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The Effect of The Environment Condition on The Strength of Fishing Net

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Abstract: The environmental condition plays a significant role to the strength of the fishing net. As it could lead the net to break during fishing. The strength of fishing nets is critical for fishing activities, since a lack of net strength can result in fish escape, ghost fishing, and economic losses. The main objective of this study is to determine the strength properties of fishing nets in different environmental conditions. The strength of the fishing nets was measured from tensile test. For sample A it will be put into light fastness machine, sample B will be soaked in a container of seawater, and sample C will be in both condition which is the sample will be soaked in the container of seawater before taken out to put into light fastness machine. Tensile test machine will be used to get the raw data for the specimen. Based on the result obtained, different environmental condition has different degradation, and the elongation of the nets were dropped as the time spent in each environmental condition increased. Exposing the fishing net under environmental condition takes a toll to its tensile properties. It is concluded that the environmental condition do affect fishing net tensile properties and breaking strength.

Keywords: Tensile Test, Breaking Strength, Elongation

1. Introduction

With the constant improvement of technology around us, fishing has become easier and faster than the traditional methods. With a low catch volume, the traditional hook and line method is extremely time intensive. While the use of local fish nets with unregulated mesh might imperil small immature fish, negatively impacting the marine ecology. It is strongly advised that fishermen abide by the regulations in order to prevent the marine ecology from becoming extinct.

The geography of Malaysia, which is always radiant from the sun, might destroy the nets and affect the strength of nets to perform properly. The materials were often exposed to a variety of environmental conditions, where they disintegrated owing to moisture. When the nets are utilised for fishing, they exhibit weather-deteriorating behaviour. The degradation rates vary depending on the conditions, with

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high humidity speeding up the degradation rates and UV light causing material failure and degradation to molecular mass.

The purpose of this research is to conduct an experimental evaluation of the mechanical properties of fishing nets, such as breaking strength and tensile strength of netting twine, under various environmental conditions. In addition, the influence of environmental circumstances on fishing net mechanical qualities has been studied based on prior research.

2. Materials and Methods

2.1 Materials selection

Jaya Nets Sdn. Bhd. supplied the fishing nets, which are composed of Polypropylene (PP). PP is a high-quality polymer that can withstand high temperatures as well as UV radiation. As a result, the same net will be used throughout the whole environment conditioning process. This research used knotless rope with yarn diameters of 0.06 cm and mesh sizes of 2.30 cm x 2.30 cm.

2.2 Methods

The method of preparing the sample, is by cutting the samples for three different environmental condition. Where sample A is for UV sunlight, Sample B is for exposure to seawater, and Sample C is for both condition, exposure to seawater and UV sunlight. For sample A the duration spent in light fastness machine are 90 hours, 120 hours, 200 hours and 330 hours. Meanwhile for sample B the duration being exposed to seawater are 7 days, 14 days, 21 days and 28 days. For sample C the duration will be the combination of the duration both sample A and sample B which are 7 days and 90 hours, 14 days and 120 hours, 21 days and 200 hours and 28 days 330 hours. The seawater was collected at Tanjung Emas, Muar which will be used in this study. While for the light fastness machine UV intensities could not be determined as the were no longer data regarding this model of machine.

2.3 Equations

Throughout the test, the sample mesh area remained constant at 5.29 cm^2. The tensile load would then be applied to the mesh at a constant extension rate of 0.10 m/min and force. The acquired data was used to determine tensile stress and strain, as stated in Eq.1 and Eq. 2. The data will be collected and evaluated.

$$Tensile\ Stress/Breaking\ Strength = \frac{Force,F}{\text{Area,A}} \qquad Eq.\ 1$$

$$Tensile\ Strain/Elongation = \frac{Length\ of\ Stretch,\Delta\ell}{Original\ Length,\ell 0}\ X\ 100 \qquad Eq.\ 2$$

3. Results and Discussion

The results and discussion are organized into three sections. The first section discusses the exposure of the fishing net to UV radiation, the second section discusses the exposure of the net to seawater, and the third section discusses the exposure of the net to both UV sunlight and seawater. The breaking strength of the material is obtained from Eq. 1 where the average value of the twine diameter is 0.06 cm.

