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SUSTAINABLE WATER MANAGEMENT IN THE COSMETIC INDUSTRY

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Abstract: *One of the key issues of the 21st century is sustainable water management, as we are witnessing an increasing water shortage caused by uncontrolled consumption. This is a global problem that poses a major challenge of the modern era, affecting individuals, the general population, and large corporations alike. The aim of this paper is to present how companies are responding to this growing problem by implementing sustainable practices and innovative systems that enable water consumption reduction in industrial settings. Through a case study, an environmentally friendly shower system is presented, which applies water fragmentation technology to ensure reduced water usage while maintaining rinsing efficiency. It is concluded that the application of technological solutions and sustainable practices in business processes has the potential to become a standard within environmentally responsible industrial operations.*

Keywords*: sustainability, water, industrial consumption, eco-friendly shower system, fragmentation*

1. INTRODUCTION TO SUSTAINABLE WATER MANAGEMENT

Sustainable water management entails the balanced use, protection, and preservation of water resources to meet the needs of current generations without compromising the ability of future generations to meet their own needs. This approach integrates ecological, economic, and social aspects into water resource planning and management.

According to the United Nations, “sustainable water management means using water in a way that meets the needs of people and ecosystems today without compromising the ability of future generations to use the same resources” (UN-Water, 2021). [1]

Water scarcity is one of the most serious global challenges today. According to the World Health Organization (WHO, 2023), more than two billion people worldwide still lack access to safe drinking water, and projections suggest that by 2025, as much as half of the world's population could be living in areas experiencing severe water shortages.

Industry consumes about one-fifth of the world’s available freshwater, and in developed countries, that share can reach up to 50% (OECD, 2020), further worsening the situation by degrading ecosystems and reducing resources available to local communities.

In addition, according to the World Resources Institute (WRI), a significant number of aquifers are being depleted faster than they can naturally recharge, threatening the sustainability of water supplies (WRI, 2019).

Water pollution further complicates the situation, as agricultural chemicals enter rivers and lakes, causing eutrophication—a process that diminishes water quality and destroys

aquatic ecosystems (UNEP, 2022). Industrial and municipal waste exacerbates this problem, altering the chemical composition of surface and groundwater.

Unequal distribution of water resources also contributes to the problem. While some regions enjoy abundance—often used inefficiently—others, such as Africa and the Middle East, face severe shortages that threaten basic human needs (FAO, 2020). This imbalance clearly indicates the urgent need for coordinated global action focused on conservation and equitable water distribution.

Despite the growing number of declarations, policies, and corporate sustainability reports, the question remains whether sustainable water management has truly become practice—or if it remains merely an image.

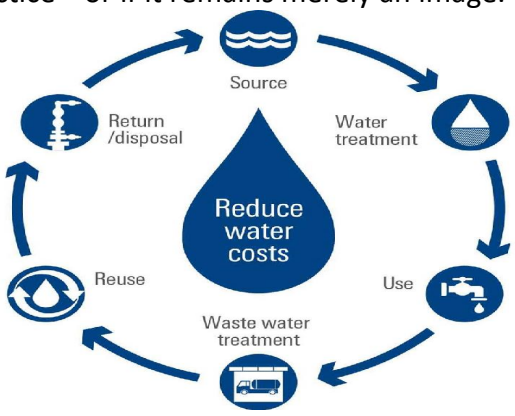

Figure 1. *Reduce water costs*

Many companies and governments promote "sustainability" in their strategies, but concrete measures are often lacking or limited to symbolic actions with little real effect. As McKinsey & Company (2021) noted, "many companies invest more in sustainability marketing than in actual changes to their water supply chains." [2]

Although there are success stories of local initiatives, smart technologies, and participatory planning, on a global scale, sustainable water use is still the exception rather than the rule.

2. INDUSTRIAL WATER CONSUMPTION

Water is a key raw material in the cosmetics industry, not only as a base ingredient in many products (e.g., lotions, shampoos, creams) but also in the manufacturing process, equipment cleaning, and plant hygiene. On average, water makes up 70–80% of the formulation of products like lotions and toners. It is also used in cooling systems, raw material rinsing, and as a solvent in various production stages. Without it, mass production of cosmetic products is virtually impossible.

