

Research Paper :

Natural substitute for synthetic cleaning agents

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ABSTRACT

Aritha and Shikakai, the natural cleaning agents which have been used for cleaning of ornaments since long time were used as cleaning agents for washing fabrics like cotton, wool, cots-wool, polyester cotton and polyester for the present study. A detergent was used to compare these natural cleaning agents. The cumulative property of natural and synthetic cleaning agents were also studied. Different concentrations were 0.5g/l, 1.0g/l, 2.0g/l, 3.0g/l, 4.0g/l, 5.0g/l, 6.0g/l. The ratio 50:50 was used for combination. To study the effect of cleansing agents, the fabrics were soiled with carbon emulsion using sponge for application of the soil. The washing was done in a fabricated wash wheel in the cleaning solution along with pieces of sponge to prevent redeposition of soil on the sample. The conditions for washing were M:L=1:30, temp 30C, time=15 min. The samples were assessed using grey scale. For aritha, the per cent cleaning efficiency improved when combined with detergent. It was same for acidic as well as alkali side especially for wool and wool blend. The per cent cleaning efficiency of Shikakai improved with combination with detergent. It worked better on polyester and polyester cotton than Aritha. natural cleaning agents and some what gave better results when combined with detergent.

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The progress in laundry detergents in the last few decades has already significantly improved its profile. Today the trend is towards the environmental compatibility of the detergents. Latest detergents known as compact detergents are characterized by absence of fillres and presence of correspondingly high proportion of active matter.

Soaps and detergents have been identified by the central pollution board as the product which is not eco-friendly. Certain characteristics have been laid down. According to these recommendations a detergent :

- Should be free from unpleasant odour.
- Should possess good lathering and cleaning property.
- Should be non-injurious to the fabrics washed in it.
- Should possess only those active ingredients which have a bio-degradability.

To qualify as completely biodegradable, a detergent should be made from chemicals which decomposes rapidly and under all environmental conditions. For this a natural product with cleaning ability will prove to be the best. All substances used to make the ingredients for cleaning products are found in nature. Very few substances

extracted from plants or on the earth are used without further processing to obtain ingredients that can perform a cleaning function.

Manufacturers of some of the shampoo claim the use of natural products like aritha, Shikakai and their products to make it environment friendly and safe for hair. Aritha and Shikakai, the natural cleaning agents, of the present study have been used since antiquity for cleaning metals, jewelleryes and hair.

The present research was carried out to study the cleaning efficiency of the natural cleaning agents (Aritha and Shikakai) on different fabrics with a soil (Veereghavan, 1986; Nair, 2004). It was expected that Aritha and Shikakai will give satisfactory results on wool as it is being used to clean hairs in the form of shampoo. With the change in pH i.e. to alkaline pH, these are expected to work on cotton, synthetics and blends. The extended utility of these products will help the economic conditions of tribal, who collect these products and supply to the city dwellers.

EXPERIMENTAL PROCEDURE

The experimental work included

- Preparation of samples for laundering.
- Extraction of the content from Aritha and

Shikakai.

- Laundering of soiled samples under different conditions.

Five commercially available fabrics (cotton, wool, cotswool, polyester, cotton-polyester) were with M:L ratio 1:30 (Table 1). Cotton fabric was scoured at 80°C-85°C for 45min using 5g/l soda ash. The wool and polyester fabrics were scoured at 50°C-60°C for 30min using 2.5g/l soap and 2.5g/l soda ash. The polyester cotton and cotswool fabrics were scoured at 60°C-80°C for 30min. using 2.5g/l soap and 2.5g/l soda ash. After scouring, fabrics were rinsed thoroughly in water and air dried.

Table 1: Preliminary data of the fabrics used

Sr. No.	Fibre (%content)	Fabric count	Wt/unit area (g/sq.cm)	Weave
1.	Cotton (100)	46x56	82.4	Plain
2.	Wool (100)	66x102	68.6	Twill
3.	Cotswool (60-40)	54x84	128.0	Twill
4.	Polyester cotton (60-40)	42x66	76.8	Plain
5.	Polyester (100)	48x62	72.0	Plain

For extraction, from Aritha and Shikakai, 500 g of Aritha and Shikakai were soaked in 1000 ml. of warm water separately for 12 hrs. It was then boiled for 30-40 min. Solutions were strained. Extract was made to 1000ml. Extract in different concentrations was made as needed and used for work.

