

Production and Investigation of the Properties of Non-Disposable Diaper in Comparison with Disposable Diapers

*Alebiosu, S. O., Akindiya, I. O., Adekeye, T. O., Muhammed-Raji, A., Oseghale, H. E.

Department of Polymer & Textile, Yaba College of Technology, Lagos, Nigeria.

*Corresponding author: bunmibisu@yahoo.com

ABSTRACT

This research work produced a reusable diaper and compared its properties, especially absorbency with selected commercial disposable diapers in Nigeria market. The absorbency of two reputable commercial disposable diapers A and B in Nigeria were compared with the reusable diaper C. Absorbency test was carried out in action and also in a saline solution. The result shows that all the diapers have good absorbency. Diaper A has the highest absorbency of see fig.1 which was closely followed by diaper B with 86.00% while diaper C has absorbency of see Fig.1. Though diaper C has see fig.1 percentage absorbance, it is relatively close to those of A and B, thus, compares favourably given that it is not a onetime use diaper. The dimensional stability of the reusable diaper C was found to be excellent with no obvious shrinkage after three washes. Again, from the economic view point, the reusable diaper is cheaper on the long run when the cost of its production was compared to the prevailing market price of all the commercial disposable diapers.

Key words: Production, Investigation, Diaper, Disposable, Reusable, Properties.

INTRODUCTION

Diapers are underwear in which the wearer can urinate or defecate into when the wearer is unable to use the toilet. It has the ability to retain the waste for a little while before discomfort sets in, diaper can be used by infant, children and incontinent adult. Cloth diapers are reusable diaper [1]. Diapers are underwear of polymeric materials been worn by infants, children and incontinent adults in which the wearer can defecate or urinate into it in the absence of toilet; more so, when the wearer cannot control waste disposal mechanism at will [2].

Inability to replace a used diaper regularly may lead to skin diseases in the area in which the diaper covers. Cloth diapers can be found in many different styles and fabrics [3], basically waterproof (plastic material), diaper cover (or shell) and an inner absorbent material [4]. Proponents of cloth diapering cite challenge of environmental friendliness and baby health [5] of disposable diaper as reasons for their usage. Disposable diapers are more harmful because they create enormous amount of trash [6]. They are being produced or treated with chemicals that enhance absorbency and are been disposed after usage [7,8]. Pants made of polymeric material are been used as cover diaper to minimize leakage of waste if over full [9]. The cost of disposable diapers, depend on how well a child or user is potty-trained.

The reusability of cloth diapers also means one can clean them and use afterwards. It can also be transferred to another user in turn, increases savings [10]. For decades, the disposable diaper has been in use. In recent time, these disposable diapers have become very expensive due to recession in the economy and not affordable by low income earners. The numerous disadvantages of disposable diaper viz-a-viz higher environmental cost which arise from significant consumption of natural raw materials, energy usage, health challenge, environmental pollution (majorly air and water) and their disposal after usage contributes a lot of hazard because they are not easily decomposed been made of synthetic material. This necessitated this research.

These issues raise concern and call for the production of alternatives that can take care of the problems generated by the use of disposable diapers. [11] and [12] reported negligent disposal of soiled disposable diapers which is associated with environmental health challenges [13]. The prevalence of disposable diapers in dumpsite attest to this assertion. According to [14] and [15], disposed diapers when buried will eventually mix with underground water and this is dangerous to human health. This research work produces a reusable diaper that may be a good alternative to disposable diaper by taking care of most of the problems identified with disposable diapers. In this research work, a cloth diaper that can compete with the disposable diaper in terms of

absorbency, cost and contain less chemical was produced, the absorbency of the diaper produced examined and a field test carried out in other to assess its comfortability.

MATERIALS AND METHODS

Materials

Chip board, Pre-fold, Velour, Polyester fabric, Water proof cover, Elastic, Plaster, Absorbent pad, Diaper, Saline solution (NaCl in water), Water (1ltr), Salt (0.9 gram) and (9 gram), Sewing Machine: butterfly product, (Made in China), Stop watch, Beaker, Cloth pin, Weighing balance.

Methods

With the aid of a chip board paper, a pattern was drafted using a dimension according to the size wanted and during drafting, there was no seam allowance, after which the pattern was cut out. The pattern was laid on the material to be used, such as the pre-fold, velour, polyester material, water proof cover, suede cloth, after which it was traced out and cut. After cutting the material out, the pre-fold was first joined with the velour placing the absorbent pad at the center and then sewed them together. The suede cloth material was then sewed to cover the surface of the velour. The polyester material (decorative print) was then placed on the surface of the suede cloth with elastic and sewed on both sides (left and right). After which the fabric was turned in order for the decorative print to be at the back of the diaper. Finally, the plaster was added at both ends; at the top (the waist of the diaper) and joined all ends together by sewing to complete the making of the cloth diaper.

Absorbency Test

Some quantity of saline solution was prepared using Sodium Chloride at 0.9 g per litre solution or 0.9 % solution per litre solution, and stimulated the minerals in baby's urine the weighted dry sample of reusable diaper was immersed (lying flat) into the saline solution in a container and allowed to stay for average of 10 minutes. The diaper was withdrawn from the solution and allowed to drip (placed vertical) for an average of 2 minutes to allow excess solution to drip-off and the final weight was taken. The best diaper for the performance attribute will be the one with the highest absorbent capacity.

The procedure above was repeated for all the samples. This was carried out five times and the averages were recorded.

