WATER-EFFECT ON DIFFERENT SYNTHETIC FIBRES AND TREATED COTTON USED AS NET MATERIAL IN U.A.R.

by

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INTRODUCTION

When nylon was discovered, it was called the miracle of science especially for fishing industires because it provides easier living for the fishermen. Numerous types of synthetic fibres have been discovered afterwards carrying the most important property of nylon which is its rot-proofness. This property was the main promotion which encouraged the fisherman to use these synthetic fibres to make his nets replacing the natural fibres. V. Brandt (1944) reported that fyke nets made of Polyvinylchloride (Pe Ce) have been in continuous use for ever 15 years.

This does not mean that the synthetic fibres can be used continuously without deterioration. Studies have been done to know the characters of synthetic fibres from all points of view. The weathering effects tests gave some facts that synthetic fibres are affected by light. This effect varies according to different groups of fibres, morevoer to the types of fibres processed from the same group.

With regard to their resistance to light and weathering, synthetic fibres show extra-ordinary great difference in their degree of resistance to light and weathering, in contrast with the resistance of nets made of vegetable fibres which has been little observed (Klust 1957). These test fibres are affected by light and weathering in a small degree if it is compared with that caused by cellulose digesting micro-organisms in water. This character - for the nautural fibres, especially cotton, is the main drawback which encouraged the fisherman to replace this natural material fibre nets with the synthetic ones.

Because of the higher initial cost of synthetic nets, it became necessary to gain knowledge about the all factors which could shorten the time of their usefulness. In U.A.R., cotton fibres are mainly used in net manufacture, because of its high quality among natural fibres and-at the same time-is of low price if compared with the prices of imported synthetic nets.

Taking into consideration the importance of cotton twines to net industry, the author found that it is important to carry out the following work to clarify these points :

(*a*) The sea water effect on the synthetic fibres of different groups and in the same time to test the different types of fibres of the same group, especially the polyamide one (PA) .

(*b*) The sea and brackish water effect on the treated cotton by the synthetic resins (Arigal)

(*c*) The sea and brackish water activity to rotting on the natural cotton fibres twisted in twines of the same strength nearly equal to that of treated cotton twines.

MATERIAL AND METHODS

To carry on the water effect tests, the following materials have been used:

1.—*Synthetic fibres*:

Trade name	*Group of fibres*
(*a*) Perlon staple Nm 20/9	Polyamides
(*b*) Anzalon, Td 210 × 15	,,
(*c*) Perlon monofilament 0.25×8	,,
(*d*) Trevira Nm 20/9	Polyester
(*e*) Nymplex. 0.25/0, 0.45 × 6	Polyethylene
(*f*) Fon Td 500 × 6	Polypropylene
(*g*) Newlon 20/18	Polyvenylalcahol

2.—Treated cotton under a trade mark Arigal which is produced by Ciba limited (Switzerland).

3.—Raw material of cotton locally manufactured in U.A.R. textile factories as twines Ne. 20/9

The synthetic and treated cotton twines were grouped in bunches of 60 twines 30 cm in lenght. The test was carried under natural conditions (V. Brandt 1957) as the twines were immersed under water surface in the field.

The twines were left in the water and their resistance was tested on samples of 5 threads, taken out at intervals varied from one month to four months.

The tests of rotting action of the water where the synthetic and treated cotton twines tested was monthly determined by immersing the raw cotton twines Ne 20/9 on the first day of each month. Four bunches of 10 twines, were used in the experiment. After one, two or three weeks and on the last day of the month, one bunch was taken from the water to determine the average loss in breadking strenght of the twines. This method was changed in water by higher rotting activity, where 100 percent loss of breaking strength occured before the end of the month, so the sample were replaced by new ones when they had lost approximately three quarters of their preaking strength. The losses in breaking strenght of all samples were added up to establish the monthly rotting activity.

The resistance was measured by means of the strenght testing machine and the data for loss or remain in strength were used to indicate the resistance to water-effect for the different materials tested and the rotting action of the water where these samples immersed.

Stations of experiments:

Two stations were elected to immerse the twines. One is the same station chosen by the author in the Mediterranean region to test net material, synthetic and preserved twines (Koura 1963). Another station was chosen in the strait connecting a lake with the Mediterranean Sea near Alexandria (Lake Edkou) where there is continuous exchange of water between the lake and the sea. The environment of this station is somewhat different than that of the sea station where the salinity is always lower and the phosphate salts are higher than that of the sea as its water is drained from an eutrophic lake.

