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Research Article

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Physico-Chemical Evaluation and Comparative Study of Various Shampoo Samples Available in the Market

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Abstract Shampoo is the most commonly used hair care product, typically in the form of viscous liquid. Shampoos are primarily been products aimed at cleansing the hair and scalp. In the present scenario, it seems improbable that herbal shampoo, although better in performance and safer than the synthetic ones, will be popular with the consumers. Objective of this work is to find quality of shampoo. In this present study we have selected various types of shampoo for their physical and chemical analysis. We select four different brand of shampoo from the local market. Different methodologies have been used for this work. We found pH values in the range of 5.07 – 7.33, conductivity 2117 – 2993 us/cm, acidity 0.047 – 0.44 %, ash value was in between 11.76 – 14.10 %, sodium was found to be in various range between 6.3 – 46 ppm. Other parameters were also tested such as dirt dispersion, viscosity, cleaning ability, turbidity and formation of foam volume etc.

Keywords Shampoo, Physico chemical analysis, Cleansing ability, Dirt dispersion

Introduction

In India, a variety of herbs and their extracts were used as shampoos since ancient times. Earlier a very effective shampoo was made by boiling Sapindus with dried Indian gooseberry (aamla) and a few other herbs, using the strained extract. Sapindus, also known as soapberries or soapnuts, is called Ksuna in ancient Indian texts and its fruit pulp contain saponins which are a natural surfactant. The extract of soapberries, a tropical tree widespread in India, creates a lather which Indian texts called phenaka. It leaves the hair soft, shiny and manageable. Other products used for hair cleansing were shikakai (*Acacia concinna*), soapnuts (Sapindus), hibiscus flowers ritha (*Sapindus mukorossi*) and arappu (*Albizzia amara*). Background shampoos are getting more attention by the consumers as compared to soaps. Shampooing is an art by which sebum or grease produced by sebaceous gland are rinsed off from hairs making them dirt/oil free [1].

Earlier soap based shampoos were used to clean hairs and remove sebum. But study showed that these soaps did not have good leathering quality and it left some residual layers on the hair which could not easily removed and rinsed off. So no a day's modern shampoos replaces soap based shampoos with good ability to cleansing, conditioning and medicinal activities [2]. The Sebum produced on hair and scalp excreted from sebaceous gland located within hair follicles. Sebum cannot be removed simply by water because oil and water cannot be mixed well [3, 4]. Therefore, cleansing agents are used for its removal.

Shampoos are primarily been products aimed at cleansing the hair and scalp. Evaluation of shampoos comprises the quality control tests including visual assessment and physiochemical controls such as pH, density, acidity, water content and viscosity [5]. Hair is one of the external barometers of internal body conditions. Shampooing is the most commonly used form of hair treatment. The primary function of shampoo is cleansing of the hair necessitated due to accumulated sebum, dust and scalp debris etc. Various shampoo formulations are according to hair quality, hair care habit and specific problems such as treatment of oily hairs, dandruff and for androgenic alopecia. Shampoos are liquid, creamy or gel like preparations [6].

Shampoos are expected to be much more than mere cleansing agents. The findings of some investigation reveal that synthetic preservatives have sometimes been the cause of adverse effects among consumers [7].

Various types of Shampoos are in the market such as, powder shampoo, clear liquid shampoo liquid shampoo, lotion shampoo, solid gel shampoo, medicated shampoo, liquid herbal shampoo etc. Depending upon the nature of the ingredients they may be simple or plain shampoo, antiseptic or antidandruff shampoo and nutritional shampoo containing vitamin, amino acids and proteins [8].

Material and Methods

We select four different brand of shampoo available in local market such as, Dove, Head and Shoulder, Johnson and Johnson and Protein shampoo. We did study of various physical, chemical an Rheological study of these samples by different methods of analysis. All samples were measured physical and chemical properties three (triplicate) times for all parameters.

pH or Hydrogen ion concentration is determined by using 10% of soap sample. pH meter is standardised with buffer of pH 4 and 7. All samples were tested for three times and averages of all three readings were used as final reading.

Conductivity of the samples were measured by diluting shampoo sample to 10%. Conductivity is measured in us/cm. Viscosity was measured by using viscometer and it was recorded.

Acidity was determined by titrating diluted shampoo sample with standard NaOH solution with phenolphthalein indicator. Bulk density of the shampoo samples were measured by using peacnometer. Water content was determined by heating shampoo samples in the oven at controlled temperature at 105^0C for 2 hours.

Ash value was determined by heating 5.0 g of shampoo sample in crucible till char (blackish) and then kept in furnace for further burning and converted into ash. Ash value was measured until obtained a constant weight.

