International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Rethinking Shampoo Packaging: A Study of Portability, Convenience and Modular Design

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ABSTRACT

Shampoo is a weekly staple of most people's beauty routine, but the bottle it comes in has remained pretty much the same throughout the years. Whilst the standard shampoo bottle is great for at home use, once you're on the road it's not a great asset. Most bottles are far too big for the average traveller who only needs a few washes on the move, leaving them with the conundrum of either taking up valuable suitcase space with a full size bottle or squeezing their shampoo into a smaller travel appropriate one. The latter presents its own issues with the potential for leakage, losing the cap, and unnecessary use of additional travel packaging.

This paper explores ways to improve shampoo packaging by reviewing existing research on containers, refillable systems, consumer behaviour, dispensing mechanisms, hygiene concerns, and the specific needs of travellers. Studies show that many shampoo bottles use more plastic than necessary, and that bottle design itself can influence how much product people actually use. Research on the refill and dispensing systems proves that convenience and usability are the main influencing factors for the customers, followed by such parameters as the cost, cleanliness, product quality, and the required effort for the operation.

With the target audience in mind, the proposed shampoo bottle comprises a combined 250 ml and 20 ml system: the former is a regular-sized bottle, while the latter is an additional detachable part at the bottom of the primary one. It satisfies the customer's need for a product to take everywhere, while the 20 ml portion can be used as a travel size, detached from the main bottle. Additionally, the cap of the dispensing system can be placed on the magnetic pad at the bottom of the travel-size portion to ensure its secure storage.

Current study aims to illustrate the relevance of the previous research, rather than provide conclusive data. Therefore, the example above merely demonstrates the idea that could be developed into a prototype for further testing and improving the product.

Keywords: Shampoo packaging, modular packaging, travel packaging, detachable pod, refillable packaging, consumer behaviour, convenience, product design, magnetic cap.

INTRODUCTION

Packaging plays a major role in the presentation of any personal care product. Firstly, the package protects and facilitates the use of the contained product and, secondly, it becomes an integral part of the product consumption experience. Shampoo, being a frequently used product, is a perfect example of the packaging importance: the bottle with the product is handled as often as the product itself. While the functional requirements to the shampoo packaging are minimal and purely focused on the storage and transportation of the product, the aesthetic appeal of the shampoo packaging plays a major role in the consumer choice

and brand building. When outside the home, the shampoo packaging, while being a necessary evil, has to fulfil additional requirements of convenient transportation and storage which it is not suited for. A typical 500 ml shampoo bottle, while convenient at home where the product is stored in the bathtub, becomes an undeserved burden to a traveller who only needs about 30 ml of shampoo for a week-long journey. The most obvious solution to the problem is a separate travel bottle, but such an approach requires additional effort from the consumer who has to fill the new packaging, store it and clean it after use. Moreover, there is always a risk of losing the small bottle or forgetting to bring it during a trip. One of the biggest concerns regarding toiletries during travel is the liquid spillage due to improper packing and transportation. The initial research for this project was aimed at finding inspiration and ideas for the development of a new packaging concept which would introduce a seamless and intuitive refilling experience.

The review of the existing literature and scientific articles on the topic of toiletries packaging provides an insight into the possibilities of the shampoo packaging in particular. According to the case describing the study of the rigid toiletries packaging, shampoo bottles were found to be largely oversized and used an assortment of plastics which made recycling challenging. Meanwhile, the same case suggests that the toiletries product packaging has to be both convenient for the consumer and fit for the end-of-life processing. Research into the refillable pouches suggested that consumers were to prefer a simple, intuitive, quick-to-use and versatile system which would suit their regular toiletries consumption patterns.

Research Objectives

- To identify the shortcomings of the traditional shampoo bottle design related to the travel and/or portability needs.
- To conduct a literature review on cosmetics packaging, refillable systems, dispensing, hygiene, and consumer behaviour related to the modular packaging concept.
- To come up with an idea for a modular shampoo bottle consisting of a 250 ml main compartment, a 20 ml travelling pod, and a magnetic pod cap as a solution to the problem described above.
- To assess the proposed solution in terms of convenience, hygiene, leaking risks, and consumer receptiveness based on the findings of the review.
- To determine the scope of prototyping and testing necessary for the proposed concept before its launch.

Scope and Approach

The present study consists of secondary research data only, as there was no opportunity to conduct user testing and/or prototype development. Instead, the focus of this literature review was on the design of cosmetic packaging, refillable systems, dispensing, product hygiene, and consumer behaviour to determine the feasibility of the proposed modular shampoo packaging, define the directions for future prototype development, and conduct an assessment of the idea based on the critical factors.

