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# Hygienic, affordable and environmentally friendly water packaging container

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## Abstract

Disposable plastic drink containers are a major global environmental problem. In many countries, Coca-Cola and other drinks are packaged in non-disposable glass bottles. Consumers of these drinks return the bottles to the retailers, which are cleaned at the production factory and reused to package drinks. This method of packaging does not pollute the environment. However it could endanger consumers' health because even the most effective cleaning machine may not always eliminate germs and other contaminants from all cleaned bottles. This danger cannot be over-emphasized in countries where numerous companies produce drinks such as water and standard enforcement agencies are not well resourced to effectively monitor them. Thus disposable containers are hygienic but not friendly to the environment and non-disposable containers are environmentally friendly but not so hygienic. This paper describes a novel container for packaging water which is both hygienic and environmentally friendly. The idea proposes packaging water in a disposable polyethylene bag which is tightly attached to a non-disposable stand. Because the stand is not disposable, a consumer must return the empty container (empty bag attached to the stand) to the seller after drinking the water. Subsequently, the empty bags (wastes) are removed at the water factory and replaced with new bags for repackaging of water. In this way the wastes are economically accumulated in a clean and homogeneous state for recycling. The innovation provides consumers the health benefits of drinking in a disposable container and curbs littering.

**Keywords:** Disposable bag, Non-disposable stand, Recycling, Wastes, Water, Packaging

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## **1. Introduction**

One major environmental problem in the world is pollution from plastic wastes. In Ghana, drains constructed with scarce resources usually get choked by such wastes. This contributes to floods with attendant loss of lives and property. Stagnant water in choked drains breed mosquito, which causes malaria. Moore et al. (2001) estimated that approximately 106 million plastic debris weighing 12 metric tons occur on the Orange County beaches in USA. A large number of marine species are killed or harmed by plastic debris each year (Jose, 2002; Moore, 2008) and the livelihood of millions of fishermen is under threat due to destruction of river bodies by these debris (Nash, 1992).

Disposable water containers pollute the environment heavily. The main disposable containers used in packaging drinking water are polyethylene bags (water sachets), pouches and plastic bottles. Sachet is made of thin polyethylene material, and it is the cheapest water packaging container. Because they are cheap, sachets are the predominant water packaging containers in low and middle income countries. Because sachet is made of thin and flexible material, it collapses easily. Therefore the water in it often spills out if it is opened and placed down. For this and other reasons sachet water is seldom served at formal meetings and functions.

Plastic bottles and pouches on the other hand can stand upright because the containers are relatively thick, but because of the thickness they are relatively expensive. Another problem with plastic bottles is that they are voluminous, therefore their transportation cost is high; and they swell up the volume of domestic wastes. Out of about 29 billion plastic bottles used in packaging water in USA annually, only 30% is recycled. The rest end up in landfills and other parts of the environment (Fox, 2011). Because of environmental pollution by the bottles, some states and institutions in the advanced countries have banned or threatened to ban bottled water (Locker, 2013; Richard, 2013; Daily mail, 2009). And out of the about 5 trillion polyethylene bags that are used per annum in the world; only 1% is recycled (Burtinshaw, 2011; Eco Solutions, 2008). The rest end up in landfills and other parts of the environment. Pollution by water sachet is so massive in some countries that decision makers have threatened to ban sachet water (Citifmonline, 2011; Nkechi, 2011).

One major reason for low recycling of polyethylene wastes is that a chunk of the wastes is littered on the environment and the rest is mixed up with other wastes. Since polyethylene developed from virgin raw materials is very cheap, it is not very economical to collect and clean littered wastes for recycling. The need for an effective and economical strategy to salvage polyethylene wastes for recycling cannot be over-emphasized.

