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Combination Netting yarns for Low Energy Fishing

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The fishing industry is familiar with the physical properties of netting yarns made of polyamide (PA), polyethylene (PE) and polypropylene (PP). The characteristics of netting yarns used for fish nets depend on the basic characteristics of fibre and yarns and mode of preparation. This paper deals with the studies on mixing of different synthetic yarns for the production of combination netting yarns. The analysis of physical properties shows that combination twines effectively combines the intrinsic characteristics of the component yarns giving a wider choice of material for low energy fishing.

Polyamide (PA), Polypropylene (PP) and Polyethylene (PE) in monofilament/ multifilaments are popularly used at present in India for the fabrication of various types of fishing gear. The property common to all synthetic twines is the rot proofness while each type of material possesses specific properties. For instance, PA possesses high strength, elongation, pliability and good sinking speed. The buoyant nature of PE coupled with rigidity make the material suitable for heavy strain classes of nets. PP fibre has the lowest density but possesses high strength in both dry and wet conditions with low stretching property.

Klust (1973) reported mixing of soft continuous filament yarns of polyamide and polyester with split fibers of polypropylene in different proportion and found the resultant products with varying degrees of flexibility. Combination twines with components of PA filament with Saran and PA filament with polyvinyl alcohol and polyvinyl chloride filament under the trade names of Kyokurin, Livlon and Marlon were produced in Japan. ICI (1959) reported mixing of high tenacity terylene filament with spun acetate for the manufacture of pilchard nets which was found to maintain stability of knots.

In India, so far, no attempt has been made for mixing of yarns for making fishing nets and accessories and hence preliminary studies were undertaken with a view to study the possibility of making combination twines in a laboratory scale and also to evaluate their physical properties to assess their suitability for low energy fishing.

Meterials and Methods

Four series of twisting experiments were conducted using hand driven twine twisting machine.

1. Monofilaments of PA of size 0.15mm and PP & PE of 0.20mm size were twisted into various specifications of combination twines keeping the number of yarns in the ratio of 1:1:1.
2. Multifilaments of 210 denier PA and 190 denier PP were mixed by twisting
3. Multifilaments of 840 denier PA and 1000 denier PE fibrillated tape yarns were mixed in the ratio of 1:1 and 1:2.
4. Combination netting yarns of 210 denier PA,190 denier PP and 1000 denier PE fibrillated tape were made.

The properties of the resultant combination netting yarns were evaluated along

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with those made of exclusively of the components.

Results and discusion

The physical properties of different specifications of combination netting yarns made of monofilaments of PA, PP and PE are presented in table 1.

Comparative tenacity (g/denier) values of the above combination products along with those made exclusively are presented in fig.1.

The stress strain behaviour of combination netting yarns, made of multifilaments of PA and PP exclusively is presented in fig. 2.

The effect of combination of multifilaments of PA and PE fabrillated tape yarns and those of PA and PP with PE fibrillated tape yarns is presented (Table 2 & fig. 3.).

Different specifications of combination netting yarns made with monofilaments of PA,PP and PE showed improved strength in dry state with no reduction in the wet condition when compared to netting yarns made of PA monofilments twisted alone. The inclusion of PA monofilaments with PP and PE improved sinking ability of the

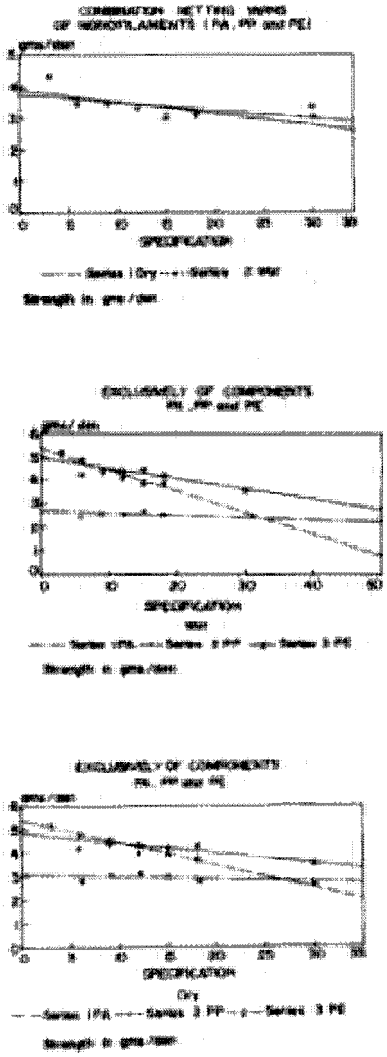

Fig. 1. Tenacity of monofilaments (combination and components)

Table: 1. *Physical properties of combination twine made of monofilaments of polyethylene, polypropylene and polyamide in the ratio 1:1:1*

Sl. No.	Specification	Mass per metre (g)	Twist per metre outer	Twist per metre inner	Breaking strength (kg) dry	Breaking strength (kg) wet	Breaking Strength (%) dry	Breaking Strength (%) wet	Knotstrength (Kg) wet
1	3 x 3	0.35	595	535	13.5	13.6	39.5	39.9	8.0
2	6 x 3	0.79	161	245	24.5	24.3	42.4	40.0	18.3
3	9 x 3	1.12	153	285	34.5	34.7	40.8	45.8	25.0
4	12 x 3	1.52	129	102	45.4	45.0	45.2	43.4	36.0
5	15 x 3	1.96	136	114	54.8	52.4	50.8	49.2	40.0
6	18 x 3	2.39	138	122	66.2	66.8	54.8	55.6	46.0
7	30 x 3	3.67	88	60	99.5	110.0	53.5	51.4	81.4

