SAWTRI TECHNICAL REPORT

No. 492

A Laboratory Study of the Interrelationship between wool Scouring Efficiency and the Partition of Detergent during Subsequent Centrifuging

by

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P.O. BOX 1124
PORT ELIZABETH
REPUBLIC OF SOUTH AFRICA

ISBN 0 7988 1971 5

A LABORATORY STUDY OF THE INTERRELATIONSHIP BETWEEN WOOL SCOURING EFFICIENCY AND THE PARTITION OF DETERGENT DURING SUBSEQUENT CENTRIFUGING

by T. E. MOZES, N. J. J. VAN RENSBURG and D. W. F. TURPIE

ABSTRACT

A laboratory study of the use of twenty nonionic detergents for scouring of raw wool showed that scouring efficiency decreased with an increase in the detergent partition coefficient obtained by centrifuging of artificial creams prepared with B.P. lanoline. This was the case irrespective of whether the cream was untreated, acidified to pH 5 with sulphuric acid, or treated with 1% (m/v) magnesium chloride prior to centrifuging. It was also found that the scouring efficiency increased and the detergent partition coefficient decreased with an increase in the hydrophilic-lipophilic balance (HLB) of the detergent. Further research of a selected number of detergents showed that, in certain cases, it was possible to significantly improve the scouring efficiency of the detergent by increasing its concentration in the scouring liquor while maintaining a reasonably high detergent partition coefficient.

INTRODUCTION

Studies carried out in 1975 on the unconventional scouring of raw wool[1,2] in liquors containing 5 to 10% grease clearly showed that the scouring efficiency of this system was extremely high (nearly 100%), provided the concentration of detergent in the scouring liquor was maintained at a high level (about 0,5%). The merits shown by this scouring system[3,4] motivated an in-depth study during the subsequent years. Aspects investigated included topics such as the effect of grease, suspended solids and suint on scouring efficiency, possibilities of purification and recycling of the first bowl scouring liquor and grease recovery from the system[5-9].

Earlier studies[10] showed that as much as 50% of the total available amount of detergent was present in the cream phase removed by centrifuging. The detergent-rich cream cannot be recycled to the scouring bowl, since this would increase the grease content of the liquor in the bowl to an unacceptable level. The possibility of recovery and recycling of the detergent from this cream, therefore, becomes an important area for research. It was decided to carry out a laboratory investigation into the scouring efficiency of raw wool and detergent partition into the grease phase for a variety of nonionic detergents of the polyethoxy type. The effects of treatment of the creams with sulphuric acid and magnesium chloride on the partition coefficient of the detergent during centrifuging were also studied.

There are various factors which could influence the scouring efficiency and the detergent partition coefficient, the hydrophilic-lipophilic balance (HLB) of the detergent being one of them. It is known[11-13] that the HLB has a significant effect on the wettability, emulsification abilities and detergency of a surfactant and, therefore, its effect on scouring efficiency and detergent partition coefficient was investigated during the present study.

EXPERIMENTAL

Investigation No. 1

Both the scouring efficiency of raw wool and the detergent partition coefficient of centrifuged creams were investigated using twenty different nonionic detergents of the polyethoxy type. The description and chemical structural properties of these detergents are given in Table I. The raw wool used for the scouring trials was in the form of a core sample which had been obtained from a blend of medium length merino backs of an average topmaking style and had a grease content of 17,3%.

(a) Scouring Efficiency

Scouring liquors were prepared in the laboratory by dissolving detergent in 300 mℓ water at 60°C. A 2 g sample of cored wool was then scoured for 2 min (22 up-and-down scouring cycles) in these liquors, simulating the scouring operation in the first bowl of a commercial scouring train. Three different levels of detergent were used namely 0,04, 0,07 and 0,10% (v/v). Subsequent to scouring, the wool sample was squeezed through a laboratory squeeze roller. Regain, residual grease content and bone dry clean mass of the scoured wool as well as the grease content of the scouring liquor[14] were tested and the scouring efficiency calculated using a formula suggested by Turpie[15,16].

