

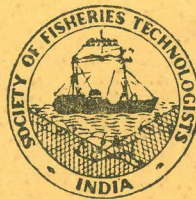
Polypropylene Netting Yarns

S. GOPALAN NAYAR, K. RADHALAKSHMI and B. MEENAKUMARI
Central Institute of Fisheries Technology, Cochin-682 029

Reprinted from
HARVEST AND POST-HARVEST TECHNOLOGY OF FISH
pp. 269-271

Edited by

K. RAVINDRAN
N. UNNIKRISHNAN NAIR
P. A. PERIGREEN
P. MADHAVAN
A. G. G. K. PILLAI
P. A. PANICKER
MARY THOMAS



Society of Fisheries Technologists (India)
Matsyapuri P. O., Cochin-682 029

1985

Polypropylene Netting Yarns

S. GOPALAN NAYAR, K. RADHALAKSHMI and B. MEENAKUMARI

Central Institute of Fisheries Technology, Cochin-682 029

Fine netting yarns made of continuous multifilament polypropylene manufactured in India are evaluated for their properties like diameter, weight per metre, twist, strength, wet knot strength, deterioration due to UV and outdoor exposure tests. The values are compared to nylon multifilament twines at present used by the fishing industry. Studies indicate that polypropylene multifilament twines can be substituted for nylon on an equal diameter basis for certain types of gear which will result in savings of material by about 10%.

Polypropylene is a non-apparel fibre popular in the west because of its inherent properties and versatility. It is melt spun from polypropylene resin. First introduced in 1954 in Italy (Klust, 1964) its production started in India in 1976 and only in the eighties its use as a multifilament yarn for the benefit of the fishing industry was envisaged. This paper deals with the first set of twines made available in the country for fish net and makes a comparison with polyamide multifilament twines because of the latter's pre-eminence in the fishing industry.

Materials and Methods

Trade descriptions of the samples under test were 210/1/2, 210/1/3, 210/2/2, 210/2/3 and 210/3/3.

Methods of tests were based on IS 5815 Parts 1,3 and 4 (1971) and part 2 (1970). For determination of knot strength a simple over-hand knot was made with the direction of knot opposite to the direction of twist of the samples and tested (Klust, 1968). A tex values were calculated from the weight per unit length values and coefficient of twist (a) by applying the formula,

$$a = \frac{\text{Turns/m}}{\sqrt{\text{Nm}}}$$

sample. Deterioration due to weathering was studied from out door exposure tests. The samples were also subjected to UV radiation in a closed chamber with an atmospheric condition of 32°C temperature, 70–80% relative humidity and fitted with 60 W, UV lamp (2700°K, 3200–4000Å giving 4.2 W)

Results and Discussion

Both dry and wet strength and stretch values are almost the same in each of these samples. The samples are soft twisted with a coefficient of twist ranging from 110–130. There is deterioration due to weathering; the 50% of strength getting lost in a span of 112 days for the finer samples. All the samples have diameter within 1 mm and are therefore susceptible to

penetration by UV ray (Indefurth, 1953), with the thickest among the samples attaining 50% level of breaking strength after a period of 225 h of UV exposure.

Table 1. Showing the properties of polypropylene twines

Specification	210/1/2	210/1/3	210/2/2	210/2/3	210/3/3
Diameter mm	0.388	0.454	0.578	0.705	0.846
R tex	51.0	83.7	101.2	177.0	248.5
Runnage m/kg	19605	11948	9880	5650	4025
Twist/m outer	524	282	340	272	253
inner	877	619	404	526	467
Strength in					
kg. dry	2.65	4.21	5.69	8.90	11.38
wet	2.85	4.55	5.65	8.16	12.05
wet knot	1.82	2.75	3.60	4.91	7.06
Extension at					
break % dry	25.3	25.2	26.5	27.8	26.2
wet	27.6	25.2	23.1	25.4	23.2
*% retention of					
strength after					
112 days of out					
door exposure	22.2	45.7	45.8	65.2	69.5
„ 325 h					
UV exposure	9.2	19.9	20.6	26.5	35.2

*Meenakumari & Ravindran (unpublished)

Polypropylene twines are thicker than polyamide twines of equivalent specification by a maximum of 15%; between polypropylene and polyamide twines of the same diameter the former possesses lesser weight, thus affecting a savings of material to the order of more than 10% (Fig. 1). This property has an advantage in gill nets where the practice is to substitute the material on an equal diameter basis.

