

## Weathering of Nylon Netting Yarns

B. Meenakumari, K. Radhalekshmy and P.A. Panicker\*

*Fishing Technology Division  
Central Institute of Fisheries Technology  
Cochin - 682 029, India*

Studies on properties of the netting material form a prelude to the applicability of material to different types of fishing gears. Weathering of nylon is mainly due to the effect of ultraviolet rays. The effect of insolation on nylon netting yarns of 9 different specifications (210Dx1x3 - 210Dx24x3) over a period of 150 days was studied by measurement of loss in breaking strength. A common regression line for percentage retention of breaking strength (Y) vs. period of exposure (X) of nylon netting yarns was fitted ( $Y = 99.6 - 0.276X$ ), irrespective of specifications, based on results of Bartlett's test and analysis of co-variance.

**Key words :** Nylon netting yarn, weathering, insolation.

Chemical deterioration due to exposure to sunlight is the major drawback in synthetic netting yarns. Wearing encompasses mechanical and chemical factors according to Mc Nally and Mc Cord (1960). In the process of this deterioration, the oriented long-chain fibre molecules are oxidised and broken apart into smaller units affecting the fibre properties adversely. This deterioration is measured in terms of the mechanical properties (Singleton *et al.*, 1965). Nylon is known to have the maximum abrasion resistance among synthetics (Brandt, 1957) and is practically rot proof. Hence, exposure to sunlight is a major factor promoting deterioration. In the process of development of netting material, manufacturers have started incorporating UV retardants to delay the process of deterioration due to UV rays. Source to source variation of this application is ascertained by collecting nylon samples from different firms and exposing them to UV rays (Meenakumari & Ravindran, 1985). A general profile of the deterioration of nylon netting yarns was presented by Meenakumari & Radhalekshmy (1988) by testing the samples under controlled exposure conditions. In

the present study, nylon twines of different sizes were exposed outdoors for assessing deterioration in terms of period of exposure.

### Materials and Methods

Nylon netting yarns of 9 different specifications ranging from 210Dx1x3 to 210Dx24x3 were covered under the study. The samples were tied to a rectangular frame held vertically and kept in north-south direction on a roof top where sunlight falls directly during the whole day. The maximum temperature at the test site varied from 35.5 to 29.1°C and minimum 27.2 to 20.1°C. The period of exposure was January to May 1988. The maximum average precipitation during the experiment period at the site was 62 mm. Noon radiation recorded at the test site, measured using Environmental Data Acquisition system (EDAS) (Sivadas, 1985), is given in Table 1.

Samples were retrieved at fortnightly intervals and breaking strength was measured using the ZWICK 1484 UTM as per BIS (1970). The loss in strength in terms of the original was calculated, based on the

\* Present address: Pulluvallil House, Nettoor P.O., Kerala, India

consideration that netting material loses its serviceability when 50% reduction occurs in its original strength.

Table 1. Monthly average noon radiation at the test site

| Month         | Radiation,<br>W m <sup>-2</sup> |
|---------------|---------------------------------|
| January 1988  | 693                             |
| February 1988 | 718                             |
| March 1988    | 841                             |
| April 1988    | 774                             |
| May 1988      | 486                             |

## Results and Discussion

Table 2 presents the data on the breaking load of the exposed samples at fortnightly intervals for a period of 150 days. The retained strength was correlated with period of exposure for each sample and the rate of deterioration was calculated based on the relation  $Y = a + bX$ , where  $Y$  is the retained strength in percentage,  $X$  is the period of exposure and  $a$  and  $b$  are constants. Comparison of  $b$  values obtained for the different samples was made by analysis of covariance (Snedecor & Cochran, 1968). The