3.1 Exposure to UV sunlight

Table 1: Strength properties of fishing net expose to UV sunlight

Sample	Breaking Strength (kg/cm²)	Elongation (%)

90 hours	2281.58	106
120 hours	2180.55	103
200 hours	2161.96	98
330 hours	1989.84	101

The reading for breaking strength after 90 hours is 2281.58 kg/cm^2, whereas the reading after 120 hours is 2180.55 kg/cm^2. The readings for 200 and 330 hours are 2161.96 kg/cm^2 and 1989.84 kg/cm^2, respectively. This demonstrates that the nets gradually lose strength after being exposed to UV rays.

The elongation lengths of the net after testing are 106.00 %, 103.00 %, 98.00 %, and 101.00 %, respectively. Figure 1 shows that the elongation values at 330 hours were marginally greater than the readings at 200 hours. This might be due to the net structure being more brittle than the other sample. According to Balik (2010), the exposure of material to UV radiation can cause material failure and degrade to molecular mass.

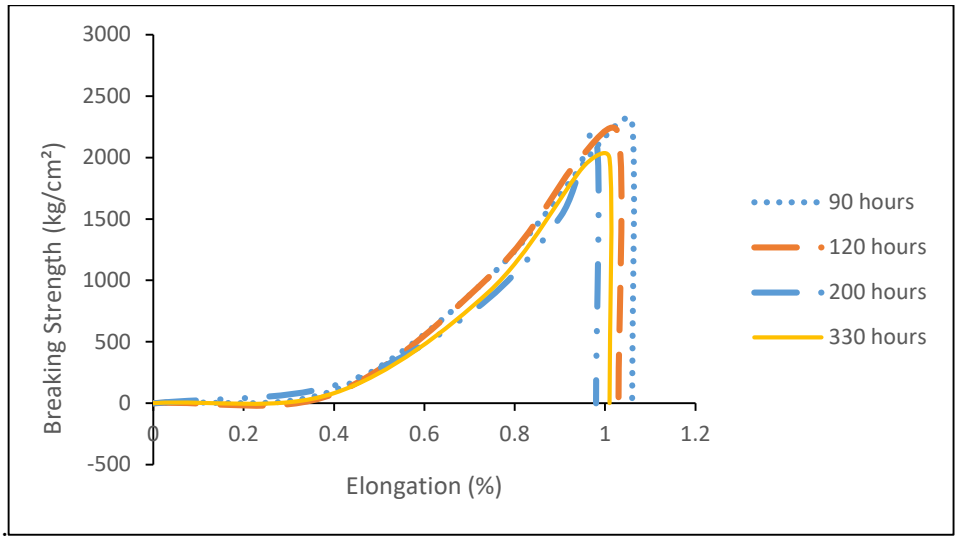

Figure 1: Breaking strength versus elongation of fishing nets exposed to UV sunlight

3.2 Exposure to seawater

Table 2: Strength properties of fishing net expose to seawater

Sample	Breaking strength (kg/cm²)	Elongation (%)
7 days	2478.24	110
14 days	2265.52	103
21 days	2183.07	104
28 days	2020.69	92

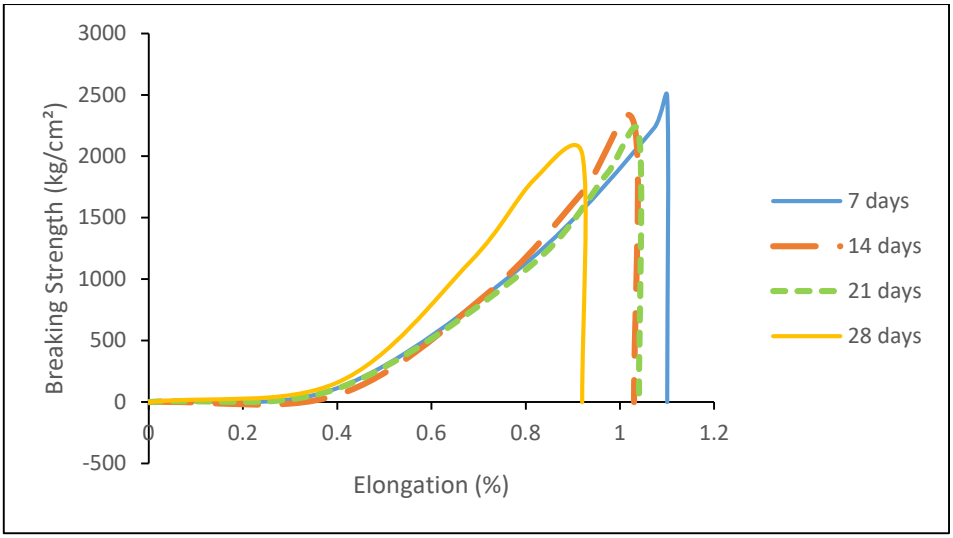

Figure 2: Breaking strength versus elongation of fishing nets exposed to seawater