(b) Detergent Partition Coefficient

Artificial creams were prepared by stirring a mixture containing 20% B.P. lanoline, 1% detergent and 0,2% or 1,6% suint at about 7 000 rev/min for 10 min. The suint solutions used were produced by scouring raw wool in water, followed by centrifuging to remove suspended solids. The stability of each emulsion which was obtained (at 70°C) was evaluated visually after 5 min. by measuring the height of the interface formed, the relative height being recorded on a scale of 0 to 10 (0 meaning a completely destabilised emulsion and 10 an emulsion of good stability).

TABLE I

CHEMICAL DESCRIPTION AND STRUCTURAL PROPERTIES OF THE NONIONIC DETERGENTS INVESTIGATED DURING INVESTIGATION NO 1

Detergent*	Description	HLB**	No of Ethylene Oxide groups**
A	Nonyl Phenol Ethoxylate	13,3	10
B	Octyl Phenol Ethoxylate	12,8	8,5
C	Nonyl Phenol Ethoxylate	12,8	9
D	Alcohol Ethoxylate	14,1	8
E	Alkyl Phenol Ethoxylate	13,2	6,5
F	Nonyl Phenol Ethoxylate	11,7	7
G	Nonyl Phenol Ethoxylate	12,9	9
H	Secondary Alkyl Ethoxylate	14,5	12
I	Linear Alkyl Ethoxylate	10,4	5
J	Linear Alkyl Ethoxylate	12,8	9
K	Alcohol Ethoxylate	11,2	6
L	Alcohol Ethoxylate	13,2	11
M	Nonyl Phenol Ethoxylate	10,9	6
N	Nonyl Phenol Ethoxylate	12,3	8
O	Nonyl Phenol Ethoxylate	12,8	9
P	Nonyl Phenol Ethoxylate	12,3	8
Q	Nonyl Phenol Ethoxylate	13,9	12
R	Nonyl Phenol Ethoxylate	15,0	15
S	Nonyl Phenol Ethoxylate	12,0	10
T	Nonyl Phenol Ethoxylate	12,4	12

* Names available confidentially on request
** Based on information provided by the manufacturer

The creams were then divided into three sub-samples, namely (1) untreated, (2) acidified to pH 5 with sulphuric acid and (3) treated with 1% (m/v) magnesium chloride (using a 20% solution of magnesium chloride flakes). Sub-samples (2) and (3) were stirred for 5 min at 80 rev/min. Aliquots of these creams were then transferred to a laboratory centrifuge and centrifuged at 1500 G (3 000 rev/min) for 10 min. The volumes of the grease and the aqueous phases were recorded, the detergent contents of the grease phases tested[17] (a separate calibration curve was prepared for each detergent investigated) and the detergent partition coefficient (related to the grease phase) evaluated as follows:

$$DPC = V_r \frac{C_g}{C_o}$$

where,

DPC = detergent partition coefficient (%)
V_r = volumetric fraction of grease phase after centrifuging
C_g = detergent content of grease phase (%)
C_o = detergent content of mother cream sample (%).

Investigation No. 2

Four detergents were selected from the original group of twenty (see Results and Discussion) and the interrelationship between scouring efficiency and detergent partition coefficient was studied for these detergents, at somewhat higher detergent concentrations than in Investigation No. 1. Detergent concentrations of 0,1 0,3 and 0,5% were studied in the scouring liquors and of 1%, 3% and 5% in the creams (suint content was fixed at 1%). Scouring efficiency and detergent partition coefficient were determined in the same manner as previously.

RESULTS AND DISCUSSION

Investigation No. 1

The results obtained during the scouring trials are given in Table II and those obtained during the detergent partition trials, in Table III.

Table II indicates that all the parameters tested showed a significant variation for the set of detergents investigated, the residual grease content of the scoured wool varying between 1,4 and 9,3%, the regain between 35 and 49%, m* between 1,2 and 1,9 g and the grease content of the scouring liquor between 0,1 and 0,5%.

Table III shows that, with a few exceptions, the volumetric fraction of the grease phase varied in the narrow range of 0,25 to 0,35, while the detergent content of the grease phase varied in the broad range of 0,4 to 3,7% (the original detergent content of the mother cream sample was 1%).