Table 3. Regression between percentage retention in strength ( $Y$ ) and period of exposure ( $X$ ) of nylon netting yarns

| Specification | Regression coefficients |
|---------------|-------------------------|
| 210Dx1x3      | $Y = 94.083 - 0.227X$   |
| 210Dx2x3      | $Y = 96.365 - 0.275X$   |
| 210Dx3x3      | $Y = 97.869 - 0.224X$   |
| 210Dx4x3      | $Y = 102.207 - 0.261X$  |
| 210Dx5x3      | $Y = 101.857 - 0.294X$  |
| 210Dx6x3      | $Y = 103.187 - 0.338X$  |
| 210Dx9x3      | $Y = 97.761 - 0.267X$   |
| 210Dx18x3     | $Y = 101.577 - 0.314X$  |
| 210Dx24x3     | $Y = 103.481 - 0.335X$  |

values for different samples calculated based on this method are presented in Table 3. The trend of deterioration individually for the different samples appeared to follow a common line. The homogeneity of residual variance evaluated using Bartlett's test was not found significant ( $\chi^2 = 2.4399$ ;  $df$  89;  $p > 0.05$ ). The analysis of covariance applied to different samples did not reveal significant differences in slopes ( $F_{8,80} = 1.6323$ ;  $p > 0.05$ ) showing that percentage rate of deterioration remained the same irrespective of the size of netting yarn.

Table 2. Breaking load (N) of the nylon netting yarns exposed outdoors

| Specification<br>Period<br>exposed, days | 210Dx1x3 | 210Dx2x3 | 210Dx3x3 | 210Dx4x3 | 210Dx5x3 | 210Dx6x3 | 210Dx9x3 | 210Dx18x3 | 210Dx24x3 |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|
| 0                                        | 31.73    | 80.34    | 120.66   | 152.45   | 179.02   | 262.17   | 326.83   | 641.50    | 810.44    |
| 15                                       | 28.34    | 74.34    | 113.60   | 147.91   | 178.84   | 260.62   | 304.73   | 621.63    | 796.74    |
| 30                                       | 28.29    | 72.31    | 110.70   | 147.16   | 167.93   | 253.80   | 291.88   | 599.17    | 763.97    |
| 45                                       | 26.27    | 65.60    | 106.95   | 135.97   | 157.84   | 228.58   | 285.93   | 567.68    | 724.72    |
| 60                                       | 25.85    | 63.79    | 103.59   | 133.77   | 154.98   | 217.85   | 272.55   | 502.67    | 686.15    |
| 75                                       | 25.08    | 59.11    | 96.28    | 122.28   | 138.02   | 195.54   | 243.80   | 494.17    | 670.88    |
| 90                                       | 22.15    | 57.58    | 94.71    | 119.08   | 132.58   | 182.44   | 239.50   | 480.56    | 603.92    |
| 105                                      | —        | 53.58    | 89.18    | 112.08   | 116.28   | 169.12   | 229.17   | 453.55    | 571.73    |
| 120                                      | 21.87    | 49.45    | 84.32    | 110.02   | 123.37   | 162.85   | 221.74   | 420.61    | 535.04    |
| 135                                      | 20.63    | 48.61    | 81.30    | 101.17   | 134.95   | 160.20   | 199.51   | 365.72    | 468.13    |
| 150                                      | 19.01    | 47.04    | 80.01    | 96.20    | 109.29   | 144.24   | 189.67   | 342.38    | 429.41    |

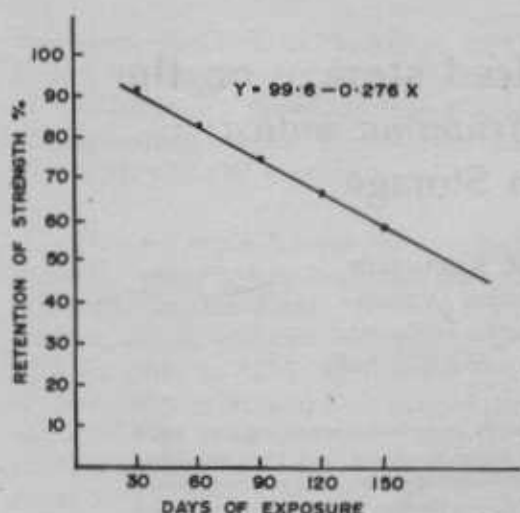


Fig. 1. Regression of strength retention of netting yarns on exposure period

A common trend line fitted for all the samples correlating retained strength in % (Y) and period of exposure (X) (Fig. 1) gave  $Y = 99.60 - 0.276X$ . This could serve as a reference index for deterioration of nylon netting yarns subjected to insolation under similar conditions.

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