Measurement of Creep in Keratin Fibres

CREEP characteristics of wool fibres in water have yielded valuable information on the fine structure of keratin[1-4]. Creep fluidity at high extensions is also of technological significance[5].

The absence of plastic flow in unmodified fibres (as made evident by the perfect reversibility of extensions greater than 70 per cent) and knowledge of the α–β transformation has led to the use of constant loads throughout creep tests on the assumption that the load per molecular chain remains constant. Even under these conditions variations among fibres drawn from the same staple are large with respect to initial extension and rate of creep[6].

We have noted that the occurrence of the well-known stages of the load-extension curve are relatively constant with respect to extension but extremely variable with respect to stress. Stress at 30 per cent extension varies between 4 and 7 kgm./mm.[2]; two typical examples are set out in Table 1.

Table 1. STRESS OF WOOL FIBRES AT 30 PER CENT EXTENSION (S30)

Fibre No.	Sample A Diameter (μ)	S 30	Fibre No.	Sample B Diameter (μ)	S 30
1	22·4	4·60	1	18·2	6·13
2	24·7	4·62	2	21·4	5·56
3	26·0	4·51	3	23·8	5·78
4	21·8	4·75	4	21·0	5·98
5	19·2	5·88	5	20·2	6·31
6	20·3	4·65	6	21·4	6·06
7	22·4	5·36	7	20·1	6·44
8	21·3	4·69	8	19·2	6·02

The application of a constant stress of 6 kgm./mm.[2] would result in an initial extension of 30–50 per cent for sample A fibres, whereas sample B fibres would give initial extensions of c. 30 per cent. A comparison of these two samples would not involve creep at the same level of extension.

It is well known that extension to 30 per cent under specified conditions does not damage wool fibres[7] and by calibrating a fibre in this way it is possible to estimate, with reasonable accuracy, the load required to give any extension. Details of an experiment comparing this technique with the constant stress method are given in Table 2.

Table 2

Group	Fibre No.	S 30 kgm. mm.[2]	Stress applied kgm. mm.[2]	Stress applied as a percentage of S 30
1	1	5·54	3·88	70
	2	5·75	4·03	70
	3	6·14	4·30	70
	4	5·57	3·90	70
			mean 4·03	
2	5	5·01	4·03	80·4
	6	5·47	4·03	73·7
	7	5·77	4·03	69·8
	8	4·68	4·03	86·1
			mean 4·03	

Both groups (drawn from the same staple) have the same mean stress applied. Group 1 fibres have variable stresses but each stress represents a constant fraction of S30, whereas Group 2 fibres have constant stresses bearing no relation to S30. The creep curves of these fibres in distilled water at 15·4° C. is illustrated in Fig. 1.

The great reduction in variation of fibres in Group 1 indicates the value of the technique in experiments requiring the comparison of creep properties at a definite extension. We have used the method with equal success in the post-yield region, for example, by using stresses of 130 per cent S30. It appears that investigations of load-extension of fibres to the
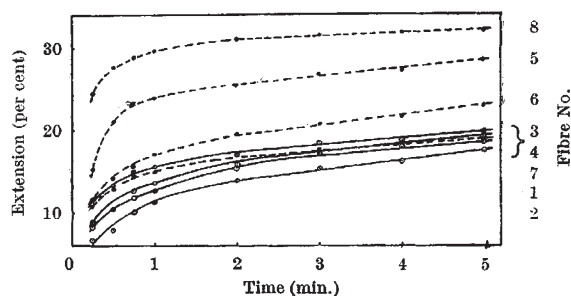

Fig. 1. Creep of wool fibres in distilled water at 15·4° C. Full lines, fibres under stress equal to 70 per cent S 30; broken line, fibres under mean stress of 4·03 kgm./mm.[2]

breaking point will enable accurate prediction of creep properties at any given load in unmodified keratin fibres.

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BIOCHEMISTRY

Identification of Sugars in Royal Jelly

THE presence of sugars in the nutrients of the honey-bee termed royal jelly has been reported; but the analyses were based on fermentation and reducing power investigations[1,2] or paper chromatography evidence[3,4]. The chromatographic evidence indicated the presence of components having the same R_F values as glucose and sucrose in all samples studied, and in certain samples, R_F values corresponding to sucrose, maltose and ribose. Because this evidence was not based on an evaluation of physical constants of the crystalline sugars and their derivatives, an investigation was undertaken to isolate and identify precisely the carbohydrate components of this bee larval food.

A fresh quantity of royal jelly (100 gm.) (kindly supplied by R. B. Wilson, Inc., 250 Park Avenue, New York, 17) was placed in casing and dialysed in water at 5° C. with frequent changing of this solvent, until the dialysate showed a negative Molisch test. This required 20 days and about 5 litres of water. The dialysate was concentrated (in vacuo) at 40° C. to a thin syrup and the residual water removed by adding increments of dry ethanol and evaporating the ethanol–water azeotrope under vacuum. As the water was removed, the syrup hardened into a plastic solid which, after complete dehydration, was then transferred with 100 ml. of ethanol to a Waring blender. During the homogenization process which followed, requiring 15 days, a total of 5 litres of dry ethanol, added in 150 ml. increments, was used for extracting the sugars from the amorphous product. Approximately 15 per cent of the dialytic substance was insoluble in ethanol and may be principally the pteridin compound which has been reported[5].

The alcohol-soluble components, principally sugars, were concentrated (in vacuo) at 40° C. to a thin syrup