II.—Water-effect on synthetic and treated cotton twines :

(a) *Synthetic twines* :

The samples have been immersed in the sea water station for a period of 488 days extending from 9-3-1963 to 9-7-1964. The remaining breaking strength and its percentage from the initial strength is shown in table (1) and figure (1).

The polyamide twines represented in different forms of fibres as Perlon staple, Anzalon continuous and Perlon monofilament show extraordinary great difference in their degree of resistance to water effect. Perlon staple was greatly injured and its wet strenght decreased gradually from 100 percent to 26 percent at the end of the experiment. Anzalon continuous, its strength was constant for a long time extended from 9-3 to 9-10-1963, then the strength began to decrease gradually afterwards until it reached 80% at the end of the period, but the Perlon monofilament, alghough was not affected at all for a long time but abruptly, its strenght fell down from 99 percent in 9-4 to 69 percent in 9-7 1964.

The trevira twines (Polyester group) was not affected at all as its strenght-after this period of immersion - remained the same, in contrast with the Nymplex from polyethylene group which is completely resistant to water-effect for a long time and then its strenght dropped to 48 percent in the last three months. The same behaviour was followed by polypropylene and polyvinylalcohol twines whose strength fell down to 50 and 68 percents respectively.

(b) *Treated cotton by synthetic resin Arigal* :

The cotton yarns treated with this material has been tested in the sea and brackish waters. In the sea station (Table 1 & Fig. 1) the immersion and strength tests were followed for the same period of syynthetic twines (488 days) but in the brackish station, unfortunately, was followed for four months only (from 31.5 to 30.7.1964) because of the loss of the material. In the sea water Arigal was not injured severely. Its strenght remained constant for a long time (from 9.3 1963 to 9.1.1964) then began to fall gradually in the last months of immersion until it reached 78 percent in 9.7 1964.

In the brackish water, the strenght of Arigal was not affected at all until the end of the four months.

(c) *Untreated cotton* :

The raw cotton material twisted as twines Ne 20/9 was used which of wet strength 4.6 kilogram. This srength was nearly equal to the strenght of treated cotton (Arigal) tested, which was 5.0 kilogram for sample tested in sea water and 4.6 kilogram for samples tested in brackish water.

These twines were tested monthly all the year round (see material and methods) to show the rotting activity of the water where the synthetic and treated cotton tested.

The behaviour of these twines in the sea water was completely different than that of the other materials. The rotting activity was determined monthly (Table 2 and Fig. 2). By following the data it is clear that the twines are highly affected in July and August than in the period from November to March where the actual strength fell down under 50 percent which is the limit of use of the net. The loss in strength may reach this percentage in the second or the third week.

In September–October and April-May periods, the rotting activity was low in these months when it is compared with the previons other months. The loss in strength did not fall under the 50 pereent level. It might be due to the accumulation of water fauna and flora mainly of green algae which inhibited the activity of micro-organisms to digest the cellulose. This view is supported by the values of rotting activity in winter. These values are more or less equal to that of summer months. In winter the temperature falls to the minimum as it reached 15.6°C in February.

This temperature is considered to be favourable to micro-organisms especially bacteria to attack the cellulose. Klust and Mann (1954) estimated that the process of rotting does not stop until 4°C and the rate increases when the temperature increases.

Accordingly, it can be concluded that temperature, in our weters, is high enough all the year around and might not be taken as the main factor controlling the process of rotting but the fouling and decaying agaents which might reduce or increase the action of bacteria on cellulose material. These two factors are limited in action, increase or decease, by the effect of water current.

The values of rotting activity of the water in station 1I (Brackish water) show that it is much higher all the year around (Table 3 & Fig. 3) than that of the sea water in the Mediterranean. It increases gradually from winter to summer months. In autumn another unexpected increase was observed although the temperature tends to decrease. This increase in rotting activity may be due to the Nile water flood effect which accelerates the activity of micro–organisms to digest cellulose.

Ball (1939) estimated a series of curves deduced from the analysis carried out by Mr.Mosseir, representing the annual courses of the variations in the gram equivalent of the principal bases and acids per hundred grames of the total dissolved solids in the Nile water at Cairo. It is clear from these curves that Calcium (Ca) concentration increases in flood months (August to November).

