# SAWTRI BULLETIN



SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH INSTITUTE
OF THE CSIR

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The following extract taken from Dr Garbers' address aptly expresses SAWTRI's belief in its approach to its work on behalf of the textile industry of South Africa.

> "The challenge facing the CSIR with its 24 institutes, units and groups is to find solutions to the problems of the future through basic scientific research. We also strive to render high level service to industry without entering into competition with industry. We assist in solving the problems encountered in industry and, in particular, also encourage innovation. The speed with which new knowledge is generated makes an effective mechanism for the dissemination of information to the South African scientific and industrial community essential in addition to the major task of scrutinizing developments in other parts of the world for adaptation to suit local conditions."

**Chief Director Addresses CSIR Guests**

During their tour of the Institute, Dr Turpie addressed CSIR guests and Council members on some aspects of SAWTRI's research work and achievements. Highlights of his address included:

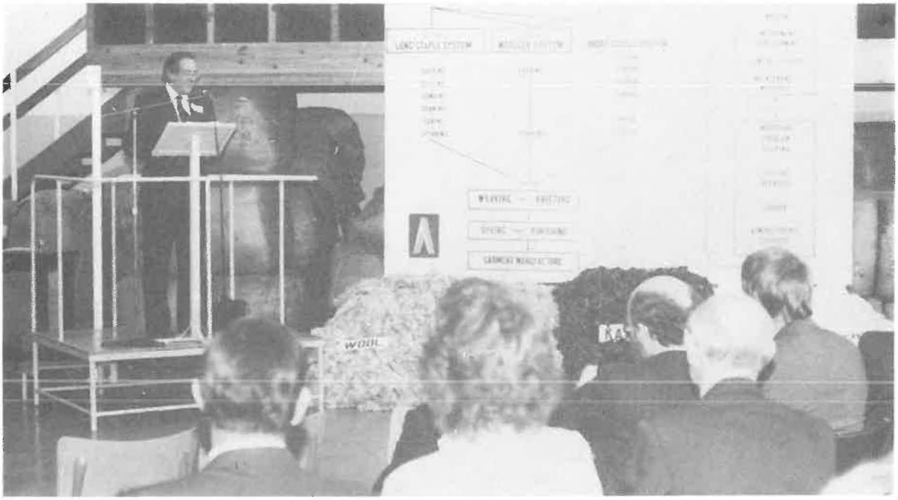
- the development of a process for the treatment of sludges and also creams from wool scouring;
- the creation of a set of data on the characteristics and processing behaviour of South African wools;
- pioneering work on the specialised conditions required for processing mohair which is leading to the creation of data on its processing performance.

**Dr C. F. Garbers, President of the CSIR, addressing guests at the CSIR reception.**

**Dr D. W. F. Turpie, Chief Director of SAWTRI, delivering his address on aspects of SAWTRI's research.**

**Mr M. A. Strydom explaining the action of a wool comb to some of the guests touring the Institute.**

**Mr Hannes van der Merwe pointing out an aspect of woollen processing to members of the group of visitors to SAWTRI.**



**Dr D. W. F. Turpie addressing the touring party in the Scouring Department**

Dr Turpie said that although studies in Woollen Processing had only recently begun it had already been shown that the popular Lambswool and Shetland-type yarns and garments can be made with a careful selection of South African wools. In the Shetland class bleached karakul showed great promise.

Expertise and facilities in Cotton Research have reached a stage where SAWTRI can make an important contribution. Information has been compiled on the characteristics of the various cultivars grown in South Africa and the work is being extended to cover processing performance from ginning through to spinning.

Unfortunately, because of the limited time available, guests were not able to visit the many Laboratories and research support services at the Institute but Dr Turpie stressed the importance of the work in the departments of Textile Chemistry, Textile Physics and Statistics all of which had played a major role in all developments. In the fields of Knitting and Weaving much work had been devoted to the development of new and novel yarns and fabrics concentrating on lightweight fabrics where natural fibres such as wool and mohair are at a particular disadvantage.

Referring to the very important role that dyeing and finishing play in the textile industry Dr Turpie said that SAWTRI was well equipped in this field. He said that the work had to cover a very wide spectrum ranging from fundamental studies in textile chemistry to the practical application of technology. Recent major contributions made by this department were the development of a shrinkresist process for wool tops (see below) and significant work in the application of radio frequency dyeing of both natural and synthetic fibres.