The calculated values for scouring efficiency and detergent partition coefficient are given in Table IV. To simplify the study of the interrelationship between the two parameters investigated i.e. scouring efficiency (SE) and detergent partition coeffient (DPC), the results given in Table IV were averaged, and the average scouring efficiency then regressed against the average detergent partition coefficients for the three experimental conditions (1), (2) and (3) (corresponding theoretically to an average suint content of 0,9%). At first, a power curve was fitted to the data. This showed only slight

*** The mass of a 2 g sub-sample of bone dry scoured wool after handwashing and drying (g).**

TABLE II

RESULTS OBTAINED DURING THE SCOURING TRIALS (INVESTIGATION NO. 1)

Detergent	Residual grease content of scoured wool (%) for a detergent content (%) of			Regain of scoured wool (%) for a detergent content (%) of			Value of m* (g) for a detergent content (%) of			Grease content of scouring liquor (%) for a detergent content (%) of		
	0,04	0,07	0,10	0,04	0,07	0,10	0,04	0,07	0,10	0,04	0,07	0,10
A	3,1	2,4	1,7	49	42	46	1,7	1,7	1,9	0,4	0,3	0,1
B	4,7	2,6	1,6	38	42	35	1,3	1,7	1,8	0,4	0,5	0,3
C	2,7	2,0	2,5	44	42	40	1,8	1,8	1,7	0,3	0,3	0,4
D	3,4	1,8	1,8	45	42	39	1,7	1,8	1,9	0,2	0,2	0,1
E	5,2	2,8	2,0	47	38	34	1,7	1,7	1,7	0,1	0,1	0,1
F	6,0	3,1	6,0	41	42	36	1,6	1,7	1,5	0,1	0,1	0,1
G	3,6	2,8	3,3	44	42	41	1,7	1,9	1,8	0,2	0,2	0,2
H	5,6	2,0	1,4	41	44	38	1,6	1,7	1,8	0,1	0,1	0,3
I	9,3	7,0	6,3	42	40	39	1,5	1,6	1,6	0,1	0,1	0,2
J	2,8	2,0	2,3	41	39	37	1,7	1,7	1,7	0,1	0,1	0,1
K	8,4	7,2	7,2	42	38	42	1,6	1,3	1,8	0,1	0,1	0,3
L	5,2	2,0	2,1	43	39	39	1,7	1,8	1,8	0,1	0,1	0,1
M	2,2	7,4	7,0	37	37	35	1,4	1,2	1,5	0,1	0,2	0,2
N	6,7	3,7	4,1	40	47	35	1,5	1,7	1,7	0,1	0,2	0,3
O	4,1	2,4	3,4	44	44	44	1,7	1,8	1,7	0,1	0,1	0,1
P	5,3	3,4	2,4	39	40	45	1,6	1,7	1,9	0,2	0,3	0,1
Q	3,1	2,8	3,1	38	41	42	1,7	1,6	1,7	0,1	0,1	0,1
R	4,3	3,4	1,5	41	41	44	1,7	1,7	1,8	0,1	0,1	0,1
S	6,8	7,4	3,6	43	41	43	1,6	1,7	1,8	0,1	0,1	0,1
T	5,3	3,7	3,3	39	40	38	1,4	1,6	1,7	0,1	0,1	0,1

* The mass of a 2 g sub-sample of bone dry scoured wool after hand-washing and drying (g).