This intensive water use becomes particularly problematic in regions where water resources are limited or already under stress. Industries that heavily rely on water, such as cosmetics, must reassess their practices to preserve local resources and meet ecological standards. According to research by the Water Footprint Network, the industrial sector consumes over 20% of the world's available freshwater, with the cosmetics sector having a high "hidden water footprint" through raw materials and production processes. Moreover, wastewater from production often contains chemicals, preservatives, and microplastics that degrade the quality of surface and groundwater. [3]

As awareness of climate change and sustainability grows, so does social pressure on cosmetics companies to reduce their water impact. Stakeholders—including investors, NGOs, and regulatory bodies—are demanding that companies adopt strategies for efficient water management, measure their water footprint, and publicly disclose their environmental impact. Meanwhile, consumers increasingly choose brands that operate sustainably and communicate their environmental initiatives transparently.

Irresponsible water use can damage brand reputation, lead to product boycotts, and result in market losses. Society now expects not only quality products from cosmetics companies but also responsible behavior toward shared resources, with water being one of the most vital. Sustainability is no longer a bonus—it is becoming the standard.

The environmental consequences of unsustainable water use are serious. The most direct effect is water scarcity—depleting local water sources reduces availability for

households, agriculture, and ecosystems. This is especially harmful in arid and vulnerable areas, where every liter plays a key role in sustaining life and food production.

However, there are solutions. One of the most significant is the development of waterless formulations—products that contain little to no water. These include solid shampoos, stick balms, facial powders, and oil-based serums. Such products not only save water in production but also reduce the need for preservatives. Another key solution is recycling and reusing process water within facilities using closed-loop systems and advanced purification technologies. These systems enable multiple uses of the same water, thereby reducing total consumption.

Figure 2. *Sustainable water management*

By implementing these solutions, the industry not only minimizes its environmental footprint but also achieves long-term resource savings and meets market demands that increasingly value sustainability. Another major issue is water pollution. In addition to local impacts, unsustainable water use contributes to global environmental challenges, as water treatment and transportation systems consume significant energy, increasing greenhouse gas emissions. Therefore, rational water use is essential not only for resource conservation but also for protecting the entire environment.

3. WATER TREATMENT (RECYCLING) AND REUSE

In today's industrial environment, where resources are increasingly limited and environmental standards more stringent, sustainable water management is essential. Industries around the world are increasingly implementing systems for water recycling and reuse to reduce their environmental footprint, save resources, and meet international standards and regulations. Of particular importance are so-called waterloop factories—production facilities where water is continuously treated and reused in the process, without being discharged into the external environment.

Almost 20% of the world's water is used by industries, and that percentage continues to rise. Typical factories use far more water than they actually need, after which the water is discharged into sewage systems. In waterloop factories, the same water is treated and reused. Water drawn from the environment is reserved for drinking and as a product ingredient.

There are many benefits to this system, including significant water savings; at L'Oréal's factory in Jichang, water consumption has been reduced by 85% compared to 2005. The factory saves approximately 16,758 tons of water annually. There is also a notable reduction in wastewater released into the environment, directly contributing to ecosystem protection and reducing environmental footprints. [4]

Companies that invest in responsible water management send a clear message of concern for social and environmental issues, thereby strengthening their brand image and customer trust. Although initial investments may be high, long-term savings on water, energy, and wastewater treatment positively affect overall business efficiency.

However, implementing waterloop factories comes with challenges such as high upfront costs and technical system complexities. Integration into existing facilities often requires infrastructure adjustments and process modifications, which may cause disruptions and additional expenses. Also, system maintenance and water quality control require ongoing attention and expertise to ensure safety and effectiveness.

Beyond technical aspects, employee education and a shift in organizational culture

are necessary to adopt new water conservation practices. Furthermore, regulatory requirements and local laws may pose additional obstacles.

Waterloop factories adhere to international standards such as ISO 14001 for environmental management and ISO 22716 for good manufacturing practices in the cosmetics industry, reducing environmental impact and complying with strict regulations for production processes.

The Water Framework Directive (WFD) focuses on maintaining good water quality and quantity, reducing and eliminating pollution, and ensuring sufficient water for both nature and human needs. [5]

4. GJOSA & L'ORÉAL WATER SAVER

L'Oréal Water Saver is the first handheld showerhead to use patented water fragmentation technology, designed for hair salons. This shower system was developed in response to the need for efficient and sustainable rinsing systems in professional cosmetic treatments. Traditional rinsing systems use large amounts of water, leading to resource waste and higher energy costs. This showerhead offers a solution that not only reduces environmental impact but also provides high service quality and adaptability for professional use.

The technology is based on colliding water streams that produce droplets 10 times smaller than standard ones. This results in greater coverage, lower overall consumption, and maintained rinsing efficiency. In addition to fragmentation, the system also uses aeration—injection of air into the water stream—to increase the sense of water pressure and coverage without raising actual flow. This creates a "water curtain" that evenly covers the hair, enabling quick and effective rinsing.

