the fact that they were skin bleaching creams. While 86% of the bleaching creams analysed pose no safety threat concerning hydroquinone concentration, 43% of the bleaching creams pose safety concerns as they recorded pH outside the acid mantle (pH range of the human skin). It was therefore recommended that regulatory bodies should ensure that manufacturers adhere to standard practices.*

Keywords *- pH, Hydroquinone, Bleaching cream, Melanin, Acid mantle, Skin cancer*

Ovie Benedict Enivwenae
Department of Chemistry
Delta State University Abraka, Nigeria.
Email: ogheneovieben@gmail.com
Orcid id:

1.0 Introduction

Skin bleaching, sometimes referred to as skin whitening or skin lightening, is the process of employing chemicals to directly interfere with the skin's melanin production to lighten or produce an even skin tone (Mahe et al, 2005).

In the majority of societies worldwide, fairness is associated with grace, beauty, and high social standing. The majority of women are encouraged to bleach their skin because of this belief. In many places around the world, particularly in African nations, skin-lightening or bleaching has become widespread (Olusola et al, 2019; Mahe et al. 2005). Worldwide demand for skin-bleaching cosmetics is encouraging the manufacture of these goods (Celine, 2016).

By using skin care treatments that bleach the skin, many African women hope to maintain the beauty and tone of their skin. According to Olusola et al. (2019), the majority of these bleaching creams contain many dangerous substances that may be damaging to the user's health, including hydroquinone, mercury, kojic acid, and ascorbic acid.

Hydroquinone is one active chemical that is been used to lighten skin and treat hyperpigmentation but may be very carcinogenic. Hydroquinone does not bleach the skin literally, rather it goes straight to inhibit the synthesis of melanin, the black pigment. By inhibiting the production of melanin in the skin, the black pigment is eroded from the skin eventually, leaving the skin whitened. When applied topically, hydroquinone has the potential to pose major health risks if overused. Severe adverse consequences from hydroquinone toxicity include blood poisoning, kidney and liver damage, nausea, abdominal cramps,

convulsions, and even unconsciousness (Eric et al., 2006; Scissors, 2010).

The pH of the skin is altered by most bleaching lotions. Strong pH disturbances to the skin regularly can cause or exacerbate several issues, including several skin conditions. Studies have indicated that slight variations in the pH of the skin are transient. In about an hour, the skin naturally returns to its normal pH. However, using extremely acidic products (pH 2.5 or lower) or alkaline (pH 8 or higher) causes a more noticeable disturbance to the skin's pH, which makes it take longer for the skin to return to normal. For an extended period, skin is susceptible to conditions that might cause pimples, eczema symptoms, redness, and sensitivity. Hence, using products with pH values that are too high or too low on a regular basis causes skin damage that is noticeable and progressive (Monika-Hildegard et al. 2007; Bryan 2022).

Skin disfiguration arising from the use of body bleaching creams is common in society today. In a bid to make their products have quicker results and attract more customers, some manufacturers have made formulations with pH that have adverse effects on the skin. Others have exceeded the permissible limit of active chemical agents in their bleaching creams as against regulations.

The main objective of this research was therefore to evaluate the pH and the hydroquinone content of different bleaching creams used by some students of the Delta State University, Abraka with a view to ascertaining their compliance with existing regulations.

2.0 Materials and Methods

All chemicals used for the analysis were of analytical grade as purchased. The skin bleaching cream samples used were sourced from volunteered users at Delta State University, Abraka.

2.1 pH determination

The pH of the bleaching creams was determined electronically using a pH meter (Fisher Scientific). After standardization of the pH meter with standard buffer solutions (pH 4, pH 7 and pH 10), the pH of each of the cream samples was taken and recorded.

2.2 Hydroquinone determination

The hydroquinone concentration in the cream samples was determined by using the UV Spectrophotometer (Hach Spectrophotometer DR 6000) The absorbance of hydroquinone was taken at a wavelength of 294 nm for all samples (Siyaka. 2016)

2.3 Preparation of standard stock solution of hydroquinone

10mg of hydroquinone reference standard was weighed and transferred into a 100ml volumetric flask, 20ml of methanol was added and mixed for about 5 minutes before making up to 100ml with methanol, to give a standard stock solution (100µg/ml equivalent to 100mg/L) (Siyaka, 2016)

2.4. Preparation of working solutions of standard hydroquinone stock solution

Several concentrations of working solutions of hydroquinone (3, 8,10,12 and 15 mg/L) were prepared from the standard stock solution by diluting further with methanol. The volume of stock solution required for each concentration was calculated from the equation;

$C_1V_1 = C_2V_2$

where C_1 is the concentration of stock solution (mg/L), V_1 is the required volume of stock solution (unknown) C_2 is concentration of working solution (mg/L) andV_2 is the volume of working solution (ml)

2.5 Calibration curve of working solutions

The absorbance of the working solutions of hydroquinone was measured using the UV - Spectrophotometer. A calibration curve of the absorbance against the concentrations of working solutions was obtained (Appendix 1)

2.6 Determination of hydroquinone concentrations in cream samples

The absorbance of hydroquinone in each bleaching cream sample was measured using the UV - Spectrophotometer. The concentration of hydroquinone in the sample was then extrapolated from the calibration

curve of the working solutions with the absorbance obtained.