TABLE III

RESULTS OBTAINED DURING THE DETERGENT PARTITION TRIALS (INVESTIGATION NO. 1)

Detergent	Emulsion stability of artificial cream containing 1% detergent and		Volumetric fraction of grease phase obtained by centrifuging of artificial cream containing 1% detergent and						Detergent content (%) of grease phase obtained by centrifuging of artificial cream containing 1% detergent and					
	0,2% Suint	1,6% Suint	0,2% Suint			1,6% Suint			0,2% Suint			1,6% Suint		
			(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
A	10	10	0,33	0,30	0,26	0,31	0,33	0,26	1,1	0,9	0,9	1,1	1,1	1,2
B	10	10	0,40	0,34	0,32	0,34	0,30	0,32	1,3	1,1	1,1	1,8	1,5	1,4
C	10	10	0,29	0,30	0,28	0,32	0,32	0,33	1,3	1,1	1,1	1,3	1,3	1,3
D	10	10	0,15	0,23	0,32	0,31	0,32	0,33	1,2	1,3	1,5	1,2	1,2	1,2
E	10	10	0,33	0,34	0,33	0,33	0,35	0,33	1,2	0,8	1,0	1,1	1,0	1,0
F	10	10	0,33	0,26	0,26	0,30	0,34	0,30	1,7	2,0	1,9	1,5	1,6	1,3
G	10	10	0,30	0,25	0,31	0,29	0,30	0,29	1,3	1,4	1,4	1,4	2,2	2,1
H	10	9	0,37	0,33	0,31	0,34	0,32	0,32	0,6	0,5	0,4	0,7	0,7	0,8
I	10	10	0,32	0,32	0,31	0,29	0,30	0,31	1,6	2,5	2,2	2,2	2,1	2,3
J	10	9	0,31	0,29	0,27	0,33	0,28	0,31	1,1	1,1	1,3	1,0	1,2	1,3
K	10	10	0,33	0,29	0,28	0,35	0,32	0,29	1,7	1,8	2,1	1,7	1,9	1,8
L	10	8	0,28	0,34	0,28	0,30	0,29	0,28	0,8	0,8	0,9	1,1	0,9	1,1
M	10	6	0,33	0,28	0,28	0,29	0,29	0,28	2,6	2,7	3,4	3,6	3,7	3,2
N	10	10	0,29	0,27	0,29	0,28	0,32	0,29	1,4	1,4	1,2	1,3	1,5	1,2
O	10	10	0,32	0,31	0,26	0,34	0,32	0,32	1,2	1,2	0,9	1,3	1,3	1,4
P	10	9	0,33	0,29	0,29	0,31	0,34	0,28	1,1	1,1	0,9	0,8	1,0	0,9
Q	10	8	0,30	0,27	0,24	0,28	0,31	0,28	0,8	0,6	0,7	1,0	0,9	0,8
R	10	9	0,32	0,28	0,28	0,32	0,35	0,31	0,6	0,4	0,5	0,6	0,7	0,6
S	10	9	0,29	0,32	0,31	0,29	0,31	0,28	1,8	1,9	2,5	1,8	1,9	2,1
T	10	9	0,29	0,32	0,29	0,33	0,27	0,30	1,3	1,4	1,5	1,3	1,5	1,6

(1) – Untreated; (2) – Acidified to pH 5 with sulphuric acid; (3) – Treated with 1% (m/v) magnesium chloride

curvature and so a linear regression was considered to be adequate. The following equations were found to be significant at the 99% level of confidence:

$SE = 96,8 - 0,30\,(DPC_1)$ ..... (1)
$n = 20$; $r = 0,72$; % fit = 52%

$SE = 97,8 - 0,32\,(DPC_2)$ ..... (2)
$n = 20$; $r = 0,81$; % fit = 65%

and

$SE = 95,9 - 0,28\,(DPC_3)$ ..... (3)
$n = 20$; $r = 0,73$; % fit = 54%

where

SE = scouring efficiency (%)
DPC_1 = detergent partition coefficient for experimental condition (1) (%)
DPC_2 = detergent partition coefficient for experimental condition (2) (%)
DPC_3 = detergent partition coefficient for experimental condition (3) (%)

Since the confidence limits given by these regression lines overlapped, it was decided to pool the three sets of data and to regress the average scouring efficiency against the overall average partition coefficient. The following general equation was found to be significant at the 99% level of confidence:

$SE = 98,0 - 0,33\,(DPC)$ ..... (4)
$n = 20$; $r = 0,78$; % fit = 61%

where

DPC = general detergent partition coefficient (%).