The image is a contour map showing how fluid velocity changes across a surface or space. This is actually the average velocity as a parameter being monitored, denoted as Umean. The X and Y axes represent position in millimeters, showing a cross-section of the water jet.

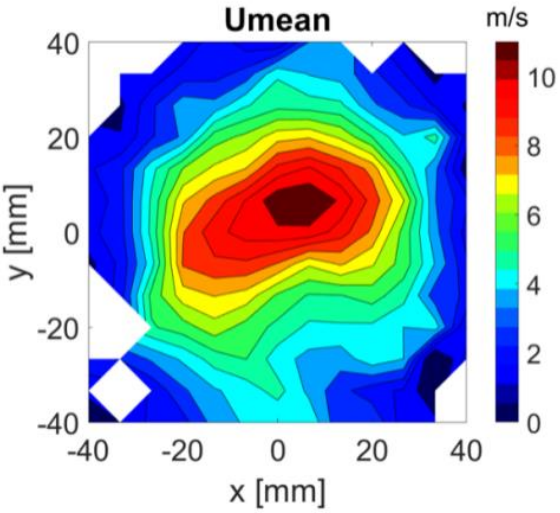

Figure 3. *Contour map of fluid velocity*

The red and dark red areas in the center show the highest speeds—over 10 m/s—while blue and dark blue areas show lower speeds, from 0 to 2 m/s. The gradient from blue to red represents the change in speed from the edges to the center. Based on this image, it can be determined whether jet design should be changed—either if speed is too low in the center or if flow needs optimization.

According to fluid mechanics principles, an optimal velocity distribution across the jet cross-section enables controlled direction of energy to where it is most needed-in the central part of the jet. The goal is to maintain a high velocity at the center to maximize the transferable impulse, while velocities at the edges are reduced to prevent uncontrolled splashing and water loss. Such velocity profile controle ensures that the fragmented droplets have enough energy to remove impurities, while remaining gentle enough to provide a comfortable rinsing experience.

Gjosa designs shower to concentrate water energy in the center while reducing it where it1`s not needed. This leads to efficient hair rinsing with less water and energy without compromising wash quality.

The system includes:

- precisely directed water jet collisions,

- controlled and uniform flow ensuring consistent rinsing performance,
- a wide, curtain-like spray for optimal hair coverage, and
- an ergonomic rotating nozzle for easy scalp access.

L'Oréal Water Saver was first implemented in hair salons worldwide as part of a pilot project for sustainable operations in the cosmetics industry. By the end of 2023, more than 10,000 salons globally had adopted this system. It has also been integrated into L'Oréal's manufacturing plants, particularly waterloop factories, where water is recycled and reused.

The image shows, on the left, a compact hemisphere of water—i.e., a part of the stream exiting the showerhead.

Figure 4. *Contour map of fluid velocity*

On the right are finely dispersed droplets moving slower and more evenly spread. While conventional showers emit a continuous strong stream, Gjosa uses a mist of small droplets that move slowly, better cover the scalp, and use less water.

The application of this technology has led to numerous positive environmental effects, including:

- up to 69% water savings per user,
- reduced CO_2 emissions from lower energy use to heat water,
- faster and better-quality treatments, and
- improved working experience for salon professionals.

5. CONCLUSION

Are technical solutions, innovations, new technologies, and artificial intelligence the right path to resource preservation in the near and distant future?

In a world facing increasing water scarcity, growing industrial consumption, and stronger societal pressure, sustainable business practices and water management are becoming essential. As shown in this paper, high water consumption in the cosmetics industry and irresponsible use of water resources lead to long-term environmental and social consequences. Therefore, many companies, such as L'Oréal, are implementing technological solutions and innovations to enable more rational consumption and reduce environmental impact. This also includes the use of artificial intelligence, which is becoming increasingly important for data analysis, identifying bottlenecks, and optimizing business processes. Together, these measures enable a proactive approach to environmental protection, which is becoming almost inevitable today.

L'Oréal Water Saver is an ideal example of innovation responding to the need to reduce ecological footprints and preserve local resources. It allows the company to balance economic goals with ecological responsibility. This raises the question: do companies truly apply sustainable practices out of environmental concern, or to preserve their image and respond to public pressure?

Although it is difficult for consumers to determine companies' true intentions, it can be said that, for most, sustainable business represents a combination of strategic, ecological, and regulatory goals. While some companies merely market environmental messages, others take sustainability seriously, publishing strategic plans, transparent reports, and measurable goals.

Regardless, one cannot ignore the fact that in today's world, sustainability has become an essential tool for industry survival on the market.

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