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# Water Lily Roots – Perfect Volume for Urban Hair

Dr. Bernd Walzel, Dr. Ulrike Bätz, Dr. Anja Herrmann, Beatrix Senti, Tamina Shah, Dr. Stefan Bänziger

## abstract

Water lilies originate from the water and symbolize beauty and purity. This association makes water lilies an ideal starting point to create water-based cosmetic concepts. The flowers, visible above the water, are seemingly the most attractive part of the plant. A closer look, however, uncovers that water lily roots are exceptional underwater factories of phytochemicals. Their long and branched root system produces a unique combination of metabolites – all potential additives for hair care products. Water Lily Root Extracts contain amphipathic saponins, antioxidative flavonoids, and keratin-enforcing tannins, a combination perfectly suited for the daily hair care routine.

With its proven efficacy, Water Lily Root Extract is a powerful ingredient for hair care applications. The extract protects hair from urban pollution, it improves hair manageability, it tames frizzy hair, and it optimizes hair volume and definition.

## Water Lily – Perfectly Adapted to an Aquatic Environment

*Nymphaea alba* L. (*Nymphaeaceae*), also known as European white water lily, white water rose or white nenuphar, is an aquatic flowering plant that lives in temperate and tropical climates around the world. The plant is anchored with perennial rhizomes or rootstocks in the soil with round leaves and flowers floating on the water surface (**Figure 1**). The submerged rootstocks store nutrients in up to 3 m water depth with no access to atmospheric oxygen or UV-light. They experience lower and more constant temperatures and higher pressure. As a result, their phytochemical composition is different as compared to flowers or leaves that float at the surface with contact to air [Refs 1-8]. The roots, especially the thickened root stalks (rhizomes) store saponins (biosurfactants), flavonoids (antioxidants), and tannins (keratin strengtheners) with potential value for hair care applications.

All this motivated us to further investigate Water Lily Root Extract and its beneficial properties for the treatment of hair.

## Extraction of Water Lily Roots for Cosmetic Use – Phytochemical Analysis

Flowers, leaves, and roots of the water lily plant produce unique sets of phytochemicals, of which the roots provide the most promising ingredients for hair care applications.

To optimize the extraction of phytochemicals from water lily roots, we tested various extraction systems to obtain a maximum of beneficial substances for hair treatment. Various extraction systems for *Nymphaea alba* roots were prepared based on either (a) water, (b) glycerin-water, (c)

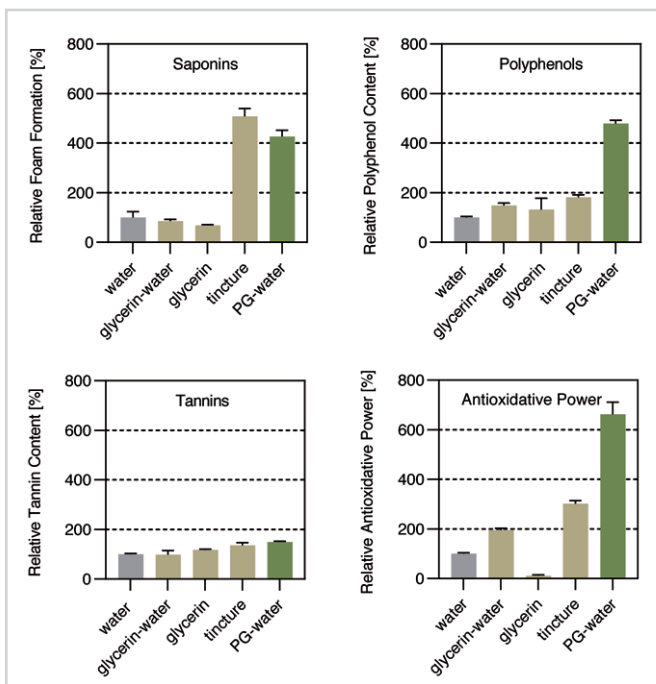


**Fig. 1** Water lilies form beautiful underwater landscapes. The stems grow from the bottom to the water surface. Its submerged roots provide a more valuable set of phytochemicals than flowers or leaves that float on the water surface.

glycerin, (d) ethanol-water (tincture), or (e) propylene glycol (PG)-water. The content of saponins, polyphenols (flavonoids), and tannins, as well as the antioxidative power of extracts were quantified using standard analytical testing (**Figure 2**).