The tenacity of polypropylene is in the range of 45.7 to 56.2 and 46.2 to 55.9 g/tex in the dry and wet conditions *vis-a-vis* 49 to 59 and 45.5 to 57.5 for polyamide twines as illustrated in Table 2.

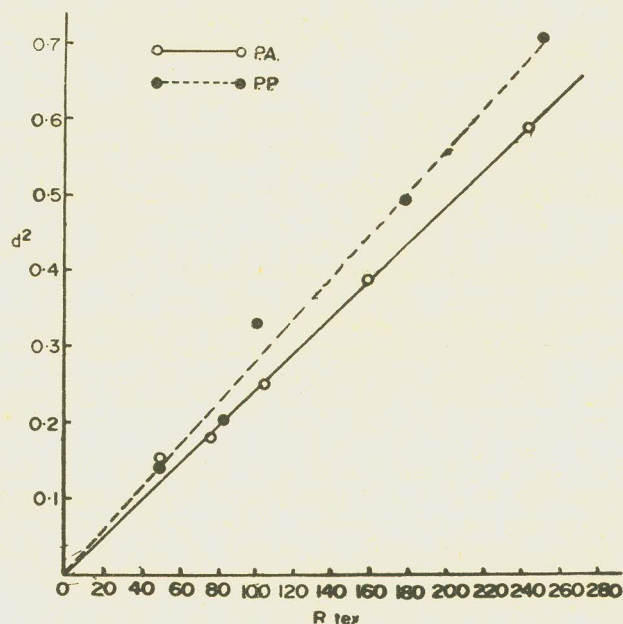


Fig. 1. Relation between square of the diameter and R tex of polyamide and polypropylene twines.

Table 2. Tenacity of polyamide and polypropylene twines

Specification	Tenacity in g tex^{-1} of multifilament twines of			
	Polyamide		Polypropylene	
	Dry	Wet	Dry	Wet
210/1/2	54.6	50.96	51.9	55.8
210/1/3	49.6	45.5	50.2	54.3
210/2/2	58.6	57.7	56.2	55.8
210/2/3	54.9	53.1	50.2	46.2
210/3/3	55.1	51.85	45.7	48.4

A reference to the work of Klust (1964) would indicate polypropylene to possess a tenacity of 5.9 to 6.55 g/denier (53 to 58.95 g/tex). Carter & West (1964) recorded 6/denier for the samples in the initial stages of production which has been made up to 8 to 8.5 g/denier over the years due to organised research.

The value of the coefficient of twist of polypropylene is in agreement with those observed by Klust (1964) for polypropylene twines and the polyamide twines available in the country (IS 4401-1976). While samples analysed by Klust (1964) refer to these made with 170 and 190 denier yarns, here it is 210 denier which is the same as that of polyamide twines. Carter & West (1964) suggest the use of 190 denier polypropylene yarn for every 210 denier polyamide yarn with 5% lesser value of twist at all levels to arrive at the same degree of twist hardness to that of polyamide twines.

While Baranov (1960) and Steinberg (1964) advocate the need for proper thickness in selecting a gear

material Sunnana (1956) and von Brandt (1964) mention about comparable wet knot strength in substitution. Considering the two aspects conjointly polypropylene twines are about 10% weaker than polyamide twines on an equal diameter basis (Fig. 2).