Table 2. *Properties of combination netting yarns of multifilament with tape*

Specification of netting yarn		Breaking strength (kg)		Breaking stretch (%)	
		Dry	Wet	Dry	Wet
(a) Combination of multifilaments of PAand PP					
PA	210 x 8 x 3	25.2	21.0	20.0	16.2
PP	190 x 8 x 3	27.6	28.2	21.2	20.5
PA + PP	210 x 4 x 3 190 x 4 x 3	27.2	25.4	19.5	23.2
(b) Combination of PA multifilament and PE fibrillated tape yarn					
PA	840 x 4 x 3	64.5	63.0	24.2	26.0
PE	1000 x 1 x 3	6.7	7.2	45.0	35.0
PA + PE	840 x 1 x 3 + 1000 x 1 x 3	24.8	24.0	21.0	21.1
PA + PE	840 x 1 x 3 + 1000 x 2 x 3	30.3	29.7	32.1	21.3
c) Combination of PA + PP + PE					
PA PP + PE	210 x 4 x 3 190 x 2 x 3 + 1000 x 1 x 3	24.2	23.2	44.6	50.5

finished product. Since PE monofilaments are consumed largely for making lines and ropes the experimental twisting carried out showed feasibility of combining PE, PP and PA monofilaments for geting an improved choice by combining the basic properties of three different materials.

Combination netting yarns made of multifilaments of PA and PP showed improvement in the stiffness of the product in comparison with flexible netting yarns made of PA alone. This property can be made use of in the selection of material for medium strained classes of nets, the requirement at present is met by using hard twisted nylon twines. The reduction in strength by wetting in case of PA multifilament twines is absent by the inclusion of PP thus possessing equal strength in dry and wet

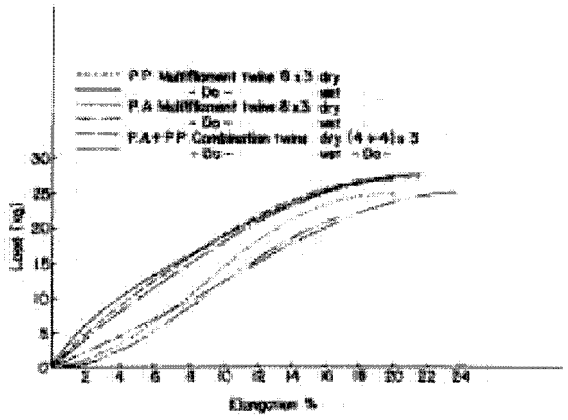

Fig. 2. Stress strain behaviour of multifilament netting yarns (combination and components)

conditions in the case of combination product.

The combination netting yarns made of PA and PE fibrillated tape showed improved strength compared to those made exclusively of the latter. By increasing the ratio of combination as 1:2,. instead of 1:1, there is ,marked reduction in the strength property commensurate with the properties of PE fabrillated tape yarns . The mixing of PE fibrillated tape yarn with PA yarns gives added surface roughness to the combination product in comparision with those made exclusively of PA. At the same time inclusion of PA in the combination add the

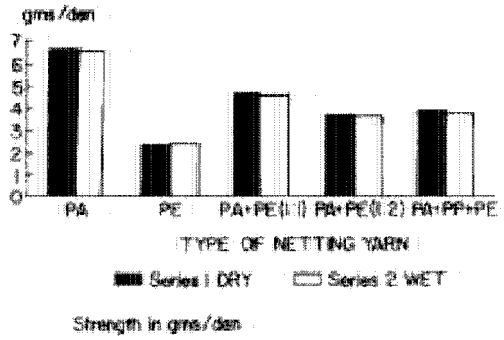

Fig. 3. Tenacity of combination natting yarns. (combination and components)

required flexibility and strength. Similarly the netting yarns made of PA, PP and PE fibrillated yarns is another combination where the properties of three different fibres combine together to give a resultant product with mixed properties. According to the degree of combination, suitable materials can be brought out as per requirement. The combination material seems to be an ideal substitute for bast fibre twines like Italian hemp and sun hemp formerly used for dara fishing.

Netting yarns made of PE and PP float in water due to low specific gravity and such nets are to be rigged with suitable weights to keep them at the required depth. The inclusion of PA in the combination tends to increase the sinking capacity of the material and add flexibility and strength.

By selecting appropriate proportion of combination, suitable netting yarns with different degree of roughness and strength can be introduced to get resultant fish net material which can be utilised for low enegy fishing gear like stake nets, traps, deep water gill nets and heavy nets as well as trawl nets.

The present studies show that polypropylene and polyethylene fibrillated yarns can find a place in the selection of material for low energy fishing by mixing with polyamide filaments. The negative features of each of the components can be lessened by the method of combination. The floatability and stiffness of polyolefines are reduced by the inclusion of flexible high specific gravity PA. The combination also brings about reduction in investment of fishing gear than those made of PA alone with added property of stiffness which is advantageous for harvesting fish.

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