In many countries, Coca-cola and other drinks are packaged in non-disposable glass bottles. Consumers of these drinks return the bottles to retailers, which undergo a cycle of cleaning and reuse several times. This method of packaging is environmentally friendly, but can endanger human health because even the most effective cleaning machine may not always eliminate germs and other contaminants from all cleaned bottles. This danger cannot be overemphasized in countries where numerous companies produce drinks such as water and standard enforcement agencies are not well resourced to effectively monitor them. Thus disposable containers are hygienic but not environmentally friendly, and non-disposable containers are

environmentally friendly but not so hygienic. This paper describes a novel water packaging container, which is hygienic, environmentally friendly and affordable.

## 2. Description of the medium

The idea proposes packaging water in a thin disposable polyethylene bag, which is attached to a non-disposable stand, and the used bag is replaced with a new bag each time water is repackaged.

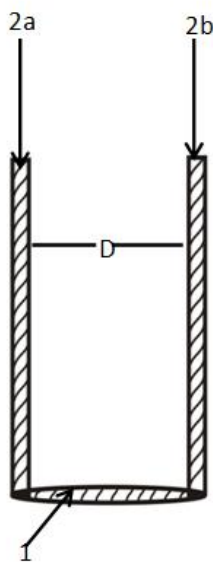


Figure 1. Non-disposable stand

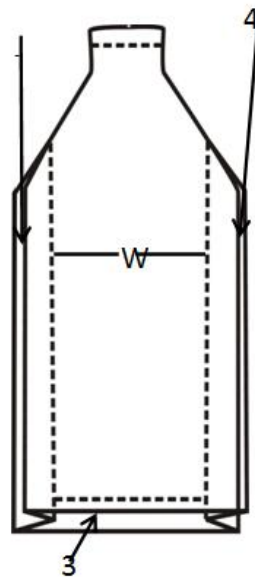


Figure 2. disposable

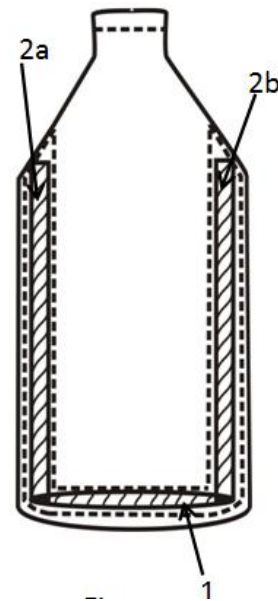


Figure 3. disposable bag fixed onto the non-disposable stand

Referring to Figure 1, the non-disposable stand has a base 1, and a pair of arms 2a and 2b located at the extreme ends of the base. The stand is made of a durable non-rust material such as plastic. The bag, just like any other bag has a base 3 and two longitudinal edges 4a and 4b as shown in Figure 2. The two longitudinal edges and the base of the bag have flaps (gussets) to accommodate the pair of arms and the base of the non-disposable stand respectively. The bag is made of a thin, transparent and flexible polyethylene material just like the normal water sachet. The base of the stand is a plate, shaped to fit the base of the bag when the bag is filled with water. The pair of arms may be flat or rounded and the distance (D) between the pair of arms is slightly less than the width (W) of the bag. Furthermore, the length of the arms is slightly shorter than the length of the bag.

The bag is fixed onto the stand by sealing along the dotted line as shown in Figure 3. Thus the stand is completely covered by the bag, and the bag is tightly held between the pair of arms. With this arrangement,

the bag will leak if it is removed from the stand. This is to prevent any consumer from removing bagged water from the stand. The water must therefore be drunk whilst the bag is on the stand. After drinking the water, the bag remains attached to the stand and it is removed at the water factory and replaced with new bag for repackaging of water. The non-disposable stand may require no cleaning or disinfection whatsoever, since it is completely covered by the bag and therefore not exposed to the user or the external environment.

## 2.1. Appearance of the novel pack of water

Plate 1 is a prototype of the stand and the novel pack of water. The prototype is very crude because appropriate facilities were not available to develop the product to be as attractive as possible. Although water is packaged in light polyethylene bag, the novel pack of water can stand just like bottled water because of the non-disposable stand (see Plate 1). It is expected that a firm with the state of art facility can redesign the stand and bag to produce a pack of water which is as attractive as bottled water.