Equation (4) clearly shows that the *scouring efficiency decreased* with an increase in *detergent partition coefficient,* irrespective of the type of treatment applied to the cream. From the data given in Table IV, it is clear that it was not possible to obtain a high detergent partition coefficient when a high scouring efficiency was obtained and vice versa. The relationship is illustrated in Fig. 1

The interrelationship between scouring efficiency and detergent partition coefficient was considered to be governed by many parameters. Of all these parameters two seemed particularly important, i.e. the HLB and the number of ethylene oxide groups, both characteristic of the type of detergent studied.

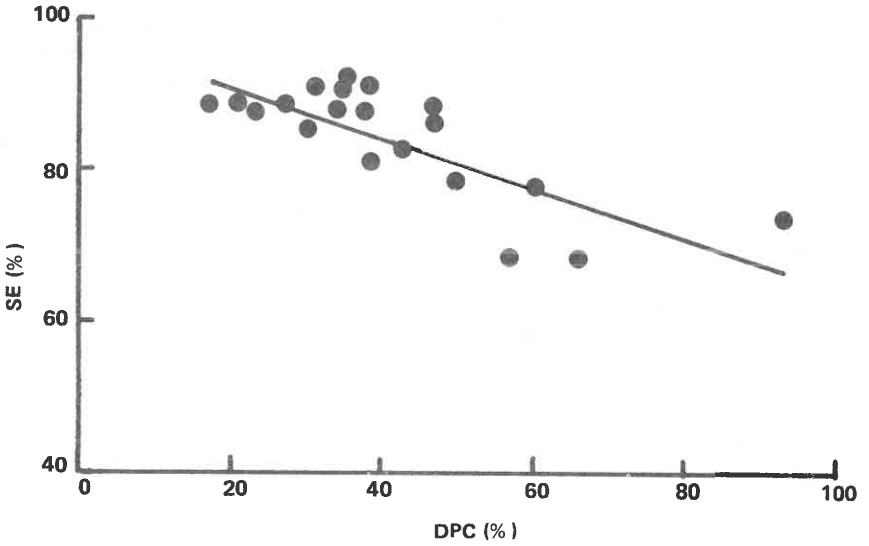

FIGURE 1
Interrelationship between scouring efficiency (SE) and detergent partition coefficient (DPC) (Investigation No. 1).

Quadratic regressions were carried out on the data shown in Table IV together with the data for HLB and number of ethylene oxide groups given in Table I. The following equations were found to be significant at the 99% level of confidence:

$DPC_1 = 195 - 12{,}1\ (HLB)$ ..... (5)
$n = 20;\quad r = 0{,}81;\quad \%\ fit = 66\%$

$DPC_2 = 214 - 13{,}5\ (HLB)$ ..... (6)
$n = 20;\quad r = 0{,}89;\quad \%\ fit = 79\%$

$DPC_3 = 205 - 12{,}9\ (HLB)$ ..... (7)
$n = 20;\quad r = 0{,}80;\quad \%\ fit = 64\%$

and

$SE = 46{,}8\ (HLB) - 1{,}64\ (HLB)^2 - 243$ ..... (8)
$n = 20;\quad r = 0{,}93;\quad \%\ fit = 86\%$

where

HLB = hydrophilic-lipophilic balance of the detergent.

TABLE IV

CALCULATED VALUES FOR SCOURING EFFICIENCY AND DETERGENT PARTITION COEFFICIENT (INVESTIGATION NO. 1)

Detergent	Scouring efficiency (%) of liquor for a detergent content (%) of			Detergent partition coefficient (%) obtained by centrifuging of artificial cream containing 1% detergent and					
				0,2% Suint			1,6% Suint		
	0,04	0,07	0,10	(1)	(2)	(3)	(1)	(2)	(3)
A	89	91	94	35	27	23	35	36	31
B	77	91	94	53	36	35	62	45	45
C	90	93	91	36	34	31	42	40	43
D	87	94	94	18	30	48	36	39	39
E	80	90	93	40	26	34	35	34	32
F	76	88	74	57	51	50	45	55	39
G	86	90	88	39	34	43	40	65	60
H	78	93	95	22	16	13	23	23	24
I	61	71	74	51	81	67	63	62	72
J	89	93	91	33	33	35	34	34	39
K	66	66	75	57	52	59	61	61	52
L	81	93	93	22	26	26	32	26	31
M	90	60	71	86	74	96	106	106	90
N	71	86	85	41	39	35	37	46	35
O	86	90	88	37	37	24	43	42	44
P	79	87	92	35	30	26	26	33	26
Q	88	89	88	25	17	17	27	27	22
R	84	87	95	18	11	13	18	23	19
S	73	73	87	53	61	76	52	57	58
T	76	85	87	38	45	45	44	41	47

