

# CHEMICAL SHAMPOOS VS HERBAL SHAMPOOS

Rummi Devi Saini

Associate Professor

Department of chemistry, SMDRSD College, Pathankot, India

**ABSTRACT:** Shampoo is the most common form of hair treatment. Shampoos are mainly used for cleansing the hair and scalp. But these days additional benefits other than pure cleaning of the hair are expected from shampoo formulations such as conditioning, smoothing of the hair surface, good health of hair including hair free from dandruff, dirt, grease and lice and, above all, it should be safe to use without any harmful effects. So to popularize herbal shampoo, the consumer expectations from a shampoo have to be changed, with emphasis on its safety and efficacy. The challenges also lie in selecting materials that can be reasonably justified as natural and also match the performance characteristics of the chemical shampoo formulations available in the market. The increase in variety and the number of chemicals introduced into the market and also into the environment has resulted in the requirements for protection of human health and the environment. This has necessitated the monitoring of materials used and the development of rapid and reliable methods for toxicity evaluation and risks. This investigation reveals that the various chemicals and synthetic preservatives used in synthetic shampoos sometimes have been the cause of harmful effects among consumers. As our scalp is one of the most absorbent parts of the body, products applied to the scalp enter directly into the blood. So it is very important to know the effects of ingredients used in shampoo formulations. In the present review the shampoo formulations based on synthetic ingredients and herbal ingredients are compared for their effectiveness and safety.

**Index Terms-** Cosmetics, Shampoos, Chemical shampoos, Herbal shampoos, Formulations.

## I. INTRODUCTION

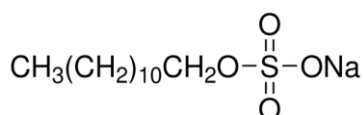
Natural and eco-friendly products are increasingly becoming popular amongst the health and environmentally conscious consumers these days. This trend also extends itself to hair care. People have started realising that the difficulty in maintaining healthy hair is due to the continuous exposure of hair to harmful chemicals in synthetic shampoos and conditioners. With the increased awareness of how natural products can positively affect our lives people are opting for safer and healthier options. (Blanc et al, 1999)

Natural shampoos are formulated from useful natural plant and herb extracts in crude or powdered form which provide a variety of positive results for the hair and scalp. Shampoo may be defined as a cosmetic preparation designed for the washing of hair and scalp. Its main task is cleansing the hair of gathered sebum, scalp debris and residues of hair-grooming products. In addition to these functions, shampoo also lubricate, condition, medicate and prevent static charge build up of hair. The care must be taken so that the complete shampoo formulation is medically safe for long term usage. (Sanju et al, 2006) Evaluation of shampoos involve the quality control tests including visual assessment and physiochemical controls such as pH, density, surface tension and viscosity measurements. The most commonly used detergents in shampoos are sodium lauryl sulphate based detergents but their concentration vary considerably from brand to brand and even within a manufacturer's product range. Cheap shampoos may have a high concentration of detergent while expensive shampoos may contain very less of a such detergent. (Mainkar and Jolly, 2000)

## II. Harmful effects of various chemicals used in commercial shampoos

The mainstream popular shampoos available in stores contain some of these harmful chemicals:

### Sodium Lauryl Sulphate (SLS)



Sodium Lauryl Sulphate

Sodium lauryl sulphate is one of the most harmful chemicals present in nearly all shampoos, which is also called as sodium laurethsulphate. Sodium lauryl sulphate is prepared from sulphuric acid, monododecyl ester, and sodium salt.

SLS is absorbed into the skin and enters brain, heart, and other organs where it gets accumulated over long use and causes harm. SLS, if contaminated also contains dioxane, a known carcinogen. (Black and Howes 1979).

#### Harmful effects of sodium lauryl sulphate

**Skin irritant:** Since SLS causes irritation; it is used in clinical studies as the universal standard of irritation that other chemicals are tested against. SLS causes irritation at concentrations of 0.5% and most products use a 30% solution of SLS. (Cowley and Farr, 1992)

**Eye Irritant:** Shampoo usually enters in the eyes during use if it contains SLS it could cause permanent damage to the cornea.