Review of literature

The findings of the previous research on cosmetics packaging are essential in the present study, as they highlight the current needs and directions of development in the field. According to Vazquez, Castillo, and Barbosa (2022), most commercial toiletries and cosmetics packaging "is oversized and uses excessive material, resulting in higher environmental impact and poor consumer experience."

Gomez-Berrada et al. (2017) demonstrated that container type and dispensing method can influence how much product people use, while Lofthouse, Bhamra and Trimingham (2009) identified convenience as a key factor shaping attitudes toward refillable packaging. Studies using life cycle assessment, such as Okada et al. (2021) and Rathore, Schuler and Park (2023), suggest that refill-based systems can reduce

environmental impact, though this depends on the specific dispensing system used. On the behavioural side, Kazançoğlu, Köse and Arslan (2024) and Miao, Magnier and Mugge (2024) found that awareness, price, quality concerns and fear of contamination remain barriers to adopting refillable or reusable packaging, while Zdonek and Jaworska (2024), Barreto et al. (2025) and Lakhan and Ng (2025) show that ease of use and cleanliness strongly shape user perception, and that favourable attitudes do not always translate into actual use. Finally, Devlieghere et al. (2015) highlighted that different dispensing and closure systems vary in their ability to protect products from microbial contamination, which is directly relevant to a detachable travel pod. Together, this literature indicates that convenience, hygiene and simplicity are more decisive for adoption than sustainability benefits alone, and that no existing study addresses a single bottle combining a full-size compartment with a separable travel-sized pod and integrated cap storage — the gap this research aims to address.

UNDERSTANDING THE PROBLEM WITH CONVENTIONAL SHAMPOO BOTTLES

The conventional shampoo bottle is designed around one main purpose: storing and dispensing shampoo. This works well for normal home use, but the same design becomes less practical when the product needs to be carried. One major issue is **size**. The user may need only 10 ml of shampoo for a short trip but may still have to carry a bottle containing hundreds of millilitres. Another issue is **flexibility**. A conventional bottle usually provides only one fixed storage option. The user cannot easily separate a smaller amount from the main product.

A study by Vazquez, Castillo and Barbosa (2022) examined 12 commercial toiletry bottles and found that many were oversized and used more plastic than necessary. The researchers suggested reducing unnecessary material and simplifying the materials used in the packaging. This does not mean that every shampoo bottle is poorly designed. Rather, it shows that there is room to rethink how much packaging is actually needed for different situations. A separate travel bottle is a simple answer, but it creates another object that needs to be filled, carried, cleaned and stored. This led to a different design question:

Can the travel container be made a part of the main shampoo bottle itself?

This question became the starting point for the modular bottle concept.

RESEARCH METHODOLOGY

This research relied primarily on secondary sources. Academic papers on shampoo packaging, cosmetic containers, refillable packaging, consumer behaviour, dispensing systems, and hygiene were reviewed and organized around five key areas:

1. Problems with conventional shampoo packaging
2. Convenience and ease of use
3. Refillable and reusable packaging
4. Consumer behaviour and acceptance
5. Dispensing, leakage, and hygiene

Literature on cosmetic containers provided insight into how packaging design influences product use, while studies on refillable packaging helped identify the factors that encourage or discourage adoption of new systems. Research on dispensing mechanisms and product protection was also reviewed, given that the proposed design introduces a detachable compartment along with an additional closure point.

PACKAGING AND CONVENIENCE

Convenience is an important part of good packaging. A product can have an interesting mechanism or sustainable idea, but if it makes everyday use difficult, people may not want to use it. Research supports this idea. Gomez-Berrada et al. (2017) studied 221 adults and compared different cosmetic containers. Their research found that the type of container could affect how much product people used. This shows that the container is not just an outer covering. Its shape and dispensing method can influence the user's interaction with the product. Research on refillable packaging also found that people respond better to systems that are quick, easy and less bulky. Lofthouse et al. (2009) found that convenience was one of the important factors affecting people's opinions about refillable packaging. This is directly related to the proposed shampoo bottle. The travel feature should not create a complicated process. The user should be able to understand the pod quickly and remove it without having to learn a completely new system. The basic idea is therefore simple: Use the full bottle at home. Remove the small pod when travelling. This makes the additional travel function part of the product instead of making it a separate accessory.

