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A MODIFIED METHOD FOR TESTING THE FLEXURAL STIFFNESS OF EXTREMELY SOFT NETTING TWINES.

MOHAMED A. IBRAHIM AND ABDOU A. AL-SAYES

Institute of Oceanography and Fisheries, Anfoushy, Alexandria, Egypt.

ABSTRACT

A simple modified method for testing the flexural stiffness of extremely soft - soft netting twines down to 0.1 gm has been presented. The method was shown to be comparable, if not superior, to the previously known proposals in this regard.

INTRODUCTION

According to von Brandt (1964), flexural stiffness is a measure of the degree at which the netting material itself resists the movement of a fish touching it. This stiffness is reported to affect the efficiency of many types of fishing gear. Usually, low stiffness increases catching efficiency whereas high stiffness makes the net easier to handle.

Since the term flexural stiffness is defined as the force required to cause a unit of bending deflection; hence, it is theoretically measured according to either of the two basic principles: either measuring the force causing certain deflection, or measuring the deflection of a horizontally mounted specimen under its own or added weight.

The known proposed methods for measuring flexural stiffness are either laberious and time consuming, or need special equipments that may not be available in an ordinary fishery technology laboratory.

The proposed method in this paper is designed mainly to aviod such difficulties and to measure the flexural stiffness of extremely soft to soft netting twines quickly and accurately to the nearest 0.1 gm.

APPARATUS

As shown in Figure (1), a 50 ml regular burette (1) and a 25 ml capacity tube (2) graduated to the nearest 0.1 ml are adequate in this regard. The float (3) is merely a regular glass tube, fits loosely inside the burette, containing few drops of water and seeled from both ends.

The volume of water inside the float should be enough only to let the tapered end of the float emerging above the upper rim of the burette when the water level in it is at the zero mark. It should also be noticed that the weight of the float must exceed the expected flexural stiffness of the twine being tested. To the tapered end of the float is attached a 15 cm long fine synthetic strand that ends in a very thin rigid hook.

To minimise surface tension between the float and the burette walls, a guide ring (4) of 1 mm diameter wire was fitted inside the burette at 1 cm level above the zero mark allowing the tapered end of the float to pass freely through its central circle.

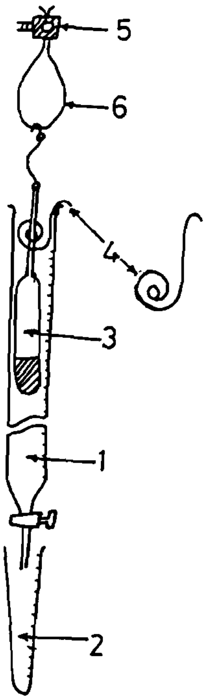

Fig. 1.
A diagram of the apparatus required for measuring the Flexural Stiffness of extremely soft-soft netting twines. The numbers from 1-6 on the diagram represent regular burette, graduated tube, float, guide ring, metal clamp and twines loop.

APPARATUS SETTING

Fill up the burette with distilled water and suspend the float in it. Drip water from the burette untill the water level is at about 1 cm above the zero mark. Pass the hook, the synthetic strand and the float's tapered end through the central circle of the guide ring which should be fixed to the inside of the burette so as to centre the float, without pressing it down.

Specimen of the twine to be tested,marked exactly at the middle, is bent in such a way that it forms a 20 cm loop (A-B) while the ends of the loop are fixed in the metal clamp (1) which is placed at about 20 cm above the burette. The central axis of both the metal clamp and the burette should be on the same vertical line.

PROCEDURE

Once the apparatus has been set, the following steps are followed:

1. Suspend the hook at the central mark of loop (A-B).
2. To start testing, drip water from the burette then stop at any initial reading on the burette - giving that the synthetic strand does not start to stretch yet - and record initial reading = (I).
3. Redrip water while receiving it in the clean graduated tube (2) noticing that the water dripping at 10 cc / min. gradually draws the loop (A-B) together as the synthetic strand starts to stretch. Meanwhile, the opening of the loop at its widest point (A-B) is constantly compared against a regular ruler. Dripping is then stopped as soon as the distance (A-B) is reduced to 5 mm
4. Record final burette reading = (F) and the water volume driped in the graduated tube = (G).

CLACULATIONS

The calculation of the flexural stiffness by the present method is based on the basic Archimedes principal " A body wholly or partly immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced". Hence, any reduction in the floats weight caused by the flexural stiffness will be met with a reducation in the weight of the displaced liquid. This is given by formula (1)

$$\text{Flexural stiffness} = D[\ F - (\ I + G\ )\ ] \text{........(1)}$$

where, (D) is the water density, (F) and (I) are the final and initial readings on the burette respectively, and (G) is the volume of water dripped in the graduated tube.

On the other hand, if the float itself is graduated to represent the volume emersed at any level - while using the same procedure as described above - then flexural stiffness can be given by the formula

$$D\,(F - I) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where, (I) and (F) are the initial and final readings on the float itself, respectively and (D) is the liquid density. The advantage of using formula (2) is to avoid both readings on the burette, and the need for the graduated tube. It is also advantageous in the sense that by using a liquid of lower density than water and a smaller diameter float then flexural stiffness of an extremely soft twine can be measured to a smaller fraction.

APPLICATION AND RESULTS

The flexural stiffness of four netting twines was tested by both the present method and the method proposed by von Brandt (1947), with little modifications mainly; the cellophane vessels weighed about 0.3 gm instead of 3 gm for measuring low flexural stiffness, and the burette opening was supplied with a 30 cm clear rubber tube that ends in a pasteur pipette for easy maneuvering in dripping the water in the cellophane vessel. The results are given in the following table:

Netting twine	No. of Teste		Mean Flexural stiffness in gm.		Standard Deviation		Relative Coefficient of variation (%).	
	Pr	v^B	Pr	v^B	Pr	v^B	Pr	v^B
a	100	69	4.03	3.93	1.03 (0.10)	0.87 (0.11)	25	22
b	100	89	2.49	2.49	0.05 (o.02)	0.06 (0.03)	09	10
c	075	65	1.89	1.93	0.13 (0.02)	0.15 (0.02)	07	08
d	070	65	0.66	0.69	0.06 (0.01)	0.09 (0.01)	09	14

Results obtained from applying the two different methods for measuring flexural stiffness of different netting twines (Pr and v^B refer to the percent and von Brandt methods respectively, while the numbers in parenthesis represent the standard errors.

By applying standard statistical analysis methods, F and T tests, at the 95% level on the data obtained from testing the four netting twines as shown in the table, it has been found that the means and variances of the flexural stiffness obtained by both Pr and vB methods were similar with the exception of the variance of twine (d) tested.

In general, the relative coefficients of variations were smaller in the present method than in von Brandt method. This leads to the conclusion that the present method is comparable, if not superior, to the vB method in measuring flexural stiffness of extremely soft-soft netting twines.

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