In addition, the phosphates of the inflowing Nile water to the hydrodrome (an impoundment near Alexandria) is of a very high concentration (Elster, Jensen & co–workers 1954–1956). The concentration of phosphates fluctuate between 0.2 to 0.4 $P0_4$=–P μg. at/L in the period from January to August and then increases gradually from about 0.5/μg at./L in September and reaches the maximum in October (1.00/μg at/L) then begins to decrease again until it reaches the normal value in January.

Klust & Mann (1954) determined that any increase in Ca ions in presence of phosphate ions activate the process of rotting.

Thus, it can be concluded that the higher rotting in brackish water than that of the sea water and the un–expected increase in this activity in the time of the Nile flood is due to the continuous rinsing for the twines and the decaying agents present in higher concentration than that of the sea water in the Mediterranean Sea and the additional increase in these salts in the time of flood.

DISCUSSION

Synthetic fibres have –in recent years–been used in increasing quantities in U.A.R because they are strong and light, absorb very little water besides the important character which is their rotproofness. Then the advantages of synthetic fibres greatly out weighed their disadvantages but there is one main drawback does not encourage the fisherman in Egypt to use them, which is the high price. Concerning the natural fibres especially cotton although cheaper than synthetic materials in general but has the main drawback which is not rot–proof.

This character caused great loss in cotton net material used, and the fisherman may pay in the price of several nets of cotton more than that on one synthetic similar net may be used instead. As we are a country considered to be a producer for the best types of cotton fibres from which the thinnest twines can be made, the cotton nets are traditionally used and the fisherman knows by experience what thickness of twines demanded, moreover, knows exactly its effect on the efficiency of his nets. So, it is difficult to replace the cotton μ aterial by synthetic ones abruptly.

The cotton fibres treated with Arigal C gave good results in these studies from the point of rot–proofness not less than the synthetic fibres tested (Fig.4). The process of imprignating the cotton yarns in this synthetic resin is done once forever and the twines used and donot require the repeated cutch treatment. Then the cutch imported in hard currency for fisheries industry will be stopped. The increase in price of the treated cotton will be compensated by the price payed for cutch. The fisherman will gain more than that, the duration of use for this nets made from this treated cotton.

These results for treated cotton tests will not prevent the authority to introduce the synthetic fibres in Egypt, because the efficiency of the gear will be an important promotive factor to replace this treated cotton with the suitable synthetic fibres such as the monofilament twines of high efficiency in the clear waters or to increase the efficiency of the dragged gear by increasing the process of filtration. This last problem is affecting the efficiency of the Italian Otter-trawl used in our waters.

The studies done to show the water effect on different synthetic fibres in the Mediterranean waters, may help us to choice the suitable material to be used in the coming steps to develop the trawl nets in Egypt. Polyamides continuous and monofilaments gave good water resistance more or less similar to Arigal, so the Polyamide continuous can be used in making trawl nets and purse seines to have benefit of its very high breaking strength, high abrasion resistance and high elasticity (Klust, 1957).

The polamide monofilament can be used to make trammel and gill nets fishing in clear waters especially in Lake Quaroun and Lake Nasser which in its way to be formed behind the High Dam. The use of these nets will be of great value to increase the efficiency of this type of nets when used in clear water of the Nile after the time of flood which extends from August to November every year.

TABLE 1.—The strength of synthetic and treated cotton twines treated in U.A.R. Sea waters from 9.4.1963–9.7.1964

No.	Fibres	Trade Name	9.3.63	9.4.63	9.6.63	9.10.63	9.1.64	9.4.64	9.7.64
			Wet strength (in kilograms)						
1	Polyamide staple	Perlon staple, Nm 20 / 9	13.3 (100)	11.97 (90)	9.177 (69)	7.45 (56)	7.24 (54)	5.26 (40)	3.50 (26)
2	Poly. continuous	Anzalon Td 210 x 15	13.50 (100)	14.99 (111)	13.91 (103)	13.64 (101)	12.42 (92)	12.70 (94)	10.80 (80)
3	Poly. monefillament	Perlon 0,25 mm X8	13.10 (100)	13.23 (101)	12.05 (92)	12.83 (95)	12.86 (98)	13.00 (99)	9.10 (69)
4	Polyester	Trevira Nm 20/9	15.40 (100)	15.66 (102)	14.78 (96)	15.55 (101)	16.24 (105)	16.52 (107)	15.70 (101)
5	Polyethylene	Nymplex 0,25/0, 0.45 X 6	18.40 (100)	17.87 (97)	19.69 (107)	20.98 (114)	23.96 (130)	22.08 (120)	8.90 (48)
6	Polypropylene	Fon Td 500 X 6	16.40 (100)	16.73 (102)	15.42 (94)	16.73 (102)	16.74 (102)	16.26 (99)	8.30 (51)
7	Polyvinyl alcohol	Nelon 20/18	13.10 (100)	13.76 (105)	13.36 (102)	13.76 (105)	13.10 (100)	13.18 (101)	9.00 (69)
8	Cotton	Arigal	5.00 (100)	5.00 (100)	5.70 (114)	5.30 (106)	5.04 (101)	4.69 (94)	3.90 (78)