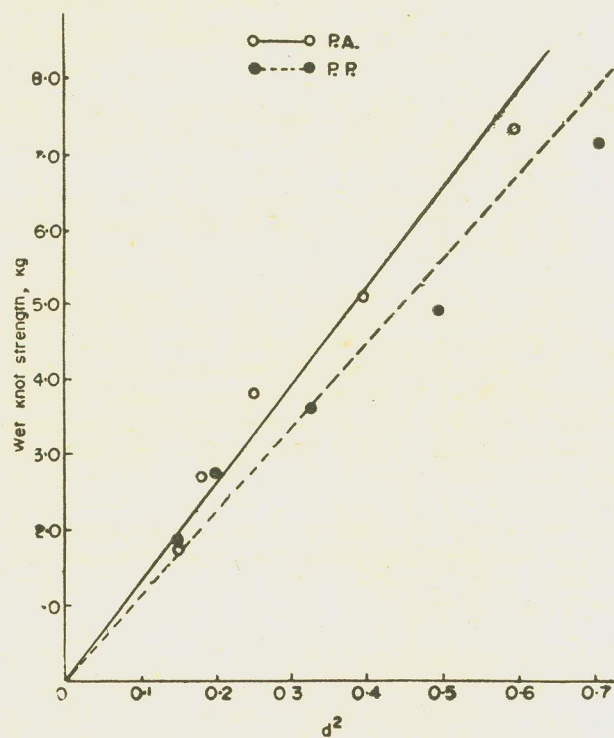


Fig. 2. Relation between square of the diameter and wet knot strength of polyamide and polypropylene twines.

UV and outdoor exposure data of polypropylene were compared with respect to two specifications of polyamide twines. Both under UV exposure and outdoor exposure tests the deterioration of polypropylene is faster than polyamide twines.

The costing of polypropylene twines has not been done by the industry. Keeping price lower than polyamide twines may make the material acceptable to the fishermen. The price quoted by Carter & West (1964) for polypropylene and polyamide twines is in the ratio of 1:1.3. The material is reported to be equally efficient as polyamide twines in gill net fishing by Honda & Osada (1964).

The samples studied were fine netting yarns which can probably replace the nylon counterparts in gill nets of twine sizes 210/1/2 and 210/2/3 with mesh size ranging from 12.5-105 mm bar used for the exploitation of prawns, sardines, mackerels, hilsa, pomfret and also in inland fishery.

The authors are grateful to Dr. C. C. Panduranga Rao, Director, Central Institute of Fisheries Technology, for his kind permission to publish this paper.

References

- Baranov, F. I. (1960) *Techniques of Industrial Fishing*. Pischepromizdat, Moscow
- Carter, C. L. B. & West, K. (1964) in *Modern Fishing Gear of the World*, vol. 2, p. 57, Fishing News (Books) Ltd., London
- Honda, K. & Osada, S. (1964) in *Modern Fishing Gear of the World*, vol. 2, p. 55, Fishing News (Books) Ltd., London
- Inderfurth, K. H. (1953) *Nylon Technology*. McGraw Hill Book Co., Inc., New York
- IS: 4401 (1976) *Indian Standard Specification for Nylon Fish Net Twines*. Indian Standards Institution, New Delhi
- IS: 5815 (Part I) (1971) *Indian Standard Methods of Test for Fishing Gear Materials. Determination of Thickness*. Indian Standards Institution, New Delhi
- IS: 5815 (Part II) (1971) *Indian Standard Methods of Test for Fishing Gear Materials. Determination of Linear Density* (mass per unit length). Indian Standards Institution, New Delhi
- IS: 5815 (Part III) (1971) *Indian Standard Methods of Test for Fishing Gear Materials. Determination of Twist*. Indian Standards Institution, New Delhi
- IS: 5815 (Part IV) (1971) *Indian Standard Methods of Test for Fishing Gear Materials. Determination of Breaking Load and Knot Breaking Load*. Indian Standards Institution, New Delhi
- Klust, G. (1964) in *Modern Fishing Gear of the World*. vol. 12, p. 50, Fishing News (Books) Ltd., London
- Klust, G. (1968) *Protokolle Zur Fischerei Technik* **51**, 150
- Steinberg, R. (1964) in *Modern Fishing Gear of the World*. vol. 2, p. 111, Fishing News (Books) Ltd., London
- Sunnana, K. (1959) *Me'A* (F jordgaten 7, Trondheim, Norway) **11**, 17
- Von Brandt, A. (1964) in *Modern Fishing Gear of the World*. vol. 12, p. 88, Fishing News (Books) Ltd., London