SAWTRI's Machine Development Department had developed a number of new machines and instruments important among these were;

- a Friction Tester
- a Withdrawal Force Tester
- a Compressibility Tester
- an Autocreel
- a Sliver Linear Density Monitor
- the SAWTRI Comb

Some of these developments have been licenced to overseas manufacturers.

**SAWTRI Announces new Wool Top Shrinkresist process**

In his address to CSIR guests and Council members on the 15th June, the Chief Director, Dr D. W. F. Turpie, announced the development of a new shrinkresist process for wooltop for which patents had been applied. He said that this important development had recently been licenced and introduced to a South African textile mill. Advantages over existing processes were its cost and simplicity.

**SAWTRI now possesses a Carbonising Facility**

The Institute has embarked on another field of research following modifications of the existing scouring machinery to include a carbonising facility. Apart from research in this area, this will provide a valuable source of raw material for the Woollen Processing department which frequently makes use of carbonised wools in its blends.

**Assistant Director Promoted**

Following Dr D. W. F. Turpie's promotion to Chief Director announced in the March Bulletin, the CSIR Executive has announced the promotion of the Assistant Director, Dr L. Hunter, to the position of Director.

**Senior Staff Members Attend Cotton Symposium in Swaziland**

SAWTRI's Director, Dr L. Hunter and Mr Keith Sanderson, Acting Head of Short Staple Processing at SAWTRI, were invited to attend and read papers at a cotton seminar organised by the Consolidated Frame Cotton Corporation Ltd and Tongaat Ltd in Swaziland from 12 to 16 May, 1983. The object of the seminar was to create a forum for discussion on the state of the art involving cotton growing, breeding, harvesting, ginning, testing and marketing systems. Mr Sanderson dealt with the question whether maturity could be predicted from micronaire within a particular cultivar and Dr Hunter addressed the delegates on the effect of cotton fibre properties on spinning performance and yarn properties.

**Chief Director's Overseas Visit**

The Chief Director left for London on May 13th. From there he travelled to Ilkley where he attended the annual meeting of the IWS Research and Development Committee. He then proceeded to Selkirk where, on May 23 and 24, he had discussions with Dr R. Harwood, Head of Technology of the Scottish College of Textiles. He also visited Tathams and Petrie and McNaught in Rochdale, Gemmill and Dunsmore in Preston, the Textile Institute in Manchester and the Headquarters of the International Mohair Association in London before departing for Italy where he was joined by Mr J. Cizek, Head of SAWTRI's Machine Development Department. They proceeded to Imola where they attended a steering committee meeting on the SAWTRI/SAVIO comb project. They inspected progress with the Autocreel and had general discussions on various aspects of this invention. This was followed by a visit to Cerimates, the research centre for SAVIO's machine development in Pordenone. Dr Turpie then attended the IWTO Conference in Copenhagen, Denmark, from 6—9 June, returning to South Africa on June 11th.

**Albany Farmers' Union's Visit to SAWTRI**

Some 50 wool and mohair growers from Albany and members of the Albany Farmer's Association and their wives were received at SAWTRI on 3 May. Mr N. J. Vogt, Group Leader for Publications and Information addressed the visitors on matters relating to research carried out towards promoting wool and mohair and the position of SAWTRI as a national research institute in the entire CSIR organisation. The group was taken on a conducted tour of the Institute.

**Overseas Visitors to SAWTRI**

Dr Riccardo Osella of the Italian firm Filatura di Grignasco paid a visit to SAWTRI for general discussions on wool processing on 23 March.

On 5 May, Mr I. Itoh, Assistant Manager, Wool Department of Kanematsu-Gosho Ltd, Osaka, Japan, had discussions with senior staff members.

Dr T. Bürgie and Mr S. Maset of Manifattura di Gemona, Italy, visited the Institute on May 12th.

Mr V. Pieragnoli of Lineapeo, Italy, and Dr G. P. Simonetti of Commercio Materie Prime Tessili, Biella, Italy, visited the Institute on 24 May. As large users of mohair they discussed mohair processing and research with the relevant SAWTRI staff members.

On 2 June, Messrs R. L. Bullock and R. M. Murdock of the American Felt and Filter Company in New York came to SAWTRI for discussions on the processing of South African Wools with particular reference to feltability.