(1) – Untreated; (2) – Acidified to pH 5 with sulphuric acid; (3) – Treated with 1% (m/v) magnesium chloride

It is interesting to note that all the parameters investigated were independent of the number of ethylene oxide groups of the detergent. Since the confidence limits given by the three regression lines (5) to (7) overlapped, it was decided to pool the respective sets of data. The following general equation was found to be significant at the 99% level of confidence:

$$DPC = 204 - 12{,}8\,(HLB) \quad \ldots\ldots (9)$$
$$n = 20; \quad r = 0{,}85; \quad \%\ \text{fit} = 73\%$$

Equations (8) and (9) are illustrated in Fig 2. The opposite trend shown by both dependent variables in the figure provides a possible explanation for the

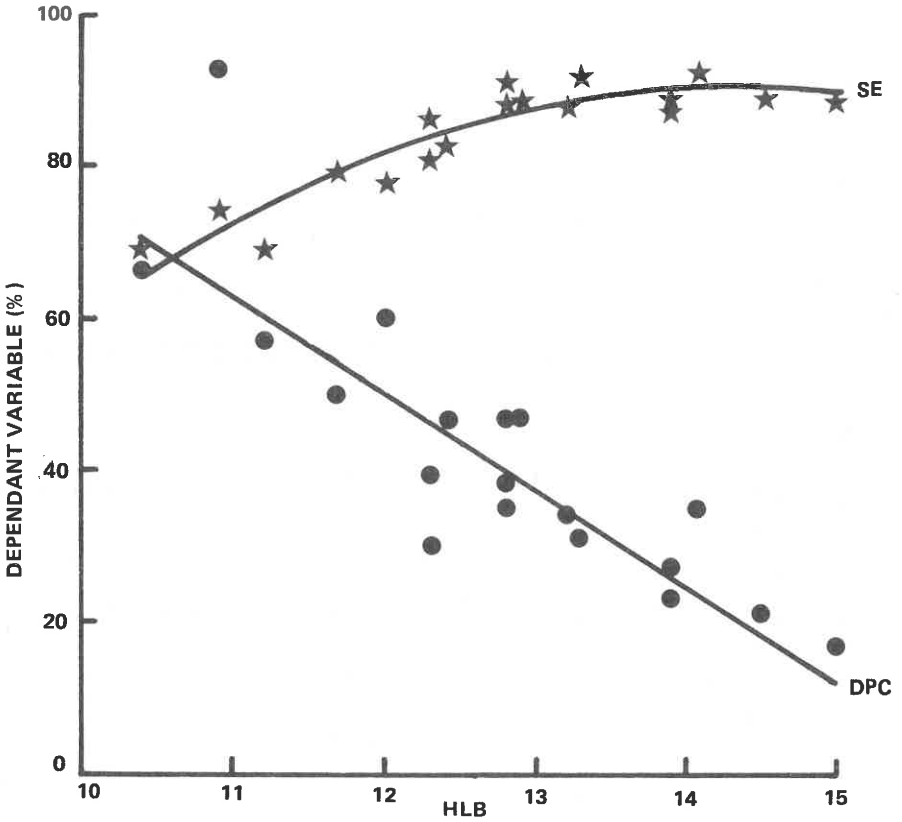

FIGURE 2
Interrelationship between (1) scouring efficiency (SE) and HLB and (2) detergent partition coefficient (DPC) and HLB (Investigation No. 1).

decreasing relationship between these two variables reported previously (equation (4)).