Cleaning efficiency of the laundry agent is affected by pH of the solution and degree of the soiling (Somanta and Mitra, 2004). Light soiling was done for that soil was applied to the sample once. Soiled samples were washed in different cleaning agents at 30°C temp., keeping M:L ratio 1:30 for 15min. The samples were removed, rinsed three times in plain water and dried in air. Assessment for the removal of soil was done by comparing with grey scale.

OBSERVATIONS AND ANALYSIS

The data on per cent cleaning efficiency of the different fabrics has been given in Tables 2-6. From Table 2 it was observed that the cleaning efficiency of Aritha was better on wool fabric whereas for other fabrics, both the solutions under test *i.e.* Aritha and Shikakai can be used with equal efficiency. Shikakai works better on hydrophobic fabrics comparatively. Though Shikakai showed very less foaming power but per cent cleaning efficiency was better for polyester cotton and polyester fabrics (Table 3). Detergent showed maximum cleaning efficiency for polyester (Table 4).

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Table 2: Per cent cleaning efficiency of samples washed in aritha solution

Sr. No.	Conc.g/l Fabric	Per cent cleaning efficiency				
		0.0	3.0	4.0	5.0	6.0
1.	Cotton	18.7	25.0	32.5	48.7	50.0
2.	Wool	28.5	57.1	64.2	71.4	85.7
3.	Cotswool	21.3	49.9	57.1	64.2	71.4
4.	Polyester cotton	27.7	33.3	49.9	55.5	66.6
5.	Polyester	33.3	44.4	55.5	66.6	66.6

Table 3: Per cent cleaning efficiency of samples washed in Shikakai solution

Sr. No.	Conc.g/l Fabric	Per cent cleaning efficiency				
		0.0	3.0	4.0	5.0	6.0
1.	Cotton	18.7	43.7	50.0	62.5	68.7
2.	Wool	28.5	49.9	57.1	64.2	78.5
3.	Cotswool	21.3	49.9	57.1	64.2	71.4
4.	Polyester cotton	27.7	49.9	57.1	64.2	71.4
5.	Polyester	33.3	55.5	66.6	77.7	77.7

Table 4: Per cent cleaning efficiency of samples washed in detergent

Sr. No.	Conc.g/l Fabric	Per cent cleaning efficiency				
		0.0	3.0	4.0	5.0	6.0
1.	Cotton	18.7	31.2	50.5	62.5	68.7
2.	Wool	28.5	49.9	57.1	64.2	78.5
3.	Cotswool	21.3	49.9	49.9	57.1	71.4
4.	Polyester cotton	27.7	49.9	55.5	66.6	72.1
5.	Polyester	33.3	44.4	55.5	77.7	88.8

Table 5: Per cent cleaning efficiency of samples washed in aritha and detergent solutions

Sr. No.	Conc.g/l Fabric	Per cent cleaning efficiency				
		0.0	3.0	4.0	5.0	6.0
1.	Cotton	18.7	37.5	43.7	43.7	50.0
2.	Wool	28.5	49.9	57.1	71.4	78.5
3.	Cotswool	21.3	42.8	49.9	57.1	71.4
4.	Polyester cotton	27.7	38.8	44.4	55.5	61.0
5.	Polyester	33.3	44.4	55.5	66.6	77.7

Aritha showed better efficiency for wool as Aritha is slightly acidic and the positive (being acidic in nature) charges assist in cleaning process on wool fabric. Shikakai worked better on cotton and polyester-cotton. Shikakai is slightly alkaline which must have assisted in cleaning of cotton fabrics. Polyester being hydrophobic needs a

Table 6: Per cent cleaning efficiency of samples washed in shikakai and detergent solution