**Hair Loss:** SLS causes hair loss as it attacks the hair follicles.

**Hormone Imbalance:** As SLS gets absorbed through the skin, it can cause disaster with our hormones. SLS causes the body to lose control over oestrogen hormone by attaching itself to oestrogen receptors. In women, SLS may lead to menstrual problems and hence infertility. In men, SLS may increase oestrogen levels, leading to breast enlargement, drop in sperm count, sperm mobility and reduction in testosterone. ( Agner et al., 1989)

**Cancer Causer:** SLS causes cancer as it damages the protein in our cells. Nitrates produced during the process of SLS, gets absorbed through our skin into our body and can do severe damage over time . SLS is also known cause mutation of genetic material in our cells. (Lee and Maibach, 1995)

Still Sodium lauryl sulphate is added to shampoos by the manufactures due to its various properties. It is a good foaming agent, it gives our shampoo that nice lather we enjoy while using the shampoo. It cleans the hair.

**Cocamidopropyl betaine :** It is an amphoteric surfactant which is commonly used in shampoos. It is reported to cause contact allergy . (Schothorst and Stephany, 2001) cases of cosmetic allergy to cocamidopropyl betaine were reported, all were caused by shampoo or shower gel (Groot et al.,1998). In another study, the presence of cocamidopropyl betain in 'no tears shampoos' for children has been reported (Militello et al.,2006). It is concluded in this study that the increase in rates of allergic contact dermatitis in children may be due to augmented chemical exposures. (Militello et al, 2006)

**Diethanolamine or DEA:** It is a regular constituent in bath products. DEA and any derivative of DEA, e.g. the widely used cocamide DEA has been observed to cause serious health problems to its users. The ill effects of DEA were reported in which, M.D of the University of Illinois and about the results of his study in which he Dr. Samuel Epstein, one of the world's foremost toxicologist testified DEA as a potential carcinogen whose repeated use in even small doses increases the risk of cancer. (Zoltan,1997).

**N-nitrosodiethanolamine (NDELA):** It has been recognized as a carcinogen. When SLS comes into contact with alkanonamides it gets contaminated with NDELA. Schothorst et.al (2001) had The NDELA content of 25 cosmetics including shampoos and gels was determined and NDELA content was observed above the limit of quantification in seven out of 25 sampled and analysed cosmetics. (Schothorst and Stephany , 2001)

**Formaldehyde:** It is used as a preservative in most of the shampoos. It is not required to list as an ingredient on the packing of shampoos. It is labled as 'Quaternium – 15'. It is recognized for its carcinogenic effects.9 Allergic contact dermatitis due to formaldehyde in shampoo has been reported . (Bork et al., 1979)

**Selenium sulphide:** The anti-dandruff shampoos contain selenium sulphide in concentration of 1% in products sold over the counter and 2.5 % in products which are sold by prescription.The selenium sulphide has been found to be carcinogenic for rats and female mice from a bioassay of selenium sulphide conducted by administering it to rats and mice.(Tech Rep Ser, 1980) In another study, hair samples from volunteers were analyzed using Inductively Coupled Plasma Mass Spectroscopy (ICP-MS) detection in a semi quantitative mode before and after hair washing with selected shampoos. A shampoo containing Selenium sulphide was established to critically contaminate the hair. (Blanc et al, 1999) Dandruff is a common scalp problem affecting a large mass of population. The treatment options available for the management of dandruff include remedial use of antidandruff shampoos usually containing Selenium sulphide, Zinc pyrithione, Salicylic acid, Imidazole derivatives, Sulphur Coal tar, etc. These substances have certain limitations and are also unable to prevent reoccurrence of dandruff.( Ravichandran et al., 2004) Hair become brittle and the scalp becomes dry on continuous use of these shampoos. So, after application of antidandruff shampoo, the use of an effective conditioner is recommended. Some shampoos which are used to control dandruff contain coal tar which not only stain coloured or grey hair and make the scalp more sensitive to sun but are also carcinogenic. Coal tar itself has been found to be mutagenic, carcinogenic in animals and phototoxic as reviewed by the WHO's International Agency for research on cancer, 1985.