Table III also contains the data relating to emulsion stability of the artificial creams, as obtained for the detergents investigated. The table shows that the stability of the artificial creams was good (10) when the suint content was low (0,2%) and slightly lower (8 to 10) when the suint content was higher (1,6%).

Investigation No. 2

Three detergents were selected from the set of twenty studied during the present investigation, based on their comparatively high detergent partition and emulsion stability of the cream. These were detergents B, I and K. Detergent A was added to the list of detergents studied in this investigation for purposes of comparison, since it was the detergent used during many years for scouring at SAWTRI.

During the present investigation, scouring efficiency was studied for a range of detergent contents in the liquor i.e. 0,1 to 0,5% while the detergent partition was studied for a range of detergent contents in the cream from 1 to 5%. The overall aim of this investigation was to ascertain whether it was possible to improve the scouring efficiency to a reasonable level while maintaining a relatively high detergent partition.

The results obtained during the scouring trials are shown in Table V and those obtained during the detergent partition trials in Table VI.

Table V indicates that the parameters tested varied somewhat, the residual grease content of scoured wool varying between 1,1 and 9,8%, the regain between 34 and 45%, the value of m between 1,7 and 1,9 g and the grease content of the scouring liquor between 0,1 and 0,7%.

Table VI shows that, with a few exceptions, the volumetric fraction of the grease phase varied between 0,19 and 0,36. The detergent content of the grease phase depended on the detergent content of the original cream sample and varied between 1,0 and 2,4% for an original detergent content of 1%, between 1,9 and 3,9% for an original detergent content of 3% and between 2,3 and 5,5% for an original detergent content of 5%.

The calculated values for scouring efficiency and detergent partition coefficient are given in Table VII. The table shows that when detergent levels in the scouring liquor were increased to the range of 0,1 to 0,5% the scouring efficiency of all detergents improved, that of detergent B becoming, in general, slightly better than that of detergent A and that of detergent K slightly worse. The scouring efficiency of detergent I, however, was not as good as any of the others.

TABLE V

RESULTS OBTAINED DURING THE SCOURING TRIALS (INVESTIGATION NO. 2)

Detergent	Residual grease content of scoured wool (%) for a detergent content (%) of			Regain of scoured wool (%) for a detergent content (%) of			Value of m* (g) for a detergent content (%) of			Grease content of scouring liquor (%) for a detergent content (%) of		
	0,1	0,3	0,5	0,1	0,3	0,5	0,1	0,3	0,5	0,1	0,3	0,5
A	2,5	1,9	1,1	38	37	38	1,8	1,9	1,9	0,3	0,5	0,7
B	1,7	1,6	1,1	42	35	34	1,8	1,8	1,9	0,2	0,4	0,5
I	9,8	4,1	4,8	42	42	45	1,7	1,7	1,8	0,2	0,3	0,5
K	3,5	2,2	1,9	38	37	37	1,8	1,7	1,8	0,1	0,3	0,5

* The mass of a 2 g sub-sample of bone dry scoured wool after hand-washing and drying (g).

TABLE VI

RESULTS OBTAINED DURING THE DETERGENT PARTITION TRIALS (INVESTIGATION NO. 2)

Detergent	Volumetric fraction of grease phase obtained by centrifuging of artificial cream containing 1% suint and									Detergent content (%) of grease phase obtained by centrifuging of artificial cream containing 1% suint and								
	1% Detergent			3% Detergent			5% Detergent			1% Detergent			3% Detergent			5% Detergent		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
A	0,33	0,33	0,27	0,29	0,35	0,31	0,31	0,34	0,33	1,0	1,1	1,3	1,9	2,1	2,3	3,0	3,1	3,3
B	0,31	0,28	0,22	0,26	0,27	0,23	0,33	0,25	0,19	1,7	1,7	1,9	2,1	1,9	2,2	2,3	2,5	2,5
I	0,35	0,36	0,28	0,16	0,32	0,35	0,29	0,29	0,26	2,4	2,2	2,4	3,8	3,8	3,9	4,4	4,3	4,3
K	0,29	0,30	0,28	0,28	0,28	0,26	0,36	0,53	0,56	2,0	2,4	2,2	3,5	3,2	3,3	5,5	5,2	4,7