Cleansing action [9] - 5 grams of wool yarn were placed in used oil, after that it was placed in 200 ml. of water containing 1 gram of type of shampoo in a flask. Temperature of water was maintained at 35^0C. The flask was shaken for 4 minutes at the rate of 50 times a minute. The solution was removed and sample was taken out, dried and weighed.

The amount of oil removed was calculated by using the following equation:

$DP= 100(1-T/C)$

In which, DP is the percentage of detergency power, C is the weight of grease in the control sample and T is the weight of grease in the test sample.

Foaming capacity [10] - Foaming capacity is related to the cleansing ability of the shampoo. Foaming capacity was tested by preparing dilute sample of shampoo and kept in a measuring cylinder. Then all samples were shake well for constant time and measure foam volume formed in measuring cylinder with time. Measure foam after some time interval.

Wetting time [11, 12] - For the determination of weighting time of the shampoo, canvas peace of cloth was cut 1 sq. in and measured weight. Take dilute shampoo sample in a disc and place the piece of canvas on the shampoo sample. Then time was measured required to the cloth to begin to sink in shampoo solution and noted as a weighting time.

Dirt dispersion [13, 14] - Two drops of 10 % each shampoo solution were added in a large test tube contain 10 ml of distilled water. Then 2 drop of ink was added; the test tube was stoppered and shaken for 10 times. The amount of ink in the foam of was estimated.

Turbidity of all samples were measured by using turbidimeter. It will give idea about the clarity of the shampoo. Shampoo having more cloudiness it will show more turbidity while those are clear and transparent will show less turbidity. Turbidity measured in NTU nits. Sodium was determined by using flame photometer. Standard sodium ion solution was prepared by using NaCl salt.

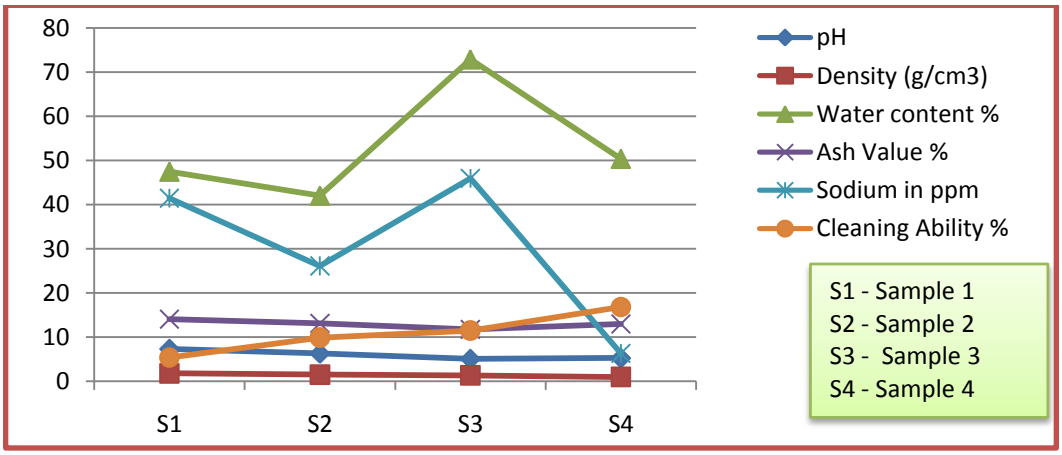
Result and Discussion

The pH of shampoos has been important for improving and enhancing the qualities of hair, minimizing irritation to the eyes and stabilizing the ecological balance of the scalp. The current trend to promote shampoos of lower pH is one of the ways to minimize damage to the hair. Mild acidity prevents swelling and promotes tightening of the scales, there by inducing shine. All the shampoos were acid balanced and were ranged 5.07- 6.31 except Head and Shoulder it shows 7.33 pH. The conductivity was found to very close to each other and in the range of 2117 – 2993 us/cm.

The rheological study shows the viscosity of samples were at variable range. It was found to be in the range of 1270 – 9850 mpas. Acidity was found in the variable range of 0.04745 – 0.4416 %. We found that there is no relation between pH of the sample and % acidity detected. Bulk density of all samples were measured in g/cm^3. All samples were high density in the range of 1.35 – 1.8 g/cm^3 except S4 shampoo was found to be 1g/cm^3. Water content was found to be the range of 42 – 50.38 % range except S3 shampoo sample. Water content of Johnson sample was very high and it was found 72 %.

Ash value measured and it was found in the range of 11.8 – 14.1 %. Ash value of all samples was found to be very close to each other.

Cleansing action of the shampoo sample was tested for its quality to remove dirt. It was tested on wool yarn which was dipped in used oil sample. Removal of oil from yarn is almost similar in all samples of shampoo. It was found in the range of 5.4 – 16.81 %. Lowest detergent capacity was shown with S1 shampoo while highest cleansing capacity was shown with Protein shampoo.