For breaking strength measurement, the 7-day result is 2478.24 kg/cm^2, the 14-day result is 2265.52 kg/cm^2, the 21-day result is 2183.07 kg/cm^2, and the 28-day result is 2020.69 kg/cm^2. This demonstrates that when the nets are exposed to seawater for a longer period of time, their strength steadily deteriorates.

According to Figure 2, the reading indicates that the nets gradually lose strength after being exposed to seawater. Elongation is often negatively linked to net breaking strength. In this study, however, it also decreased as the duration spent in the seawater grew.

3.3 Exposure to seawater and UV sunlight

Table 3: Strength properties of fishing nets after expose to seawater and UV sunlight

Sample	Breaking strength (kg/cm²)	Elongation (%)
7 days & 90 hours	2570.25	109
14 days & 120 hours	2115.59	103
21 days & 200 hours	1962.96	99
28 days & 330 hours	2236.66	95

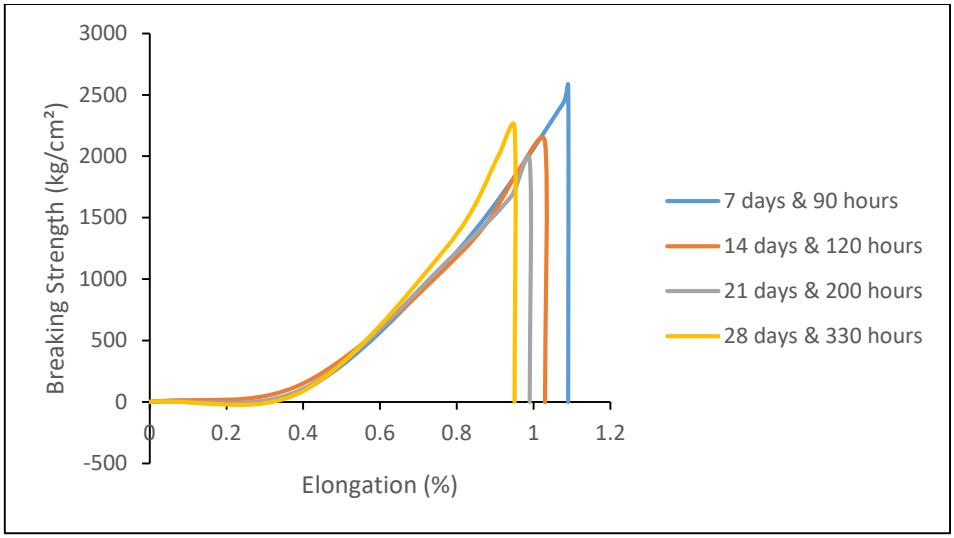

Figure 3: Breaking strength versus elongation of fishing nets exposed to seawater and UV sunlight

For breaking strength measurement, the readings after 7 days and 90 hours are 2570.25 kg/cm^2, 14 days and 120 hours are 2115.59 kg/cm^2, 21 days and 200 hours are 1962.96 kg/cm^2, and the last reading is 2236.66 kg/cm^2 after 28 days and 330 hours. According to the statistics, the net is steadily losing strength, however the final reading reveals that the breaking strength value is somewhat greater than the previous two. This might be due to the net's cutting size, or the net not being entirely submerged in the seawater container due to the fishing net is floating during the process.

4. Conclusion

Distinct environmental circumstances have a different degradation spectrum, and its tensile strength steadily declines over time. It is established that environmental factors play a significant influence in ensuring the longevity of the fishing net.

The purpose of this study is to investigate the influence of environmental conditions on fishing net tensile strength. The fishing net's tensile qualities and breaking strength suffer as a result of being exposed to UV sunlight and seawater.

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