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**Research Note**

# Effect of Cyclic Loading on Polyamide Monofilament Yarn Used in Monolining

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Repeated application of load with different periods of relaxation in between, rather than application of load at one stretch is the condition often faced in actual fishing. The resultant breaking strength and elongation of the material is an important factor to be studied to ascertain the withstanding strength of the net. These conditions can be simulated by laboratory tests and the results of the tests indicate the suitability of the material under real working conditions (Klust, 1983). Across the world studies have been carried out on the fatigue property of netting materials (Kanehiro and Susuki, 1984; Kanehiro *et al.*, 1992; Wanchana *et al.*, 2002 and Sala *et al.*, 2004). Only a few studies have been conducted to study the effect of cyclic loading on the properties of fishing net materials (Mukundan and Hameed, 1994). Polyamide (PA) monofilament yarns are available in the country in sizes ranging from 0.08 to 3.0 mm diameter and yarns of 1.0 to 3.0 mm diameter are used for monolining. The aim of the present investigation is to study the effect of repeated loading on the breaking load and elongation of PA monofilament yarns used as branch line of tuna long line.

PA 6 monofilament yarn of 1.50 mm diameter having a denier of 210 was used for the study. The cyclic loading test was carried out in the Universal Testing Machine (Shimadsu AGI 10 kN) by using the cyclic tensile test mode of *Trapezium Software ver. 1.20*. The sample was strained from a minimum to a maximum imposed load. The load was applied at a rate of 120 mm per minute (Dahn, 1978; Mukundan and Hameed, 1994) giving a pause of 5 sec. at the minimum and maximum imposed loads. The number of cycles was fixed as 10, 20, 30, 60, 100 and 180. The maximum load imposed in each cycle was kept at two different levels, viz., 30% and 60% of the wet breaking load of the sample. Six replicate tests were carried out for each condition. Immediately after the completion of the cycles, the load was withdrawn and the breaking strength and elongation of the strained yarn were measured as per IS 5815 Part 4 - 1993 (reaffirmed 2003).

The sample used for the study had a breaking load of 440.52 N and elongation at break of 47.87%. The loss in breaking load and percentage elongation respectively of the samples on repeated loading are presented in Fig. 1 (a & b). The decrease in breaking load from the original was 3.0% on an imposed load of 30% of the breaking load and 4.6% on an imposed load of 60% of the breaking load (Fig. 1a). In the case of elongation, the decrease was up to 11.66% in the first case and 15.18% in the second case (Fig. 1b). After the initial decrease in breaking load and elongation on first loading no noticeable decrease was found on further cyclic loading.

All the combinations of load brought a decrease in breaking load and elongation. In the case of breaking load, the decrease was only marginal. Duncan's multiple range test showed that there is no significant difference between the two levels of force applied on

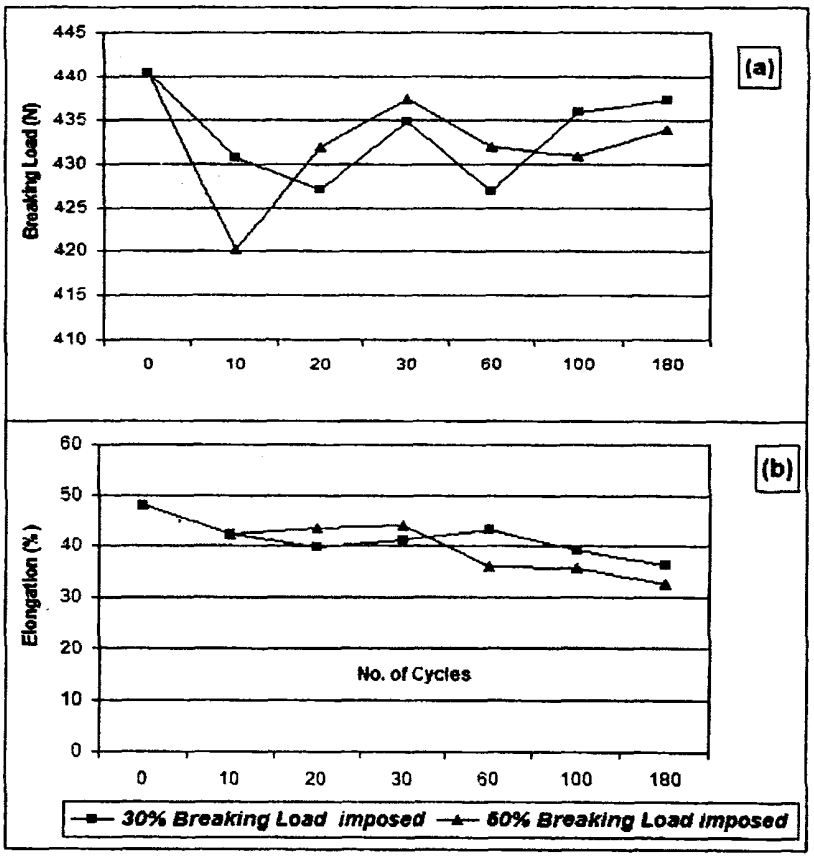


Fig. 1. The residual breaking load and elongation of PA monofilament yarn (1.5 mm dia) in which (a) denotes breaking load and (b) elongation

the residual tensile breaking load or elongation. However the number of cycles had a significant influence on the residual breaking load and elongation ($P<0.001$). Different combinations of force and cycles also influenced the load an elongation ($P<0.001$). However, Mukundan and Hameed (1994) observed that elongation is related to the amount of load applied but not on the number of loading cycles for polyethylene monofilament twisted yarn of 0.75 mm diameter.

Tanido, (1976) reported decrease in elongation in netting twines with the repeated number of loading. An increase in elongation of PA monofilament yarn of 0.48 mm diameter subjected to increasing number of cycles in fatigue tests was observed by Wanchana *et al.* (2002). Kenehiro and Suzuki (1984) also reported the influence of cyclic load amplitude on fatigue life of tuna branch line of polyester and nylon multifilament twines of 3.63 and 3.71 mm diameter respectively where the maximum load imposed was 80% of the breaking load. Dahn (1978) observed rapid deterioration of elongation from 20 to 11% after 10 load changes at a load of 25 $g.tex^{-1}$.

In fishing gear, elongation of the material is an important property as it influences the retention of mesh size, gear shape and catching performance. In actual fishing conditions also, different combinations of loading and relaxation occur. The present study showed that percentage elongation decreased significantly due to cyclic loading.

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