The extraction of *Nymphaea alba* roots with propylene glycol-water provided high amounts of saponins, polyphenols and tannins, and it showed the highest antioxidative power of all extraction systems tested.

As a result, the propylene glycolic-aqueous extraction system is the most efficient in extracting saponins, flavonoids and tannins. These compounds provide cleansing, conditioning, protecting, and strengthening benefits to hair, and may help to protect hair against urban pollution, to improve hair manageability, and to optimize hair volume.



**Fig. 2** A propylene glycolic-aqueous extraction is most efficient for water lily roots. The phytochemical content and antioxidative power of different extraction systems was analyzed. The saponin content was determined using a standardized foam test. The content of tannins was determined using a coloration assay based on Fe (III) chloride. The polyphenol content was determined using a Folin-Ciocalteu phenol reagent. The antioxidative power was analyzed using a DPPH reagent assay. N=3; Mean + SEM.

## Water Lily Root Extract Protects Hair Against Urban Pollution – A Real-Life Exposure Study

In an *ex vivo* study, the protective effect of Water Lily Root Extract against urban pollution was analyzed using scanning electron microscopy (SEM). Briefly, hair tresses were washed with a shampoo containing 0.5% Water Lily Root Extract or with a placebo shampoo. Treated hair tresses were kept in contact with urban air pollution for 4 days on a balcony in the city center of Barcelona, Spain. After exposure, hair surfaces were analyzed by SEM coupled to a microanalysis system. Representative images were taken to evaluate the degree of hair damage and particle deposition (**Figure 3**). As a result, hair treated with Water Lily Root Extract repels urban pollution. This makes hair less vulnerable to chemical damage and maintains a healthy and smooth hair surface, for improved manageability and hair quality. This way, Water Lily Root Extract supports a lifestyle of urban living.

## Water Lily Root Extract Improves Hair Manageability and Quality

In a double-blind, placebo-controlled, randomized, comparative half-head test the efficacy of Water Lily Root Extract in improving hair manageability and quality was tested. A shampoo



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## Water Lily Root Extract Optimizes Hair Volume and Definition

In a double-blind, placebo-controlled, randomized, comparative half-head test, the effect of Water Lily Root Extract on the order and definition of hair was compared to a placebo shampoo. The study evaluated hair to hair orientation and alignment that often appears frizzy, diffuse, or as flying hair. One half of the head was treated with a Water Lily Root Extract and the other with a placebo shampoo. Each side was washed, rinsed, and dried according to a standard protocol. The evolution of hair condition was monitored with a digital camera and zones of disordered, diffuse, undefined, or frizzy hair were quantified using a pixel counting software (Figure 5A).

As a result, Water Lily Root Extract gives hair a more parallel alignment. Order and definition improve by 25% (Figure 5B). This way, Water Lily Root Extract helps to tame unruly, frizzy hair. It supports defined volume and provides the perfect finish for premium volume shampoos. This is in line with our market analysis revealing that Water Lily Root Extract is indeed preferred in volume shampoos (data not shown).