TABLE 2.—MONTHLY ROTTING ACTIVITY OF SEA WATER (STATION I)

(Egyptian Cotton Twines Ne 20/9. breaking strength 4.6 kg)

Year	Month	Loss in strength after				value per month	value per day
		1 week	2 weeks	3 weeks	4 weeks		
1963	July (7)	2.8 (39.1)	1.7 (63.0)	1.7 (63.0)	1.5 (67.0)	67.0	2.2
	August (8)	3.1 (32.6)	2.1 (54.3)	1.5 (67.4)	1.4 (70.0)	70.0	2.3
	Sept. (9)	4.4 (4.3)	3.9 (15.2)	3.3 (28.3)	3.2 (30.0)	30.0	1.0
	October (10)	4.4 (4.3)	3.9 (15.2)	3.5 (23.9)	3.1 (33.0)	33.0	1.1
	November (11)	4.6 (0)	3.0 (34.8)	2.2 (52.2)	2.1 (54.0)	54.0	1.8
	December (12)	3.5 (23.9)	2.8 (39.1)	2.3 (50.0)	1.5 (67.0)	67.0	2.2
1964	January (1)	3.3 (28.3)	3.2 (30.4)	2.6 (43.5)	1.5 (67.0)	67.0	2.2
	February (2)	4.0 (13.0)	2.6 (43.5)		1.6* (65.0)	65.0	2.2
	March (3)	5.1 —	3.2 (30.4)	lost —	1.9 (59.0)	59.0	1.9
	April (4)	4.8 —	4.5 (2.2)	lost —	2.9 (37.0)	37.0	1.2
	May (5)	4.3 (6.5)	4.1 (10.9)	3.9 (15.2)	2.8 (39.0)	39.0	1.3
	June (6)	4.4 (4.3)	3.9 (15.2)	2.8 (39.0)	2.0 (57.0)	57.0	1.9

* Period ten days

Percentage of loss in strength
between barentheses

TABLE 3.—MONTHLY ROTTING ACTIVITY OF BRACKISH WATER (STATION 11) (EGYPTIAN COTON TWINES Ne 20/9 BREAKING STRENGTH 4.6 KGM)

Year	Month	loss in strength after				value per month	value per day
		1 week	2 weeks	3 weeks	4 weeks		
1963	August (8)	2.5 (146)	0.6 (87)	3.4* (26)	0.3* (93)	180	5.8
	September (9)	2.4 (48)	0.8 (83)	1.7* (63)	0.0* (100)	183	6.1
	October (10)	0.9 (80)	0.0 (100)	4.0* (91)	0.0* (100)	200	6.5
	November (11)	1.6 (65)	0.0 (100)	2.4* (48)	0.0* (100)	200	6.7
	December (12)	2.1 (54)	0.8 (83)	3.7* (20)	1.1* (76)	159	5.1
1964	January (1)	3.6 (22)	0.6 (87)	3.3* (28)	2.2* (52)	139	4.5
	February (2)	2.3 (50)	0.6° (87)		2.9* (37)	124	4.3
	March (3)	2.2 (52)	0.8 (83)	3.7* (20)	1.1* (76)	159	5.1
	April (4)	3.8 (17)	1.8 (61)	0.9* (80)	0* (100)	161	5.4
	May (5)	4.3 (7)	2.5 (46)	1.1* (76)	0* (100)	146	4.7
	June (6)	1.4 (70)	0.3 (93)	1.5 (67)	0 (100)	193	6.4
	July (7)	3.2 (30)	0.0 (100)	2.5* (46)	0.4* (91)	191	6.2

(*) New material for one week period.

(°) New material for ten days period.

Percentage of loss in strength.