Graph 1: Comparison of some parameters with four shampoo samples

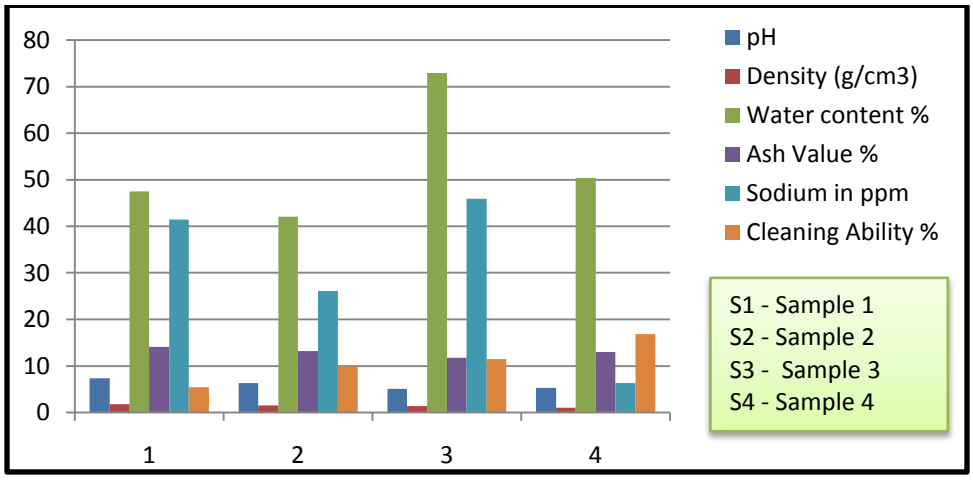
Foaming capacity was measured at certain time interval and it was found that in the range of 73–82 ml in the measuring cylinder at the initial one minute. It was reduced slowly and it was recorded in the range of 65–57. It was found that there is no direct relation between cleaning capacity and foaming capacity of shampoo samples.

Weighting time of all shampoo samples were measured by using stop watch and it was found in the range of 13 sec. to 21.5 sec. We found there is direct relation between viscosity, density and weighting time. S1 have high viscosity, high density as well as more weighting time. While S4 shampoo has low viscosity, less density and les wetting time as well.

Dirt dispersion of the shampoo was determined by knowing the concentration of ink in the foam. The foam which was more concentration of ink is the poor quality. If dirt stay in water will be difficult to rinse away and it can

deposited again on the hair. The amount of ink in the foam of S1 was low, Protein was high while S2 and S3 was evaluated as moderate.

Turbidity of the shampoo samples was found to be in the range of 136- 996 NTU. S3 shampoo which is more clear has very less turbidity while S2 shampoo has very high turbidity. Sodium was fund to be in the range of 6.3 – 45.9 ppm. S3 shampoo has high 45.9 ppm while S3 shampoo has less i.e. 6.3 ppm of sodium.



Graph 2: Comparison of some parameters with four shampoo samples

Table 1: Result of all physical and chemical parameters tested for four different shampoo samples used for analysis.

Sample / Parameter	Sample 1	Sample 2	Sample 3 (Baby)	Sample 4 (Herbal)
pH	7.33	6.31	5.07	5.26
Conductivity (us/cm)	2320.15	2410.5	2117	2993
Acidity (%)	0.0876	0.04745	0.146	0.44165
Density (g/cm3)	1.8	1.51	1.348	1
Water content (%)	47.47	42.04	72.9	50.38
Viscosity (mpas)	9850	3260	2530	1270
Ash Value (%)	14.1	13.18	11.76	12.98
Sodium (ppm)	41.44	26.12	45.94	6.31
Wetting time (Sec.)	21.5	17.4	14.4	13
Turbidity (NTU)	361	996	136	989
Cleansing ability (%)	5.4	9.9	11.5	16.81
Dirt Dispersion	Less color in foam	More color in foam	More color in foam	Very high color in foam
Foam Volume (1 min)	75	78	82	73
(after 5 min)	60	60	70	68
Solubility in Water	Turbidity with ppt	Turbidity	Clear solution no Turbidity	Turbidity

Conclusion

Based on the results of various physical and chemicals parameters tested for four different shampoo samples we found that, S4 (Herbal) shampoo has good cleansing ability, pH and wetting time as compared to other three types of shampoo. While on the basis of dirt dispersion property S1 shampoo has good quality (less color in foam) and S4 shampoo has lowest (has more color in the foam). According to solubility of the shampoo in water showed that, S3 shampoo (Baby shampoo) has no precipitate and clear solution while S1 shampoo has more ppt.

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