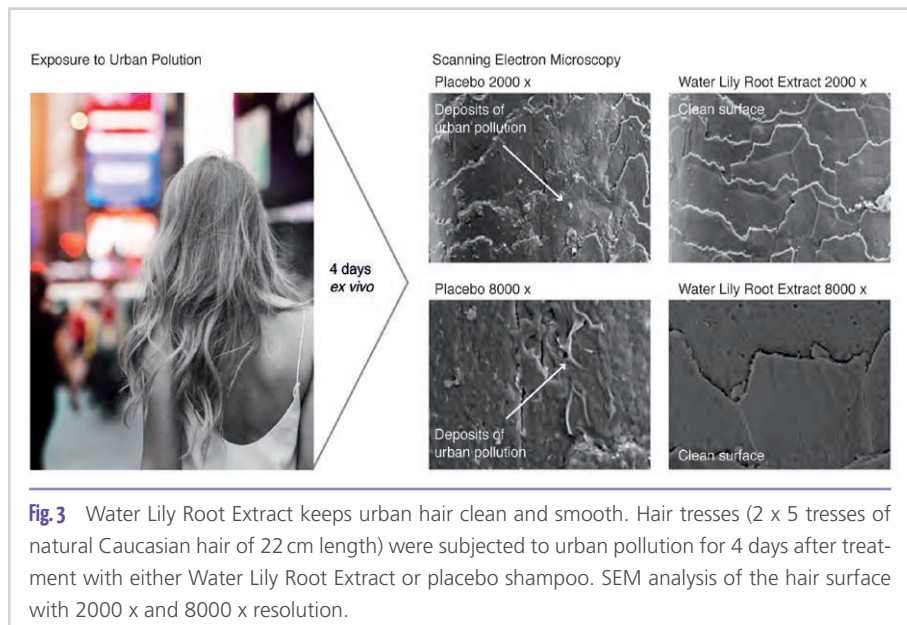
## Conclusion

Water lilies arise from the water and convey the concept of water, making it an ideal starting point to create water-based cosmetic concepts, including rinse-off products, for example

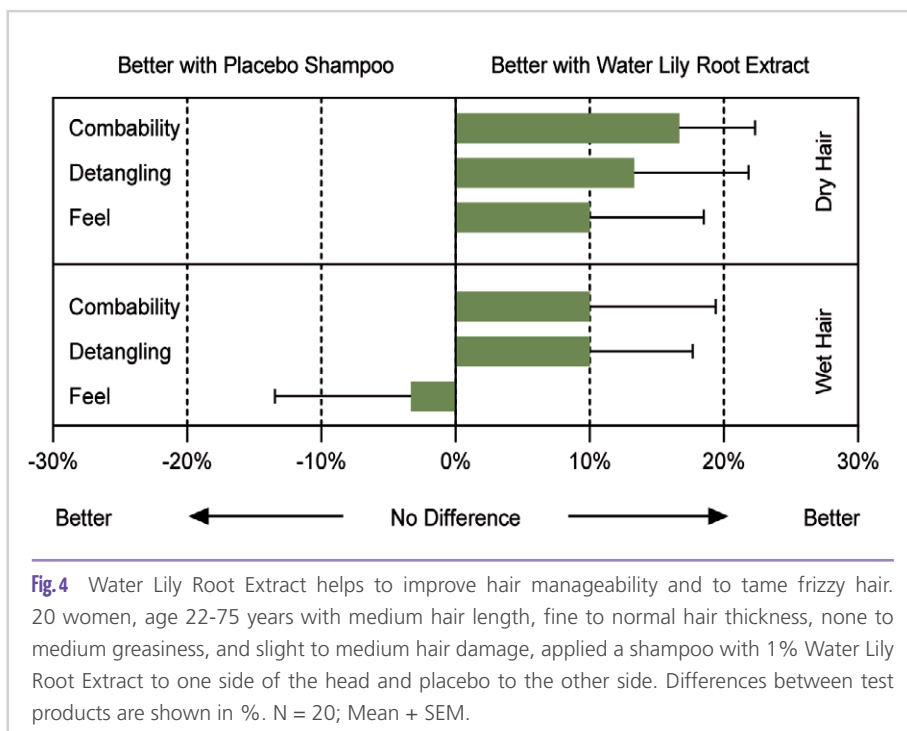
shampoos or bath products. Visually, water lily flowers are the most attractive part of the plant, but their phytochemical composition is limited to antioxidants. The roots, in contrast, are powerful underwater factories that store a unique combination of saponins, flavonoids, and tannins with cleansing, conditioning, strengthening, and protective effects for hair.

A propylene glycolic-aqueous system is best suited to extract water lily root phytochemicals for hair care applications. This extract is a phytochemical concentrate that keeps urban hair clean and smooth, that protects the hair surface from air pollution, that improves hair manageability, tames frizzy hair, and that optimizes hair volume and definition.