**Plate1.** Prototype of the non-disposable stand (left) and the novel pack of water (right). It is believed that a firm with state of art facilities can redesign this product to become as attractive as pouch or bottled water.

## 2.2. Pricing

In Ghana currently, the costs of 500 ml of sachet and plastic bottled water are about 5 and 30 cents (US) respectively. The price of the novel pack of water will be determined mainly by the costs of the non-disposable stand, the disposable bag and handling costs. The non-disposable stand is expected to cost about 50 cents and it is expected to be used at least 500 times before it may be discarded. Thus the cost of the stand per usage is about 0.0005 cents which is very insignificant. Transportation costs will be minimal because the same vehicle that distributes water will return the empty containers to the water factory. And the accumulated waste could be sold to recycling companies to defray the handling costs. The disposable bag will

be similar to the normal water sachet. It is therefore expected that the price of the novel pack of water will be similar to that of sachet water which is 5 cents per 500 ml pack of water.

### 2.3. Advantages of the non-disposable stand

- It will help increase the monetary value of wastes of the novel packaging container. The prices of waste of normal water sachet and the novel pack of water are about 1 cent and 51 cents respectively. Thus waste of the novel water pack is 2,600 % more valuable than normal water sachet. Wastes that are of high monetary value are less likely to be littered.
- It will make wastes of the novel packaging container useful and non-disposable. Wastes of normal water sachets are disposable, and people dispose them poorly resulting in massive pollution. In contrast, Coca cola bottles are not disposable, and they are not littered. Similarly no one is expected to litter the novel packaging container, if it is known that it is not disposable.
- It will make the novel pack of water stable and appear like bottled water although water will be packaged in a thin polyethylene bag.

## 3. Discussion

### 3.1. Condition of sale

At current market conditions in Ghana, a consumer can pay 5cents and drink 500 ml of the novel pack of water and return the empty container to the seller. But to take the pack from the sales point he or she must in addition to the cost of water, deposit about 50 cents (to cover the cost of the stand) and return the empty container for the deposit. Otherwise the deposit is used to pay anyone that returns the empty container. After sales, the empty containers are sent to the water factory where the used bags are replaced with new ones for repackaging of water. In this way the wastes can be effectively and economically accumulated in a clean and homogeneous state at the water factory for recycling. Thus the innovation provides consumers the health benefit of drinking in a disposable container but not the liberty to pollute the environment. This condition of sale is successfully used to market drinks in non-disposable glass bottles such as Coca-cola, Guinness and Beer in many countries.

### 3.2. Container deposit legislation

Australia, Germany, Denmark and other countries have laws called the container deposit legislation, in which drinks are sold under conditions described above. Under the law, the cost of drinks includes a cash deposit, which is refunded to whoever returns the empty container to the seller or an authorized redemption centre. The law increases the monetary value of drink containers, and therefore discourages littering. Results of a study showed that in South Australia, the law has reduced littering by 97% (Environment Info, 2012).

In Ghana today, people who collect wastes of water sachets for recycling are paid about 1 cent per sachet, which is not enough to encourage collection. If a similar law was in place, a buyer would in addition to the cost of water, deposit say 50 cents before a bag of water is taken from the sales point, and the deposit is refunded upon returning the used sachet. This can discourage littering since few (if any) people could afford to lose 50 cents anytime they drink water. And if a sachet is littered, anyone that returned it is paid 50 cents, which is extremely attractive: 2,500% more than is currently paid.

A major drawback of the container deposit legislation is that the price hike of the containers (wastes) is artificial, and any artificial increase in price of a commodity is subject to abuse. For example if by law anyone that returns water sachet waste is paid 50 cents, fraudulent people could disfigure new sachets (which cost only about 2 cents and is easy to make) and sell them as wastes. That will be 10 times more profitable than producing sachet water. This abuse is not possible with the novel pack of water because the deposit will cover the actual price of the stand.