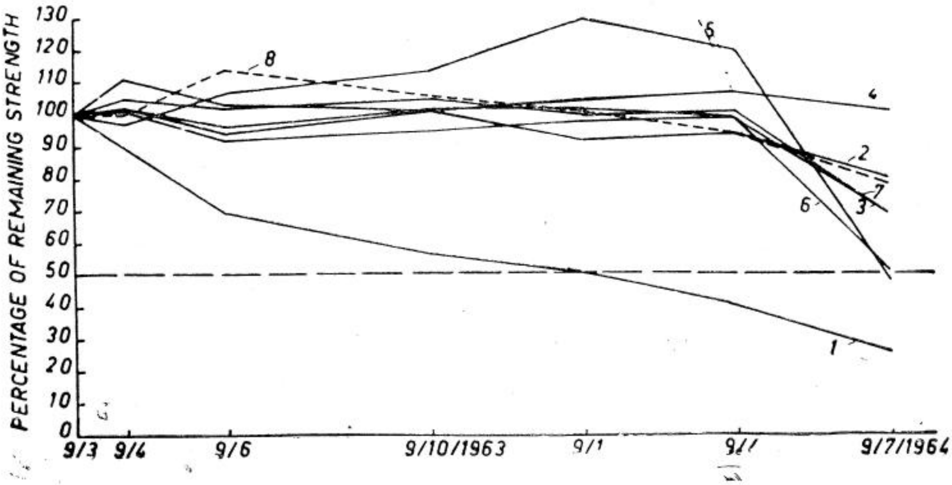

FIG. 1.—Synthetic twines of different groups and their behaviour in U.A.R. Sea Water (9.4.1963 – 9.7.1964).

1.—Polyamide (Perlon staple).

2.—Polyamide continuous (Anzalon Td 210 × 15).

3.—Polyamide monofilament (Perlon).

4.—Polyester (Trevira).

5.—Polyethylene (Nymplex).

6.—Polypropylene (Fon Td 500 × 6).

7.—Polyvinylalcohol (Newlon 20/18).

8.—Arigal (cotton).

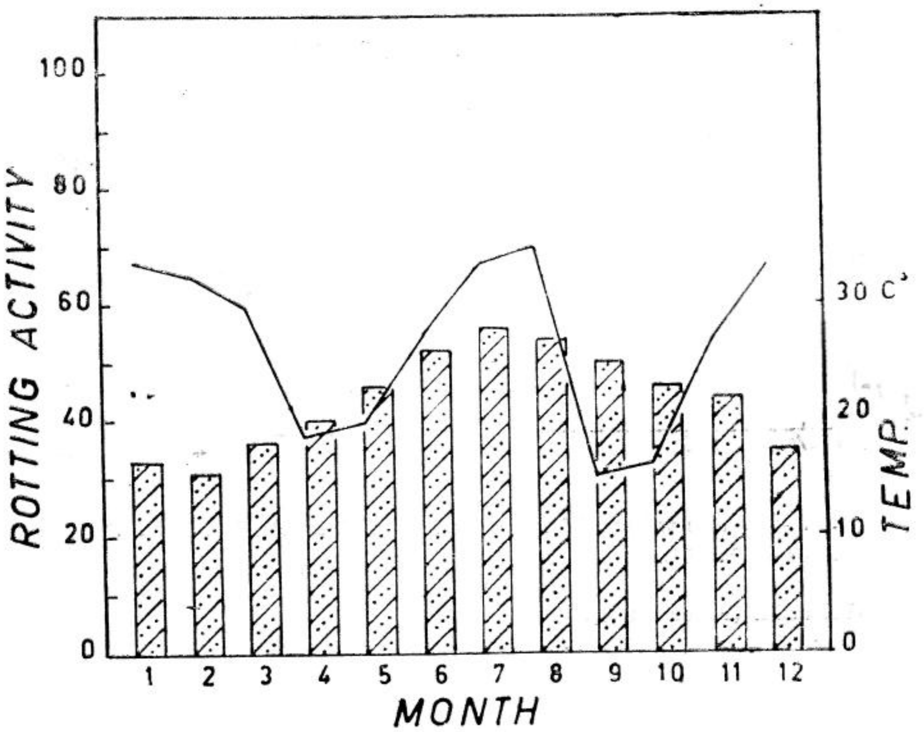

FIG. 2.—Monthly rotting activity of Sea Water (Alexandria Station) measured by cotton twines Ne. 20/9.