**Delegates to the Cotton Seminar inspecting a cotton field in Swaziland.**

**Dr D. W. F. Turpie, extreme right, with staff members involved in setting up the carbonising facility recently commissioned at SAWTRI. Dr Turpie is discussing crushed carbon material containing wool emerging from the crushing machine with Dr N. J. J. van Rensburg, centre, and Dr T. E. Mozes, left.**

## SAWTRI Publications

Since the previous edition of the Bulletin, the following publications by SAWTRI authors have appeared:

### SAWTRI Technical Reports

No. 514: Hunter, L., Leeuwner, Williena, Smuts, S. and Strydom, M. A., *The Correlation between Staple Strength and Single Fibre Strength for Sound and Tender Wools.*

No. 515: Van Rensburg, H. L. J., Hunter, L. and Smuts, S., *The Effect of Wool and Mohair Fibre Properties on Yarn Flexural Rigidity.*

No. 516: Garner, E., *Continuous Dyeing Using Radio Frequency Energy,* Part IV: *The Fixation of Disperse Dyes on Predried Polyester.*

No. 517: Maasdorp, A. P. B. and Black, Wendy., *A Colorimetric Estimation of the Degree of Photochemical Degradation of Polypropylene Films.*

No. 518: Strydom, M. A., *The Spinning Performance and Yarn Properties of Blends of Synthetics with Animal Fibres.* Part I: *The Mean Spindle Speed at Break for Wool/Polyester Blends.*

No. 519: Robinson, G. A. and Gee, E., *The Bond Peel Strength of Fused Fabrics.* Part I: *The Effect of Fusing Conditions, Wetting and Dry-Cleaning.*

No. 520: Smuts, S. and Hunter, L., *The Effect of Some Yarn and Fabric Structural Variables on Woven Wool Fabric Properties.* Part I: *Thermobench Wrinkle Recovery.*

No. 521: Hunter, L., Gee, E. and Sanderson, K., *Some Properties of Various Cotton Cultivars Grown in South Africa from 1977 to 1979.*

# A NOTE ON THE EFFECT OF NONIONIC DETERGENT TYPE AND HLB ON THE LABORATORY SCOURING OF BACKS

*by T.E. MOZES*

## ABSTRACT

*A laboratory investigation was carried out using a four-bowl laboratory scour to study the effect of type of nonionic detergent (nonylphenol, octylphenol and linear alkyl polyethoxylate) and HLB (10,9 to 15,0) on both the first-bowl and the overall scouring efficiencies in terms of grease removal. It was found that the first-bowl scouring efficiency was best for the linear alkyl polyethoxy type of detergent and an HLB of 15. The overall scouring efficiency was, in general, high (97 to 100%), independently of the parameters investigated.*

## INTRODUCTION

The effect of HLB of a nonionic detergent on wettability, emulsification abilities and detergency has been widely studied and reported in the literature[1-3], although little has been reported in the field of wool scouring. In this particular field, Wood[4] studied the effect of type of nonionic detergent in the CSIRO jet scouring process and found that the nonylphenol polyethoxy type was more efficient than the octylphenol polyethoxy type, best results being obtained with 9 or 10 ethylene oxide groups present.

A laboratory study was carried out at SAWTRI[5] to investigate the interrelationship between wool scouring efficiency and the partition of detergent into the cream phase during subsequent centrifuging of the scouring liquor and it was found, amongst others, that the scouring efficiency increased with an increase in HLB. However, in that study scouring of relatively small wool samples was undertaken in only one beaker and it was therefore important to expand the scope of the study to involve larger quantities of wool and four bowls.

## EXPERIMENTAL

Scouring experiments were undertaken using a four-bowl laboratory scour (bowl capacity 15 ℓ each), the last bowl being used as a rinse bowl. A specially lapped pair of laboratory squeeze rollers was used for the squeezing of the wool while being transferred manually from bowl to bowl. Temperatures of 60, 60, 50 and 40°C were maintained in the bowls throughout scouring.

Inferior style backs (grease content 14,3%) were used for all the experiments. The raw wool was carefully blended, packed and cored and thereafter sub-divided into eight equal lots. A total of eight experiments was then carried out, a different nonionic detergent (Table 1) being used in each experiment to scour a total of 8,25 kg of raw wool. For practical purposes, it was decided to scour in each experiment 15 subsamples of raw wool (0,55 kg each) in succession and to monitor scouring efficiency in Bowls 1 and 4.