**Silicates:** The synthetic conditioners and shine providing shampoos have silicones and silicates which form a coat around the hair strand. This coating of silicone reflects the light and it appears as if hair is shiny and healthy. Although our hair look temporarily beautiful and shiny but using these shampoos and conditioners over long period of time, these silicones accumulate in the hair and make them dull as they are non-biodegradable and difficult to wash once collected after continuous use.

### III. Beneficial herbal ingredients in natural shampoos

There is rise in the need for cosmetics and shampoos formulated with herbs, mainly due to the belief that these products are safe and have no side effects. These days, many herbal shampoos are available in the market which has herbal ingredients such as plant extracts and essential oils. There are large numbers of plants which are found to have useful effects on hair and are generally used in shampoos.

**Aloe Vera:** Enzymes in aloe Vera have been observed to dissolve dead skin cells and excess sebum which may cause clogging of hair follicles. Aloe contains salicylic acid which is an anti-inflammatory and mild anti-biotic. Aloe gel acts as an excellent moisturizer because its molecular structure is similar to keratin, a prominent protein of which up skin and hair are made up. So, aloe Vera is best used to promote hair growth. (Mainkar and Jolly, 2001)

***Punicagranatum* L. :** It belongs to the family Punicaceae. This plant has been found to be used to cure a variety of diseases, especially dandruff and scalp inflammation for thousands of years. Citric acid, ellagic acid, ellagitannins (including punicalagins), luteolin,  $\beta$ -sitosterol, icosanoic, linolenic, malic acid, protocatechuic acid, chlorogenic acid, caffeic acid, ferulic acid, coumaric acid, anthocyanins, flavonoids, polyphenols and tannins are the Chemical constituents of *Punicagranatum* L.. These chemical compounds have been reported to have various pharmacological properties, including antidandruff, anti-inflammatory (as they inhibit pro-inflammatory cytokines), anti-itching and antioxidant in a number of studies. They also have been observed to have inhibitory effects on enzymes cyclooxygenase (COX), lipoxygenase (LOX) and Phospholipase A2 (PLA2) which make the plant useful to be used in shampoos as COX and LOX are chief enzymes for converting arachidonic acid to prostaglandins and leukotriene's which are responsible for causing inflammation and ellagic acid, phenolic acid and tannin, in the plant have antidandruff, antifungal and antimicrobial properties. (Barel et al., 2001)

**Amla (*Phyllanthusemblica*) :** Amla fruit is rich in vitamin C and is used in hair preparations as antidandruff agent, hair growth promoter and to strengthen hairs. It is used in many hair tonics because it has been found to enrich hair growth, hair pigmentation, strengthen the roots of hair, maintain colour, and increase lustre. Applying the paste of fresh gooseberry on hair roots or eating it improves hair growth and colour. People in India are very fond of amla oil as it has been found to reduce the chances of hair loss, hair greying and baldness. This quality is due to the carotene and iron content of amla and its general antioxidant capacity are responsible for its these applications as they do not allow free radicals to damage hair follicles or impact the hormones that can cause premature hair loss. (Mainkar and Jolly, 2001)

***Rosmarinus officinalis* L. :** It is native of Mediterranean and linked to the family Lamiaceae. *Rosmarinus officinalis* chemical compounds include 1,8-cineole (15 - 55%), camphor (5 - 31%),  $\beta$  and  $\alpha$ -pinene (9 - 26%), tannic acid, resin, flavonoids, volatile oils consists of limonene (1.5 - 5%), borneol (1.5 - 5%), camphene (2.5 - 12%) and cineole.

This plant has the property to reduce fatty acid peroxidation and inhibit fungi growth in pH = 5 - 6 by membrane damage so it is conventionally used as an effective antifungal and antibacterial ingredient. Moreover, the methanolic extract of *R. officinalis* has antioxidant properties due to the presence of phenolic compounds, rosmarinic acid, flavonoids, natural pigments such as capsaicin and curcumin, and terpenes such as carnosic acid and carnosol. A study concluded that this test formulation is effective because of synergistic anti fungal, anti inflammatory and local immunostimulatory actions of its ingredients and is safe in the management of dandruff. (Ravichandran et al 2004)