REFILLABLE AND REUSABLE PACKAGING

Refillable and reusable packaging has received increasing attention because it can help reduce the amount of packaging discarded after use. Shampoo is an interesting product for this type of system because it is purchased and used regularly.Okada et al. (2021) compared different shampoo packaging models using life cycle assessment. Their research found that refill and replace systems could reduce environmental impacts compared with the conventional bottle model in the situations they studied. However, refillable packaging is not automatically successful just because it is better for the environment. The proposed design follows this idea. It does not ask the user to completely change their normal shampoo routine. Instead, it adds a smaller travel option to the bottle they already use. The environmental benefit of the concept would still need to be tested. The extra material and manufacturing required for the modular structure could affect the overall impact. Therefore, the design should be considered as having potential.

CONSUMER BEHAVIOUR

People do not always choose products only because they are environmentally friendly. Convenience, price, quality and effort often influence their final decision. This can be seen in research on refillable packaging. Consumers may support the idea of reuse but avoid a system if it requires too much extra work. Kazançoğlu et al. (2024), for example, identified several barriers to refillable cosmetics, including lack of awareness, price concerns, quality concerns and practical difficulties. Research by Miao, Magnier and Mugge (2024) also found that reusable packaging could create positive responses, but consumers had concerns about contamination, complexity and product performance. This is important for the proposed bottle because the modular system should remain simple.

The user should not have to:

- Buy a separate travel container.
- Transfer shampoo before every trip.
- Search for a separate cap.
- Carry unnecessary packaging.
- Learn a complicated mechanism.

Instead, the travel functionality should be integrated into the existing bottle. This implies that a well-designed modular product should not only allow additional functionalities to be added, but also facilitate

the user's routine in day-to-day life.

TRAVEL AND PORTABILITY

Travel is where the need for a smaller shampoo container is most apparent. Whereas a 250 ml bottle is perfectly at home in the daily beauty routine, transporting the entire quantity on a short trip is rarely a good idea, as only a fraction of it will be used, while the remainder must be taken along nonetheless.

The suggested design solves this problem by integrating a 20 ml, detachable pod at the bottom of the bottle, which creates two modes of operation:

At home: the full 250 ml are used as before

While travelling: the 20 ml pod is detached and can be transported separately

In essence, this creates a dual-purpose product, which allows the user to choose between a smaller and a larger capacity depending on the situation. Most importantly, there is no need to decant the shampoo into a separate travel-sized container, as the detachable pod is already lightweight and convenient to bring along.

It is worth noting that the proposed solution does not merely address the need for a reduced capacity by introducing a smaller bottle, as this would compromise the at-home beauty ritual. Rather, by integrating an alternative mode of operation, the suggested design anticipates the user's potential needs without disrupting their current routine. As such it follows the principle of good modular design to a tee: instead of merely providing additional functions, it streamlines the user's experience. Those features should genuinely simplify the user's routine.

DISPENSING, LEAKAGE AND PRODUCT PROTECTION

Leakage is an important problem when carrying liquid products while travelling. Shampoo bottles are often placed sideways inside bags and can experience pressure or movement. Even a small amount of leakage can create a mess. The travel pod therefore needs a secure closure. The dispensing system also needs attention. Gomez-Berrada et al. (2017) showed that different types of cosmetic containers can influence product consumption. This suggests that the way shampoo is dispensed should be considered as part of the overall design rather than treated as a separate component. Another study by Devlieghere et al. (2015) looked at how different dispensing systems protect cosmetic products from microbial contamination. The researchers found differences between packaging systems in their ability to protect the product.

For the proposed pod, this means that the opening and closure need to be carefully designed.

Important requirements include:

- Secure closure.
- Good resistance to leakage.
- Protection from outside contamination.
- Easy opening and closing.
- Simple cleaning.
- Reliable connection with the main bottle.

HYGIENE AND THE DETACHABLE TRAVEL POD

The detachable pod makes the bottle more flexible, but it also introduces another connection and closure. This creates additional hygiene considerations. The pod should be designed so that shampoo does not

easily collect around the connection or inside difficult-to-clean areas. The cap and opening should also protect the shampoo from unnecessary contact with the outside environment. The research by Devlieghere et al. (2015) shows why this is important. Different dispensing systems can provide different levels of protection against contamination. The proposed design therefore needs to consider hygiene from the beginning rather than adding it as a final feature. The magnetic components also need to be protected. In the proposed concept, the magnets are embedded inside the plastic structure rather than left exposed. This helps keep them away from direct contact with water and shampoo.