Preliminary trials showed suitable initial charges of detergent to be 15, 12 and 5,5 mℓ and supplementary additions after each successive 0,55 kg subsample to be 10, 12 and 4 mℓ for Bowls 1, 2 and 3, respectively. These additions corresponded to 0,10, 0,08 and 0,04% (v/v) in the first case and to 0,07, 0,08 and 0,03% (v/v) in the second case.

Residence time of the wool in the first two bowls was fixed at 2 min and that in the last two bowls at 1 min. Each raw wool subsample was dunked at a rate of 11 times/min in the bowls throughout the investigation. The level of contaminants in the various bowls was allowed to increase during the scouring of the first six subsamples in each experiment and then a backflow from Bowl 4 to Bowl 1 of 0,825 ℓ/subsample was established until the end of the experiment. Furthermore, after scouring of each subsample 7,5 ℓ rinse water was discarded and an equal amount of fresh water introduced into Bowl 4.

Scoured wool samples obtained from the squeeze rollers after Bowls 1 and 4 were tested for regain, residual grease content and bone dry clean mass. Samples of the corresponding scouring liquors were tested for grease content[6] and the scouring efficiency calculated using a formula suggested by Turpie[7]. For the statistical analysis a multiquadratic model was chosen and the best fit equation at the 95% level of significance was obtained by a stepwise procedure.

**TABLE 1**
**CHEMICAL DESCRIPTION AND SOME PROPERTIES OF THE NONIONIC DETERGENTS INVESTIGATED**

| DETERGENT NO* | CHEMICAL DESCRIPTION | HLB** | NO OF ETHYLENE OXIDE GROUPS** |
|---|---|---|---|
| 1 | Nonylphenol Polyethoxylate | 10,9 | 6 |
| 2 | | 11,7 | 7 |
| 3 | | 12,0 | 10 |
| 4 | | 12,9 | 9 |
| 5 | | 13,3 | 10 |
| 6 | | 15,0 | 15 |
| 7 | Octylphenol Polyethoxylate | 12,8 | 8,5 |
| 8 | Linear Alkyl Polyethoxylate | 12,8 | 9 |

(*) Names available confidentially by request (**) By definition

## RESULTS AND DISCUSSION

### The effect of HLB on Bowl 1 Scouring Efficiency

The following correlation was found between the Bowl 1 scouring efficiency for six detergents of the nonylphenol polyethoxy type investigated (Table 1) and their respective HLB values:

$$SE = 54{,}5 - 17{,}0X_1 + 2{,}44\,X_2 + 1{,}18\,X_1X_2 - 0{,}38\,X_1^2 \quad \text{(1)}$$

n = 90; % fit = 78%; r = 0,88

where:

SE — Scouring Efficiency (%)
$X_1$ — Amount of wool scoured (kg)
$X_2$ — HLB value of nonionic detergent

Eq. (1) is illustrated in Fig. 1, which shows that the higher the value of the HLB in the range investigated, the higher the scouring efficiency. Scouring efficiency decreased with the amount of wool scoured. The figure shows that whereas initially (0,5 kg wool scoured) the scouring efficiency was 79% for an HLB value of 11 and 91% for an HLB value of 15, it decreased in the former case to 23% and in the latter case to 71% by the end of the scouring experiment (8,25 kg wool scoured).

### The effect of type of detergent on Bowl 1 Scouring Efficiency

For purposes of comparison, three detergents with similar HLB and number of ethylene oxide groups were selected, namely number 4 (nonylphenol polyethoxy type), number 7 (octylphenol polyethoxy type) and number 8 (linear alkyl polyethoxy type) in Table 1. The data obtained is illustrated in Fig. 2, which shows that there was a significant difference in the performance of the three detergents investigated. Scouring efficiency of Bowl 1 deteriorated significantly — to a larger extent for the octylphenol polyethoxy type detergent (from 86 to 11%) and to a lesser extent for the nonylphenol polyethoxy type (from 86 to 40%) — when compared to the very slight deterioration shown by the linear alkyl polyethoxy type (from 84 to 74%).

### The Overall Scouring Efficiency

The results of this laboratory study showed that, with a few exceptions, the overall scouring efficiency (taken over four bowls) varied between 97 and 100% for all the detergents investigated, irrespective of the level of scouring efficiency obtained in the first bowl or the type of detergent and HLB investigated.