***Ziziphusspina cristi* (Christ Thorn Jujube):** The *Ziziphus spina-christi* tree, known as Sidr in Arabic, is indigenous to the Middle East including Oman, and its leaves are conventionally used by women to wash, darken and lengthen hairs. This plant has been found to have properties such as promoting the growth of thicker hair, reviving natural shine of hair, making roots strong so reducing hair loss. Being hypoallergenic, this plant adds additional texture to the hair by giving a denser look and provides more protection from the sun and daily elements. It is found to have four saponin glycosides which help in removing excess sebum without any side effects. Saponins also show antibacterial and antifungal properties which make them important ingredients of cosmetic applications. (Aghel et al, 2007)

***Matricariachamomilla* L. :** It belongs to the family Asteraceae and mainly grows in Europe, Asia and Africa. It is an annual plant. The terpenoids  $\alpha$ -bisabolol (56%), luteolin, chamazulene and azulenes are the key constituents of this plant and act as anti-inflammatory by blocking cyclooxygenase enzyme in the synthesis of prostaglandins and inhibit leukotriene formation. These compounds also slow down fungal growth. The other components of *M. chamomilla* are caffeic acid, flavonols, flavones: apigenin, glycoside, uronic acid, quercetin, rutin and a bitter substance named anthemique acid which act as a grand anti-allergic substance. Furthermore, this herb has been shown in studies to inhibit prostaglandin formation, cyclooxygenase: (COX-1), (COX-2) and central enzymes in pro-inflammatory pathways. It also blocks release of histamine which reveals its anti-inflammatory effect. (San Filippo, 2006)

***Urticadioica* L. :** It belongs to the family Urticaceae. It is found in temperate regions such as Asia, Europe and America. It is a perennial plant. Essential oils and extracts of this plant have been found to contain formic acid and acetic acid, histamine, mucilage, tannins, vitamins (A, B1, B2 and C),  $\beta$ -sitosterol, ursolic acid lutein and lycopene. These compounds have medicinal effects.  $\beta$ -sitosterol and ursolic acid in *U. dioica* inhibits the 5- $\alpha$ -reductase enzyme and promotes blood flow to nourish hair follicles.

***Menthapiperita* L. :** It is an important therapeutic plant and belongs to the family Labiate. It is a perennial plant and is common in Europe. However it is now cultivated all around the world. Leaves of *M. piperita* have 0.5 - 4% volatile oil which comprises 50 - 78% free menthol, monoterpene, menthone and menthofurane. This oil is very useful in relieving pain and improving blood flow in the scalp. The plant also contains Azulenes, carotenes, essential oil (containing  $\beta$  and  $\alpha$ -pinene), cineole, coline, limonene (1 - 5%), and flavonoids: menthoside (14 - 32%), rosmarinic acid and tannins which inhibit the growth of bacteria, fungi and yeasts. (Kumar et al., 2007)

***Salvia officinalis* L.:** It belongs to the family Lamiaceae, which is native to Mediterranean countries. It is medicinal aromatic plant containing chemical compounds such as linoleic acid, luteolin, gallic acid, ursolic acid and apigenin which are quite effective in treating dandruff and fungus. Also its constituents including rosmarinic acid, caffeic acid, gallic acid, caumarins, flavonoids, phenolic acid, tannins, 1 and 8-cineole, camphor and borneol, act as strong anti-inflammatory, antifungal and antibacterial by reducing liposomes lipid peroxidation. (Dawson et al., 2005)

The pericarp of *Spindusmukorossi*, commonly known as reetha, fruits of *Phyllanthusemblica* commonly known as Amla, and dried pods of *Acacia concinna* commonly called as Sheekakai have been conventionally used in Indian system for centuries for washing hair. Reetha and Sheekakai produce rich lather with water because of their high content of saponins. They are also observed to produce useful effects on skin and other organ systems. The *Ziziphus spina-christi* tree, known as Sidr in Arabic, is indigenous to the Middle East including Oman, and its leaves are traditionally used by women to wash, darken and lengthen hairs. It is shown to contain four saponin glycosides which help in removing excess sebum without causing adverse reactions. Saponins also exhibit antibacterial and antifungal activities that make them important ingredients of cosmetic applications. (Mainkar and Jolly, 2001)

#### IV. Formulations of herbal shampoos

In a study a polyherbal shampoo formulation containing the extracts of *Rosmarinus officinalis*, *Nigella sativa*, *Santalum album*, *Ficus bengalensis*, *Vetiverla zizanioides*, *Citrus limon* and oil of *Melaleuca leucadendron* was used by Ravichandran et.al, in 2004. The test formulation has been found to be effective due to synergistic anti fungal, anti inflammatory and local immunostimulatory actions of its ingredients. This herbal antidandruff shampoo formulation was concluded to be effective and safe in the management of dandruff (Ravichandran et.al, 2004).