Overall, Water Lily Root Extract is a powerful ingredient for hair care applications that perfectly fit into a modern urban lifestyle.



**Fig. 3** Water Lily Root Extract keeps urban hair clean and smooth. Hair tresses (2 x 5 tresses of natural Caucasian hair of 22 cm length) were subjected to urban pollution for 4 days after treatment with either Water Lily Root Extract or placebo shampoo. SEM analysis of the hair surface with 2000 x and 8000 x resolution.



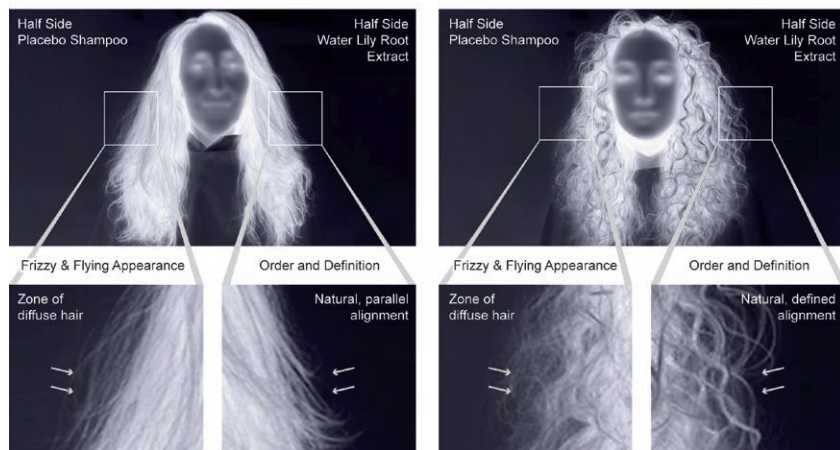
**Fig. 4** Water Lily Root Extract helps to improve hair manageability and to tame frizzy hair. 20 women, age 22-75 years with medium hair length, fine to normal hair thickness, none to medium greasiness, and slight to medium hair damage, applied a shampoo with 1% Water Lily Root Extract to one side of the head and placebo to the other side. Differences between test products are shown in %. N = 20; Mean + SEM.

containing Water Lily Root Extract was applied to one side of the head and a placebo shampoo to the other side (Figure 4). As a result, Water Lily Root Extract increased hair manageability and quality:

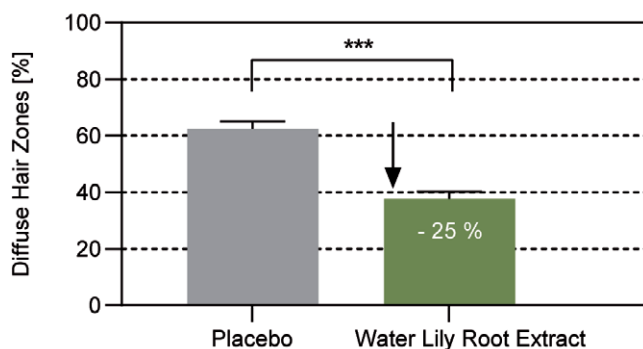
- A comb brushed through hair more easily and without hindrance (combability).
- The first brush tended to result in smooth hair (detangling).
- Overall hair quality with Water Lily Root shampoo was rated as 'top', whereas with the placebo shampoo it was rated only as 'good' (data not shown).

Thus, Water Lily Root Extract in a shampoo improves combability and detangling. It makes hair more manageable. Increased manageability is expected to go hand in hand with increased control of unruly and frizzy hair.

A) Order and Definition – Visual Evaluation



B) Order and Definition – Quantitative Evaluation



**Fig. 5** Water Lily Root Extract gives hair order and definition. (A) Representative pictures show the difference in hair appearance after treatment. Hair treated with Water Lily Root Extract looks less diffuse, more natural and defined. (B) Zones of diffuse hair were quantified using a pixel counting software calculating relative areas of diffuse hair. Hair, treated with Water Lily Root Extract, appears 25% less diffuse, frizzy, and flying. N=20, Mean +SEM, Students t-test Water Lily Root Extract vs. placebo; \*\*\* = p < 0.001.

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