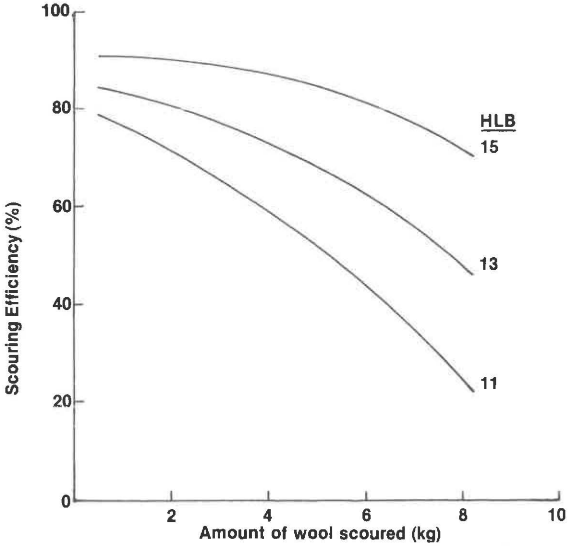



**Fig. 1: Regression curves illustrating the effect of HLB and amount of wool scoured on Bowl 1 scouring efficiency for a family of nonionic detergents of the nonylphenol polyethoxy type at a specific rate of detergent addition.**

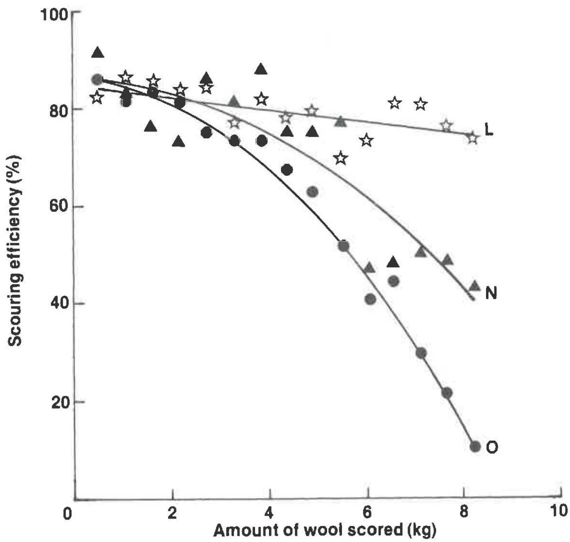



**Fig 2: The effect of type of detergent and amount of wool scoured on Bowl 1 scouring efficiency at a specific rate of detergent addition.**
**L — Linear alkyl polyethoxy type**
**N — Nonylphenol polyethoxy type**
**O — Octylphenol polyethoxy type**

## SUMMARY AND CONCLUSIONS

A four-bowl laboratory scour was used to investigate the effect of type of nonionic detergent (linear alkyl, nonylphenol or octylphenol polyethoxylate) and HLB on both the first bowl scouring efficiency and the overall scouring efficiency (taken over four bowls). Eight nonionic detergents were investigated, varying in HLB from 10,9 to 15,0. One experiment was carried out for each detergent investigated, a typical experiment entailing scouring of a total amount of 8,25 kg of backs.

It was found in a comparative trial involving three different types of detergent with the same HLB and number of ethylene oxide groups that the linear alkyl polyethoxy type was much more efficient than the nonylphenol and octylphenol polyethoxy types. Another trial, based on six detergents of the nonylphenol polyethoxy type, showed that best results could be obtained with a detergent having an HLB of 15. The increase in first-bowl scouring efficiency due to an increase in HLB from 11 to 15 was initially (0,5 kg raw wool scoured) from 79 to 91% while on completion of the experiment (8,25 kg raw wool scoured), from 23 to 71%. However, the overall scouring efficiency in all experiments was found to vary between 97 and 100%, irrespective of the scouring efficiency obtained in the first bowl or the type of detergent and HLB investigated.

## ACKNOWLEDGEMENTS

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## REFERENCES

1. Becher, P. and Griffin, W. C., HLB: A bibliography, Atlas Chemical Industries, Inc., USA (1970).
2. Schick, M. J., *Text. Chem. and Col.,* **9**, 1, 31 (1977).
3. Ferguson, C. A., *Can. Text. J.,* **7**, 41 (1978).
4. Wood, G. F., *Text. J. Aust.,* **6**, 13 (1965).
5. Mozes, T. E., van Rensburg, N. J. J. and Turpie, D. W. F., *SAWTRI Techn. Rep.* No. 492 (1981).
6. Veldsman, D. P., *SAWTRI Tech. Rep.* No. 5 (1952).
7. Turpie, D. W. F., *SAWTRI Techn. Rep.* No. 380 (1977).

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