However, the exact material, magnet type, connection and sealing method would need to be tested in later stages. The pod should have a simple shape, with as few nooks and crannies as possible where product or grime can collect. And if it's meant to be reused again and again, it needs to be easy to clean — nobody wants to fight with a fiddly little container every time they refill it.

THE ROLE OF MAGNETIC CAP STORAGE

There's a small but very real problem with detachable parts: caps go missing. Once the travel pod comes off the main bottle, its cap can easily turn into just another loose piece rattling around a bag or drawer. The design solves this with a fixed spot for the cap to live. A magnet sits beneath the travel pod, so the cap simply snaps into place on the bottle whenever it's not in use. It's worth noting that the magnet's job here is purely about keeping things organized — it's not what holds the travel pod onto the bottle in the first place. This follows a simple product-design principle: when a product has a small detachable part, that part should have a clear place to go. The magnets are intended to be embedded inside the plastic structure. This keeps them protected from direct exposure and makes them part of the product rather than an external accessory. The strength and position of the magnets would need to be tested. The connection should be strong enough to hold the cap during normal handling but still easy for the user to remove.

DESIGN OPPORTUNITY

The research points towards an opportunity to make the shampoo bottle more adaptable. Conventional bottles mainly provide one storage volume. Travel bottles provide a smaller volume but are usually separate products. Refillable systems focus more on extending packaging life, but they can sometimes require additional steps from the user. The proposed design combines these ideas in a simpler way.

The bottle has:

- 250 ml main compartment for regular use.
- 20 ml detachable pod for travel.
- Separate pod cap for secure closure.
- Magnetic storage for the cap beneath the pod.
- Embedded magnets to keep the magnetic components protected.

The important idea is that the user does not need to carry the complete bottle when travelling. The product can be understood through three simple situations:

Normal use: The complete bottle stays together.

Travel: The 20 ml pod is removed and carried separately.

Storage: The pod cap stays attached to its magnetic storage position. This makes the bottle more flexible without adding a completely separate travel product. This gives a clear direction for further product development.

FUTURE SCOPE

The next stage of this project should focus on building and testing a physical prototype. The first area to test would be the pod connection. It should be easy to remove but secure enough that it does not come off accidentally. The second area would be leakage testing. The pod should be tested upside down, sideways and under movement to understand how well the closure works. The magnetic system should also be tested with different magnet sizes and positions. The aim would be to find the right balance between secure storage and easy removal. User testing would be useful to understand whether people can immediately understand how the pod works. Users could be asked to remove the pod, open it, carry it and reconnect it. The design could also be compared with a conventional shampoo bottle and a separate travel bottle. This could help measure differences in packing space, number of parts and ease of use.

CONCLUSION

This research shows that the conventional shampoo bottle works well for everyday use but is not always suitable for travel. A full-size bottle can be unnecessarily bulky when the user needs only a small amount of product. Research on packaging also shows that convenience is closely connected to user acceptance. People may be interested in reusable or sustainable packaging, but they are less likely to use it when it adds too much effort or creates concerns about hygiene, quality or usability. The proposed solution is a modular shampoo bottle with a 250 ml main compartment and a detachable 20 ml travel pod. The pod allows the user to carry a smaller amount of shampoo without transferring the product into another container. Its cap is stored magnetically beneath the pod so that it remains connected to the product when not in use. The main idea is simple: one bottle can serve two situations. The concept still requires further development and testing. Leakage, hygiene, connection strength, material selection, magnetic performance and environmental impact all need to be studied before the design can be considered production-ready. The research therefore does not claim that the product is already a proven solution. Instead, it identifies an opportunity to rethink a familiar product through modularity, portability and convenience.

RESEARCH HIGHLIGHTS

- Conventional shampoo bottles are mainly designed for home use and can become bulky and inconvenient while travelling.
- Research shows that the size, shape and dispensing system of packaging can affect how people use cosmetic products.
- The proposed design combines a 250 ml main shampoo bottle with a detachable 20 ml travel pod.
- The travel pod is placed in the base of the main bottle and can be removed when only a small quantity of shampoo is required.
- A separate cap for the travel pod is stored magnetically underneath the pod so that it does not need to be carried separately.
- The research also shows that hygiene, leakage prevention, dispensing and material choice need to be considered along with convenience.
- The concept creates an opportunity to rethink the shampoo bottle as a more flexible and travel-friendly product.

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