3.0 Results and Discussion

Table 4. shows the pH of the various bleaching cream samples analysed. The pH ranged from 4.11 to 6.20. BCS 2 recorded the lowest pH of 4.11 while BCS 6 recorded the highest pH of 6.20. The pH of the skin (acid mantle) is known to be slightly acidic, between pH 4.50 to pH 5.50 (Lambers, 2006; Schmid, 1995). This implies that body creams outside this range can cause damage to the skin (Adrienne, 2019). Two of the analysed samples, BCS 2 and BCS 3 recorded low pH of 4.11 and 4.53 respectively. However, the pH of BCS 2 falls below the pH range of the skin. BCS 4 and BCS 6 recorded pH of 5.70 and 6.20 respectively which on the other hand, are above the pH range of the skin. BCS 1, BCS 3, BCS 5 and BCS 7 recorded pH of 5.30, 4.53; 5.20 and 4.90 respectively and fall within the range of the pH of the skin (acid mantle).

Table 1: pH of bleaching cream samples

Bleaching Cream Sample (BCL)	pH
BCS 1	5.30
BCS 2	4.11
BCS 3	4.53
BCS 4	5.70
BCS 5	5.20
BCS 6	6.20
BCS 7	4.90

Table 2: Concentration of hydroquinone in leaching creams detected

Bleaching Cream Sample (BCS)	C (mg/L)	C (%)
BCS 1	0.00	none
BCS 2	10.75	2.15
BCS 3	6.80	1.36
BCS 4	3.85	0.77
BCS 5	0.00	none
BCS 6	4.90	0.98
BCH 7	9.60	1.92

The results of the concentrations of hydroquinone detected from the bleaching cream samples are shown in Table 4.04. The concentrations of hydroquinone in the samples ranged from 0.77% to 2.15% with BCS 4 recording the lowest percentage and BCS 2 recording the highest. The maximum percentage recommended by the World Health Organization, WHO, is 2% (WHO, 1996)). BCS 2 is the only sample analysed that is slightly above the WHO recommendation. All the other samples met the recommendation of the WHO on the concentration of hydroquinone in body creams. Hydroquinone is widely used in bleaching creams due to its ability to inhibit the production of melanin pigment in the skin which is responsible for the black colour of the skin (Hu, 2009) Hydroquinone is also a known carcinogenic compound (Scissors et al, 2010) Two of the creams analysed, BCS 1 and BCS 5 did not record any concentration of hydroquinone in them even though they are skin whitening creams. Apart from hydroquinone, there are still other agents used in bleaching creams to attain white skin (Germanò, 2012; Ko, 2014)

5.0 Conclusion

This research analysis was able to show the pH and concentration of hydroquinone in samples of some bleaching creams used by some students of the Delta State University, Abraka. From the analysis, it was observed that the pH of some of the creams was not within the range of the pH of the skin which is usually between 4.50 and 5.50. These creams can be implicated in skin burns and disfiguration arising from their uses.

This research analysis also indicated that all the selected cream samples are in line with WHO recommendations on the level of hydroquinone in bleaching creams except for one which was slightly high in hydroquinone. It was also seen that there were also some bleaching creams used by the students which do not contain hydroquinone as a bleaching agent.

6.0 Recommendations

Skin burn is one of the regular adverse effects of using bleaching creams which can be

attributed to very low pH or very high pH. It is therefore recommended that the pH of bleaching creams should be within the pH of the skin to avoid burns and other skin diseases.

Although about 87% of bleaching creams analysed pose no serious health concern in terms of the level of hydroquinone present, it should be of concern that the compound can accumulate in the body after prolonged usage which therefore can pose a health risk in the long run. It is therefore recommended that a limit should be given to the use of bleaching creams. Regulatory bodies such as NAFDAC should also ensure that the level of hydroquinone in bleaching creams does not exceed the recommended level. It is also recommended that further studies should be carried out on bleaching creams that do not contain hydroquinone as their bleaching agent to ascertain the bleaching agents available and to know if they meet standards.

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Compliance with Ethical Standards

Declarations:

The authors declare that they have no conflict of interest.

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Appendix I: Hydroquinone Standard Calibration curve (λ max = 293 nm)