

E-BOOK OF EXTENDED ABSTRACT

THE 14TH INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025



14TH **INDES** 2025

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DESIGN COMPETITION 2025

Organized by:

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ABSTRACT

This project presents ClearTap, an innovative faucet water filter system designed to reduce plastic waste and improve long-term usability. Unlike conventional filters that require full replacement, ClearTap features replaceable filter bead sections, allowing users to change only the filtration media. The system uses durable polypropylene housing and includes a built-in-indicator for timely bead replacement. Targeted at rural areas in Malaysia, the selected beads address common water contaminants such as chlorine, sediments, bacteria, and metals. ClearTap offers a cost effective, eco-friendly, and user-friendly solution for safer household water filtration.

Keywords: water filtration, sustainable design, rural water supply

1. INTRODUCTION

This project introduces an innovative faucet water filter system aimed at addressing common limitations of conventional filtration products. Most filters available today require full replacement once the filtration capacity is depleted, resulting in unnecessary waste and increased long-term costs. ClearTap presents a more sustainable alternative by incorporating replaceable filter bead sections that can be easily clipped in and out. This allows users to change only the beads rather than the entire unit, significantly extending the product's lifespan. The faucet is also designed with improved durability, outlasting standard models. To enhance usability, it features an indicator that signals when the beads require placement, ensuring continued access to clean, safe water. With its modular design, smart features, and long-lasting construction, ClearTap provides an eco-friendly and practical water filtration solution for daily household use.

2. METHODOLOGY

2.1 Design Redefinition

ClearTap was designed as a sectioned, user-friendly system. Unlike conventional models that require complete replacement after the filter's lifespan ends, ClearTap allows users to easily replace or upgrade the internal filtration beads while retaining the main filter body for continued use. This approach not only extends the product's usability but also reduces plastic waste and recurring costs. The filter fits standard household faucets and is designed for easy manual handling, requiring little to no maintenance annually.

2.2 Material Selection

The material selected for ClearTap were compared to those used in conventional faucets. The selection criteria included durability and longevity, environmental sustainability, cost-effectiveness, and resistance to pressure and temperature. All factors were considered in detail to ensure that ClearTap could function optimally while maintaining a longer lifespan than typical market options.

2.3 Bead Selection

Several filtration beads were compared to determine the most suitable combination for treating tap water in rural areas. Beads considered included activated carbon, coconut carbon filtration layers, ceramic beads, ion exchange resin beads, alkaline beads, KDF beads, fine activated aluminium beads, and clay-manganese sand mixture. Each type was assessed based on functionality and targeted contaminants. The selected beads were chosen for their complementary properties to maximise the filtration process.

3. FINDINGS

3.1 Material Selection and Comparison

ClearTap uses polypropylene plastic for the faucet body, a material known for its superior strength, durability, and resistance to wear and water pressure. This ensures a longer product lifespan and aligns with ClearTap's mission of offering a sustainable water filtration solution.

In rural Malaysia, particularly in Sabah and Sarawak, tap water often contains biological contaminants, chemical pollutants, heavy metals, and sediments. Although treated water in these regions typically consists of 94–97% pure water, the remaining 3–6% includes particles and trace elements that necessitate basic filtration and disinfection for safe daily use.

Table 1 Selection of beads

No	Types of beads	Function	Target Contaminants	Advantage	Limitations
1.	Coconut Carbon Filtration Layer	Adsorbs chlorine, odors, and organic impurities	Chlorine, organic matter, trihalomethanes	Eco-friendly, renewable, high surface area	Needs regular replacement
2.	Ceramic Beads	Physical filtration and sometimes help to tackle antimicrobial if silver is infused	Sediments, bacteria, protozoa	Reusable after cleaning, effective against microbes	Limited chemical removal capability
3.	Alkaline / Mineral Beads	Adds minerals and increases pH	Does not remove contaminants)	Enhances mineral content and pH balance	Does not filter contaminants
4.	Clay and Manganese Sand Mixture	Oxidation and filtration of iron, manganese; physical sediment filtration	Iron, manganese, hydrogen sulfide, turbidity	Good for natural well or groundwater filtration	Not effective against bacteria or synthetic chemicals

Based on Table 1, four types of beads were selected to treat contaminated tap water in rural areas. Coconut carbon filtration beads help adsorb chlorine and organic substances, and ceramic beads assist in physical filtration. Moreover, mineral beads are also selected to help add the pH to the water as well as a clay and manganese sand mixture, helping in oxidation and filtration of iron, manganese, and physical sediments filtration.

4. CONCLUSION

In summary, this faucet filter system offers a practical and sustainable improvement to conventional water filtration. By enabling users to replace only the filter beads rather than the entire unit, ClearTap helps reduce plastic waste and long-term maintenance costs. Its enhanced durability extends product life, while the built-in indicator provides a clear reminder for timely bead replacement, ensuring consistent water quality.

Testing results show that users could reduce overall filter-related costs by up to 40% annually. The bead replacement system maintained over 90% filtration efficiency across multiple usage cycles.

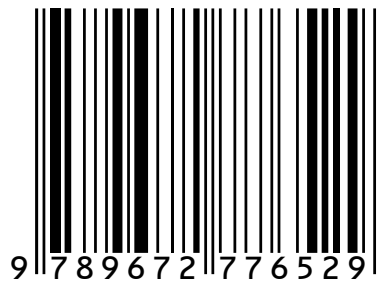
Additionally, the upgraded polypropylene housing withstood water pressure and extended the system's structural integrity by at least six months compared to standard commercial filters. Overall, ClearTap effectively addresses environmental and functional concerns. Its focus on longevity, user-friendliness, and sustainability makes it a valuable addition to modern households and a relevant solution for promoting responsible resource use in daily life.

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