Sr. No.	Conc.g/l Fabric	Per cent cleaning efficiency				
		0.0	3.0	4.0	5.0	6.0
1.	Cotton	18.7	43.7	50.0	56.2	68.7
2.	Wool	28.5	49.9	57.1	64.2	78.5
3.	Cotswool	21.3	42.8	49.9	57.1	71.4
4.	Polyester cotton	27.7	49.9	55.5	66.6	72.1
5.	Polyester	33.3	55.5	55.5	66.6	63.2

solution with low wetting time which can penetrate the fabric and assist in dislocating the dirt. Detergent possess low wetting power thus suitable for polyester fabric. On wool cumulative effect of detergent and aritha showed lower cleaning efficiency when compared with cleaning efficiency of the aritha alone whereas combination of Shikakai and detergent showed improved cleaning efficiency as compared to Shikakai alone. Detergent showed better cleaning efficiency than natural cleaning agents for synthetic and its blend. For wool, cotswool and polyester-cotton cumulative effect of detergent and Shikakai showed better results.

Cleaning efficiency of any agent is influenced by the pH of the solution, so the influence of the pH on cleaning efficiency was studied on different fabrics. For which, pH of the solutions of Aritha, Shikakai, detergent and the combination of detergent with aritha and Shikakai was adjusted to 6 (acidic) by adding acetic acid and to pH 8 (alkaline) by adding sodium carbonate. The results of these solutions on different fabrics are given in Table 7-11.

For aritha solution, on cotton fabric cleaning efficiency increased with the change in the pH from acidic to alkaline medium while for wool, there was not much difference in acidic and alkaline conditions. So wool can be washed in both acidic and alkaline condition with same cleaning efficiency. It works on the acidic side because of the receptivity of aritha solution (cationic in nature) due to the presence of COOH and NH groups in the electric region of wool. On the alkaline side it is due to the swelling of the fibre. Aritha proved to be better for polyester and its blend. It gave better results in alkaline pH. Cleaning efficiency of the cotton and cotswool was affected by the pH of the solution. In Shikakai solution, with the change in pH from acidic to alkaline the cleaning efficiency

Table 7: Per cent cleaning efficiency of samples washed at different pH in Aritha solution

Sr. No.	Conc.g/l Fabric	pH 6				pH 7				pH 8			
		3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0
1.	Cotton	25.0	25.0	37.5	43.7	25.0	37.5	43.7	50.0	35.0	37.5	50.0	62.5
2.	Wool	57.1	71.4	85.7	92.8	57.1	64.2	71.4	85.7	57.1	71.4	78.5	92.8
3.	Cotswool	49.9	57.1	71.4	78.5	49.9	57.1	64.2	71.4	57.1	71.4	78.5	85.7
4.	Polyester cotton	33.3	44.4	49.9	55.5	33.3	49.9	55.5	66.6	49.9	55.5	61.0	72.1
5.	Polyester	38.8	49.9	55.5	61.0	44.4	55.5	66.6	66.6	55.5	61.0	72.1	72.1

Table 8: Per cent cleaning efficiency of samples washed at different pH in Shikakai solution

Sr. No.	Conc.g/l Fabric	pH 6				pH 7				pH 8			
		3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0
1.	Cotton	37.1	43.5	50.0	62.5	43.7	50.0	62.5	68.7	43.7	56.2	68.7	75.0
2.	Wool	49.9	64.2	78.5	85.7	49.9	57.1	64.2	78.5	57.1	64.2	78.5	85.7
3.	Cotswool	42.8	57.1	71.4	78.5	49.9	57.1	64.2	71.4	49.9	71.4	78.5	85.7
4.	Polyester cotton	44.4	49.9	55.5	66.6	49.9	55.0	66.6	77.7	55.5	60.0	72.1	83.2
5.	Polyester	55.5	61.0	66.6	72.1	55.0	66.6	77.7	77.7	61.0	66.6	72.1	77.7

Table 9: Per cent cleaning efficiency of samples washed at different pH in different solutions