RESULTS AND DISCUSSION

Test for Diaper Performance (Comfortability test)

The non-disposable diaper was tested on 3 babies during the day and over the night, to assess the degree of comfortability. The baby was seen to be comfortable during the day and all through the night. It was also observed that there was no form of rashes on the baby's skin after use all through the night and day.

Dimensional stability test

Table 1: Dimension of diaper before and after use

MEASUREMENT	LENGTH OF DIAPERS (cm)	BREATH OF DIAPER (cm)
Before 1 st use	28	27
After 1 st use	28	27
Before 2 nd use	28	27
After 2 nd use	28	27
Before 3 rd use	28	27
After 3 rd use	28	27

Table 1: Shows the result of diaper measurement before use for the first, second and third time and there was no change in dimension.

Cleaning with detergent, antiseptic and bleaching agent

After the first usage of the diaper, it was washed with a detergent, no colour change was observed in the diaper. After the second use, the diaper was washed with water containing antiseptic (brand: Dettol), also no colour change was observed in the diaper after the second washing and the dimensional stability was the same. After the third use, the diaper was washed with water containing bleaching agent (H_2O_2), there was a slight change in colour but there was no change in the dimensional stability.

Table 2 shows the result of the diaper with the highest amount of liquid absorbed. The sample C has a weight difference of 244.5g having absorbed the highest amount of saline solution. The diaper that absorbed least is the sample D with differential weight of 163.33g. This can be compared with the least absorbed disposable diaper sample A with differential weight of 185.53g. Standard procedures were followed by ensuring that the correct measurement of saline solution was used. Also, accurate weight measurements were taken.

Table 2: Percentage swell of reusable (Sample D: Non-disposable diaper) and disposable diaper (Samples A, B and C: commercial disposable diaper)

DIAPER TYPES	INITIAL WEIGHT (DRY WEIGHT) (g)	FINAL WEIGHT (WET WEIGHT) (g)	WEIGHT DIFFERENCE (FINAL -INITIAL) (g)	SWELLING (%)
A	30.07	215.6	185.53	86.05
B	34.74	249	214.26	86.04
C	34.30	278.8	244.5	87.69
D	39.17	202.5	163.33	80.65

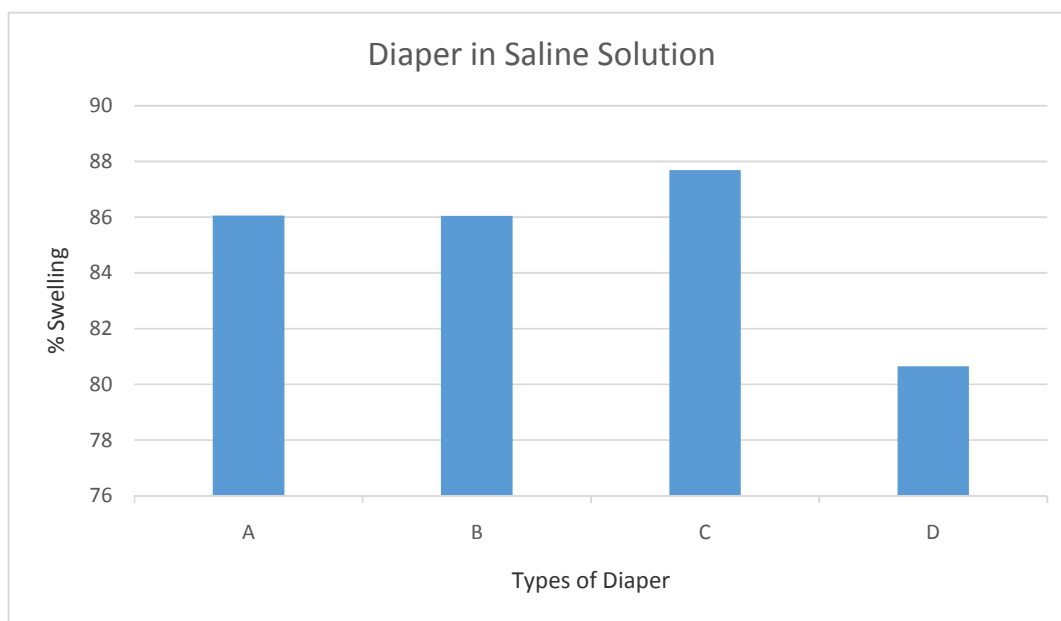


Figure 1: Comparative analysis of the swelling rate of non-disposable diaper (Sample D) with selected commercial disposable diaper (Sample A, B, & C).

Figure 1 shows that sample A and B has 86.05 and 86.04 percentage swelling respectively, the small difference in their % swelling can be attributed to similarity in their construction. Also, sample C and D has 87.69 and 80.65 percentage swelling respectively. As shown in **Figure 1**, sample D has the lowest swelling rate and this is good for comfortability because the higher the swelling rate the lower the comfortability of the diaper on the user.

CONCLUSION

At the end of this research, it was discovered that, reusable cloth diaper has similar absorbency to that of the selected commercial disposable diaper. The tests conducted include the absorbency test carried out while in use and also using a saline solution. It was also observed that the disposable diaper (sample C) has more absorbent power than that of the cloth reusable (sample D). Absorbency test also shows that the cloth diaper has similar absorbency to that of disposable diaper (sample A). In order words, the cloth diaper has an

advantage over the disposable diaper which account for their similarity in absorption with some type of disposable diaper, also no chemicals were used in the production of cloth diaper unlike those of the disposable diapers therefore it causes no harm to human health.

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