Furthermore, the container deposit legislation will not work in countries where law abiding is low. Retailers have nothing to gain by insisting on the deposit therefore those that are not law abiding could allow their customers to take drinks away without the deposit. However, the non-disposable stands are required for sustained production of water, therefore producers of the novel pack of water will ensure that retailers returned them. Thus the novel pack of water is a practical manifestation of the container deposit legislation.

### 3.3. Limitations of the novel pack of water and target group

Some people have argued that the novel pack of water is not a feasible technology because of the condition of sale could inconvenience some consumers. The response is that, every technology has a limitation; and no technology works for everybody in all situations. Therefore if attention is focused only on conditions under which a technology would not work, every technology would appear to be impractical. For example, plastic bottled water is not affordable to majority of people in low income countries. If attention is focused only on the poor, it will appear that this water would not be economically feasible to produce in these countries but it is. Some people patronize it in the midst of poverty. Certainly drinking and returning the empty containers could be a limitation under certain situations but that does not make the technology unfeasible. Coca cola and other drinks are successfully sold under similar conditions in many countries. And in the past, all drinking water was sold in non-disposable cups in Ghana. At that time, consumers drunk water on the spot, and returned the cups to the sellers, which were used to serve other consumers. The practice was banned because of health reasons. These indicate that the condition of sale of the novel pack of water is feasible.

There are two groups of buyers of sachet water. The first group are thirsty people, who drink in public places soon after purchasing water. Virtually all the water sachets that are littered on the streets, lorry stations and gutters are from this group. It takes a few seconds to drink water; therefore it should not be a problem for them to drink the novel pack of water and return the containers. That could greatly reduce the litter of sachets on the environment. The other group take the water away and drink at home or at functions. Such people can deposit cash or negotiate with sellers of the novel pack of water and return the empty containers later as consumers of Coca cola do. Some consumers of Coca cola own bottles which they



exchange anytime they buy drinks. The same can be done for the novel pack of water. Furthermore it is a normal practice for people attending meetings, funerals and other functions to drink water and leave the containers at the meeting grounds.

Some people believe that human beings cannot survive without the environment; therefore everything must be done to keep it clean for this and future generations. Such people will patronize this and other environmentally friendly innovations. It must be noted that no country can be kept clean without the citizens paying a price. In order to use a waste bin, a person must keep waste in the hand until a waste bin is found, and then he or she must walk to the bin, open it and drop the waste inside. That could be more time consuming and inconvenient than drinking and leaving the container at the sale point.

In order to keep the environment clean, some cities and states have banned bottled water. These include Bandanoo, Australia (The Guardian, 2009) and Massachusetts, USA (Environment 2013). Certainly the ban would create more problems and inconveniences than drinking and returning containers. An obvious reason why there has not been widespread ban of sachet and bottled water is that there is no pack of water, which is environmentally friendly, hygienic and affordable. The novel pack of water fills the gap. Therefore if it introduced onto the market, many countries are likely to adopt it.

The importance of the novel pack of water will be appreciated more in future. Currently some countries are facing serious challenges in getting landfill sites to dump wastes. As population escalates, waste generation will increase proportionately. Productive use of wastes will therefore be the only practical waste management strategy in future, and this will require innovations that effectively and economically salvage wastes.

#### **4. Conclusion**

The novel pack of water will be hygienic because water will be packaged in a disposable bag. It can effectively compete with sachet water because it will sell at the same price but the novel pack of water will be as attractive and presentable as plastic bottled water. It could attract consumer of bottled water, because it will be about 10 times cheaper. Additionally the novel pack of water will be environmentally friendly. The innovation shifts the cost of collecting wastes from the state to consumers. Therefore monies that otherwise are used to collect wastes could be used to implement useful developmental projects. The following are the steps needed to introduce the novel water pack onto the market:

- Design of the non-disposable stand and bag by a competent product designer to produce a product which is as attractive as possible.
- Development of a mould for industrial production of the stands and bags.
- Development of a machine for attachment of the bags onto the stands.
- Development of a machine for removal of the bags from the stands.
- Development of machine for packaging water into the novel container.

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