(1) – Untreated (2) – Acidified to pH 5 with sulphuric acid (3) – Treated with 1% (m/v) magnesium chloride

TABLE VII

CALCULATED VALUES FOR SCOURING EFFICIENCY AND DETERGENT PARTITION COEFFICIENT (INVESTIGATION NO. 2)

Detergent	Scouring efficiency (%) of liquor for a detergent content (%) of			Detergent partition coefficient (%) obtained by centrifuging of artificial cream containing 1% suint and								
				1% Detergent			3% Detergent			5% Detergent		
	0,1	0,3	0,5	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
A	91	94	96	32	37	34	18	25	24	19	21	21
B	94	94	96	54	48	42	19	17	17	14	12	10
I	62	84	83	83	79	67	20	40	45	26	25	22
K	87	92	93	58	71	63	33	30	29	40	55	53

(1) – Untreated (2) – Acidified to pH 5 with sulphuric acid (3) – Treated with 1% (m/v) magnesium chloride

It is also apparent from Table VII that the two detergents mentioned before i.e. detergents B and K showed significantly better detergent partition coefficients than that of detergent A for a detergent content of 1% in the cream, these being 42 to 54% and 58 to 71%, respectively, compared with 32 to 37% for detergent A. The levels of detergent partition coefficient shown by these two detergents, however, deteriorated with an increase in the original detergent content of the cream from 1 to 5%. On the whole, detergent K showed a significantly higher average detergent partition coefficient (48%) than detergents A and B (26% for both cases). Finally, the emulsion stability of the creams investigated was good irrespective of the detergent content and particular detergent investigated.

SUMMARY AND CONCLUSIONS

The raw wool scouring efficiency of twenty different nonionic detergents and the partition of these detergents to the grease phase obtained by centrifuging of artificially created creams were investigated. Two investigations were carried out. In the first investigation, the scouring efficiency was evaluated for various levels of detergent in the scouring liquor in the range of 0,04 to 0,1% and the detergent partition was investigated for creams containing 20% grease, 1% detergent and two levels of suint, i.e. 0,2 and 1,6%. Three different experimental conditions prior to centrifuging were investigated i.e. no treatment, acidification to pH 5 with sulphuric acid and addition of 1% (m/v) magnesium chloride.

It was found that, in general, scouring efficiency decreased with an increase in the detergent partition coefficient, irrespective of whether the cream had been destabilised or not prior to centrifuging. It was found that scouring efficiency increased with an increase in the hydrophilic-lipophilic balance (HLB) of the detergent and that the detergent partition coefficient decreased with an increase in the HLB. This finding was in line with the inter-relationship between scouring efficiency and detergent partition coefficient referred to above. It was finally concluded that, under the particular conditions investigated, it was not possible to obtain a high detergent partition coefficient when a high scouring efficiency was obtained and vice versa.

In the second investigation, four selected detergents were investigated. Scouring efficiency was evaluated for various detergent levels in the scouring liquor ranging from 0,1 to 0,5% (v/v) and detergent partition coefficient for various detergent levels in the cream ranging from 1 to 5%.

It was found that one of the detergents studied (K) showed a level of scouring efficiency similar to that of the control when the level of detergent in the scouring liquor was between 0,1 and 0,5% while generally providing a significantly better detergent partition coefficient.

ACKNOWLEDGEMENTS

The authors would like to thank the South African Wool Board for permission to publish this paper. The authors would also like to thank Mrs M. S. Heideman, Mr E. F. Pretorius and Miss P. Kerchhoff for assistance with the technical work and Mr E. Gee and his staff for carrying out the statistical analyses.

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Published by
The South African Wool and Textile Research Institute,
P.O. Box 1124, Port Elizabeth, South Africa,
and printed in the Republic of South Africa
by Nasionale Koerante Beperk, P.O. Box 525, Port Elizabeth.

ISBN 0 7988 1971 5