is not suggested as optimum, and a higher or lower rate may be more efficacious.

The results given above were obtained as part of a more general investigation; a more detailed repetition of the section dealing with toxicity is intended, before precise practical application can be suggested. These results do, however, offer distinct possibilities of practical control for one of the most acute weed problems in agriculture.

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[1] See Robins, Crofts and Raynor, "Weed Control" (1942).

Mechanism of the Milling Shrinkage of Wool Fabrics

THE work of Speakman[1] and his collaborators has indicated that the felting or milling shrinkage of wool fabrics is primarily due to the scaliness of the fibres, but that in cloths of similar construction and composition the magnitude of the effect is determined by the ease of extension and the power of recovery of the fibres. The shrinkage of fabrics milled under comparable conditions is greater in acid and alkaline solutions than in water, and cloths may be rendered unshrinkable by treatment with reagents such as chlorine[2], caustic soda[3] or sulphuryl chloride[4]. These phenomena may be due to modification of either elastic properties or scaliness, and the experiments described in this note were designed to determine which of the two characteristics was more affected. A complete account of the investigation will appear elsewhere, but its main features are as follows:

Measurements of the scaliness of wool fibres in acid (0·1 *N* hydrochloric acid), water, and 2 per cent borax solution (*p*H 9·24) were made by the violin bow method of Speakman and Stott[5], and the results are summarized in Table 1.

TABLE 1.

Medium	Scaliness
0·1 *N* hydrochloric acid	29·4
Water	23·5
2 per cent borax solution	21·5

The scaliness increases with decreasing *p*H, and hence scaliness changes act in unison with the reduced ease of extension to increase the rate of milling of fabrics in acid solutions. The reduced scaliness in alkaline solutions, however, acts in the opposite direction to the increased ease of extension, and the superior milling shrinkage in alkaline solutions of *p*H 9·24 must be due solely to increased ease of extension, which is not accompanied by a loss of power of recovery of the fibre.

The role of scaliness in determining the shrinking properties of wool fabrics has also been demonstrated by measuring the scaliness and elastic properties of wool fibres treated with a 0·2 *N* solution of chlorine in carbon tetrachloride for various times. Parallel experiments in which patterns of cloth were chlorinated under the same conditions, and then milled to measure their shrinkage, were also carried out. The results are shown in Table 2.

It is evident that the loss in milling shrinkage is mainly due to a reduced scaliness of the fibres, for there is little change in the elastic hysteresis, and the increased ease of extension would result in an increased shrinkage. Since cloths which have been chlorinated for two hours are completely unshrinkable when milled in acid or soap, it appears to be unnecessary to reduce the scaliness of the fibres to zero in order to realize unshrinkability. Similar results have also been obtained on cloths and fibres treated with other reagents which render wool cloths unshrinkable. Whereas the scaliness, as measured by the percentage difference in friction, is reduced by chlorination, the actual values of the angles of friction increase, indicating greater adhesion between the fibres and the surface over which they slip. This increased adhesion is reflected in the greater strength of chlorinated yarns, for since the strength of individual fibres falls on chlorination, the superior yarn strength must arise from an increased adhesion between the fibres.

TABLE 2.

Time of treatment (hr.)	% shrinkage after milling for 30 min.	% reduction in work to stretch in		
		Water (i)	0·1 *N* hydrochloric acid (ii)	2% borax (ii)
0·0	35·0	2·7	38·0	0·8
0·5	7·9	9·9	40·8	15·0
1·0	5·0	12·0	39·2	18·5
2·0	0·6	15·8	41·5	19·1
3·0	−4·0	—	—	—
5·0	—	17·6	41·8	22·5

% Elastic hysteresis in			(iii) Scaliness in			
Water	0·1 *N* hydrochloric acid	2% borax	Air	Water	0·1 *N* hydrochloric acid	2% borax
53·5	40·0	62·2	15·8	23·5	29·4	21·5
54·9	41·2	62·2	12·0	7·9	17·1	10·6
54·9	40·2	62·4	7·4	4·1	9·8	6·0
56·1	41·5	62·1	5·0	1·5	7·2	5·3
—	—	—	—	—	—	—
54·6	42·4	61·8	4·0	1·0	6·0	3·5

(i) Calculated as a percentage of the work required to stretch an untreated fibre in water.
(ii) Calculated as a percentage of the work required to stretch a chlorinated fibre in water.
(iii) Calculated as described by Speakman and Stott[5].

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[1] *J. Text. Inst.*, **24**, 273T (1933).
[2] Brit. Pat. 417,719.
[3] Brit. Pat. 538,428; 538,396.
[4] Hall, *J. Soc. Dyers and Col.*, **55**, 389 (1939).
[5] *J. Text. Inst.*, **22**, 339T (1931).

Halogenation in the Allyl Position

IN the last issue of the "Annual Reports of the Chemical Society"[1], F. S. Spring has directed special attention to the success of Ziegler and his collaborators[2] in substituting olefines in the α-methylene, or 'allyl position', by means of N-bromo-succinimide, and it has been claimed that this is a new reaction.

Whereas from the preparative aspect N-bromo-succinimide is obviously a valuable new reagent, halogen substitution in the α-methylene position to a double bond is but to be expected if the reaction is of the 'free radical' or 'atomic' type, as shown recently by E. H. Farmer and his colleagues[3].