Sagar et.al had formulated anti-dandruff liquid cream shampoo from active extract of *Tridax procumbens* which had been compared with standard Ketoconazole shampoo. The efficacy and safety of the formulation was proved by its evaluation using various parameters. The toxicity studies did not show any toxic effect of the formulation. (Sagar et.al, 2005)

In another study a herbal shampoo using total saponins of *Acanthophyllum squarrosum* had been formulated by Nasrin et.al, in 2007. The key objective of this study was the eradication of synthetic materials such as alkanolamides that are frequently used for the formation of stable foam, but as they produce nitrosamines hence are potentially carcinogenic compounds. The formulation was evaluated for physicochemical, organoleptic, rheological properties and its stability. The formulation was concluded to be chemically and physically stable. (Nasrin et al., 2007)

Mohamad et.al (2009) had formulated herbal shampoo powder possessing antidandruff property using *Ocimum sanctum* and *Azadiracta indica* as antidandruff agents along with *Acacia concinna*, *Hibiscus rosa sinesis*, *Trigonella foenum graecum*, *Lawsonia inermis*, *Sapindus laurifolia* as other ingredients of shampoo powder. The herbal shampoo powder was evaluated and was found to possess all characteristics of an ideal shampoo to be harmless, effective and economic. (Mohamad et al. 2009)

A completely herbal shampoo was formulated from *Asparagus racemosus*, *Acacia concin*, *Sapindus mukorossi* as main ingredients along with other herbal ingredients by Mali R et.al, 2010 and established that it is possible to formulate an entirely herbal shampoo better than the synthetic ones. To avoid the harmful effects of chemical preservatives, they formulated self preserving shampoo. Aloe vera gel and other plant extracts were used to provide the conditioning effects as they reduce the protein loss during combing and are also safer than the chemical conditioning agents. (Mali et.al, 2010)

Mc Cage et.al (2002) had formulated a herbal anti-lice shampoo by using standardized extract of thymol, Paw and tea tree oil. These ingredients have the ability to deplete ATP levels hence prevent ATP dependent pesticide resistance. The study concluded 100 % effectiveness and safety of this shampoo in removing head lice and nits. (Mc Cage et.al, 2002)

In another study, a commercially available neem shampoo based on seed extract of *Azadiracta indica* (neem tree) was compared with permethrin-based product. Neem shampoo was concluded to be more effective than the permethrin-based product. Author proposed that complex plant based compounds may replace the well defined chemical pediculicides. (Jorg et al., 2006)

#### Benefits of using natural shampoos

- Natural shampoo promotes new hair growth by naturally stimulating the hair follicles
- Infuses natural oils, minerals, and herbal extracts into hair follicles to sustain moisture and improve the overall condition of the hair



• It does not cause allergies, as it contains all natural ingredients which makes it suitable for all skin types including sensitive and allergy prone skin

• Natural shampoos attribute a more natural and mild aroma

• Natural shampoos are environmentally friendly as they are prepared from bio-degradable materials in place of harsh chemicals.

**CONCLUSION:** The formulated herbal shampoos have been found to be not only safer than the chemical shampoos, but also highly reduce the hair loss during combing as well as strengthen the hair growth. The pH of the shampoos has been adjusted to 5.5, so as to maintain the acidic mantle of scalp. The formulation of self preserving herbal shampoos, have avoided the risk posed by chemical preservatives. It is also reported that continuous use of one product loses the effectiveness over time. So we should keep changing the shampoo used over the time. There are many herbal shampoos available in the market. In the present scenario, the herbal shampoo is less popular with the consumers, although it is better in performance and safer than the synthetic ones. A more fundamental approach in popularizing herbal shampoo would be to alter the expectations of the consumer from a shampoo and to educate the consumers about the potential harmful effects of synthetic detergents and other chemical additives present in chemical shampoos.

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