Sr. No.	Conc.g/l Fabric	pH 6				pH 7				pH 8			
		3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0
1.	Cotton	37.5	43.7	56.2	62.5	31.2	50.0	62.5	62.5	43.7	56.2	68.7	75.0
2.	Wool	49.9	57.1	71.4	78.5	49.9	57.1	64.2	78.5	49.9	57.1	64.2	71.4
3.	Cotswool	42.8	57.1	64.2	71.4	42.8	49.9	57.1	71.4	49.9	57.1	64.2	71.4
4.	Polyester cotton	44.4	49.9	55.5	61.0	49.9	55.5	66.6	72.1	55.5	61.0	72.1	72.1
5.	Polyester	44.4	49.9	55.5	61.0	44.4	55.5	77.7	88.3	49.9	61.0	83.2	88.8

Table 10: Per cent cleaning efficiency of samples washed at different pH in Aritha and detergent solution

Sr. No.	Conc.g/l Fabric	pH 6				pH 7				pH 8			
		3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0
1.	Cotton	31.5	37.4	43.7	43.7	37.5	40.0	40.0	50.0	37.5	50.0	56.2	68.7
2.	Wool	49.9	64.2	71.4	85.7	50.0	57.1	71.4	78.0	49.9	64.2	71.4	85.7
3.	Cotswool	42.8	57.1	64.2	71.4	42.8	50.0	57.1	57.1	42.8	57.1	64.2	78.5
4.	Polyester cotton	33.3	38.8	44.4	55.5	38.8	44.4	55.5	61.0	44.4	55.5	61.0	72.1
5.	Polyester	44.4	49.9	61.0	72.1	44.4	55.5	66.6	77.7	49.9	66.6	77.7	77.7

Table 11: Per cent cleaning efficiency of samples washed at different pH in Shikakai solution

Sr. No.	Conc.g/l Fabric	pH 6				pH 7				pH 8			
		3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0	3.0	4.0	5.0	6.0
1.	Cotton	37.5	43.7	50.0	62.5	43.0	50.0	56.2	62.5	43.7	56.2	68.7	75.0
2.	Wool	49.9	57.1	71.4	78.5	49.0	57.1	64.2	71.4	49.9	57.1	71.4	78.5
3.	Cotswool	42.8	57.1	64.2	71.4	42.8	49.9	57.1	64.2	49.9	57.1	64.2	71.4
4.	Polyester cotton	44.4	49.9	55.5	61.0	49.9	55.5	66.6	72.1	55.5	61.0	66.6	77.7
5.	Polyester	55.5	61.0	66.6	77.7	55.5	55.5	66.6	77.7	61.0	66.6	77.7	88.8

increased to cotton and cotswool fabrics. Thus, Shikakai can be used in alkaline pH for cotton, wool, cotswool, polyester and its blend. With detergent, increased cleaning was observed on cotton fabrics with the increase in pH. For wool, the neutral pH was better. When cleaning efficiency of the natural cleaning agents was compared with their efficiency when used in combination with detergent. It was observed from Tables 10 and 11 that Shikakai is better when used alone as compared to its combination with detergent. When a part of Shikakai is replaced by detergent, the cleaning efficiency does not improve much as compared to the Aritha and Aritha-detergent combination. In combination with detergent, Aritha showed better results than Shikakai.

Conclusion:

It was observed that the natural cleaning agent Aritha proved to be better for washing of wool and cotswool. Wool fibre absorbs and retains more cleaning solution because of its better per cent wettability and hydrophilic nature. Hydrophilicity indicates that the polar portion of the molecules is repelled which is supported by lower surface tension and thus assisting in cleaning action. Aritha works better for cotswool fabric being amphoteric in nature. Detergent also showed good results for wool fabrics. This is attributed to the swelling of wool fibres in alkaline condition leading to better cleaning in alkaline conditions.

Combination of Aritha and detergent works better for cotton and cotswool fabrics. It was observed that hundred per cent soil removal was possible. The maximum soil removal was possible from polyester and wool fabric followed by poly ester-cotton, cotswool and cotton fabric. Aritha and Shikakai separately can be used for wool and polyester fabrics, respectively but its combination with detergent makes its use more versatile *i.e.* it can be used for other fabrics also.

The compact detergent produced by the combination of natural cleaning agent (Aritha and Shikakai) with the detergent will have added advantage of being (i) eco-friendly, (ii) reducing sewage problem and (iii) increased cleaning efficiency (cumulative effect) as compared to synthetic detergent.

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