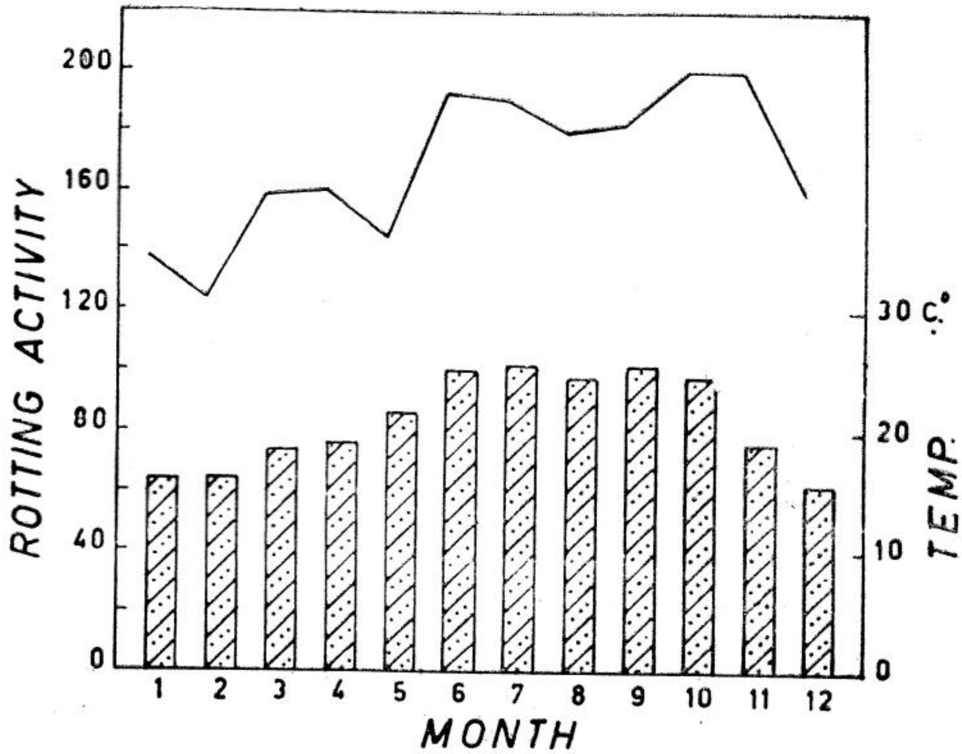

FIG. 3.—Monthly rotting activity of Brackish Water (Maadia Station) measured by cotton twines Ne. 20/9.

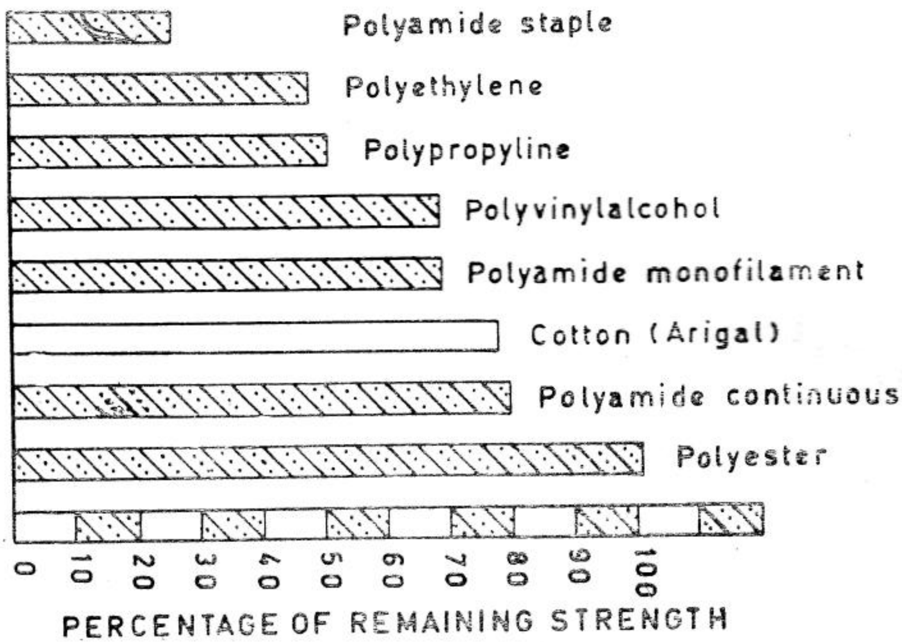

Fig. 4.—Relative resistance to water effect for synthetic and treated cotton fibres in Mediterranean Sea water (Alexandria station).

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