INVESTIGATION OF MECHANICAL PROPERTIES OF TREATED READY MADE GARMENT WASTE REINFORCED POLYMER COMPOSITES

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Abstract: Textile waste consists of by-product materials from the textile, fiber and cotton industries. Each year 750,000 tons of this waste is recycled into new raw materials for the automotive, furniture, mattress, coarse yarn, home furnishings, paper and other industries. In this study ready made garment waste cotton fibre were treated with NaOH and formic acid then mixed with ready made garment waste polyester fibre and polymer composites were produced from these treated cotton/polyester blend fibres by using thermoset resin. Then mechanical properties of treated waste cotton/polyester fibre blend thermoset composites were investigated.

1.Introduction

Each year tons of textile waste is recycled into new raw materials for the automotive, furniture, mattress, coarse yarn, home furnishings, paper and other industries. Used clothes and losses of textile industries end sooner or later in waste collection stations, and usually landfilled or incinerated[1].
The performance of fibre-reinforced environmentally friendly materials depends on the development of coherent interfacial bonding between the fibres and matrix [2,3]. In order to obtain strong bond between matrix and reinforcement material of composite structures, surface of the reinforcement material is roughed, and mechanical bond is increased. Many researches have been studied on application of chemical methods to increase the adhesion between matrix and reinforcement material. Sodium hydroxide is the most proper chemical of the surface modification of the plant fibre[4,5]
In this study, ready made garment waste cotton and polyster fibres were used as reinforcement material. Cotton fibres were treated with NaOH and formic acid. Then treated waste cotton fibre and waste polyester fibre were mixed, cotton/polyester blend ratio was set to 15-85%. Then polymer composite was produced by using treated cotton and polyester blend as reinforcing material. Polyester resin was used as matrix. Composite materials were produced by using vacuum infusion method. Finally charpy impact strength properties of the waste fibre/polyester composites were investigated. Better results were obtained from formic acid treated waste fibre/polyester resin composites.

2.Experimental

2.1.Material

In this study, ready made garment waste cotton/polyester fibre blend were used as reinforcement material. Waste cotton and polyester fibres were obtained from ready made garments and processed by Punteks, Turkey. Thermoset polyester resin was used as matrix. Polyester resin was obtained from Poliya Polyester, Turkey.

2.2.Fibre Treatment

Ready made garment waste cotton fibres were treated with NaOH and formic acid, Cotton fibre were washed with water to remove the adhering dirt for 30 min at 20^{O}C in distilled water. They were dried in an oven for 6 hours at 70^{O} C before production of the composite. Procedure of the fibre treatment is given in Table 1.

Table 1. Treatment Procedure of the Waste Cotton Fibre

Chemicals	**Producer**	**Concentration**	**Temperature (°C)**	**Time (min)**	**Rinsing Process (25°C, 10 min, pH 7)**	**Drying Process**
NaOH	Merck	5 g/L	20	30	Distilled water	At room temp.
Formic Acid	Merck	%100	20	40	Distilled water	At room temp.

2.3.Composite Production

Thermoset composite structures were produced by using vacuum infusion method, ready made garment waste cotton/polyester blend was used as reinforcement material and thermoset polyester resin was used as matrix. After production of the composites charpy impact strength properties of the composites were investigated. Charpy impact test was performed according to ASTM D5942-96.

3.Results and Discussion

Charpy impact test results of the waste fibre/polyester composites are given in Table 2 and Figure 1.

Table 2. Charpy Impact Strength Properties of the Composites

Composites	**Charpy Impact Strength (kJ/m^2)**
Waste polyester fibre / PES composite	16.6
Untreated cotton-polyester waste fibre / PES composite	17.1
NaOH treated cotton-polyester waste fibre / PES composite	22.8
Formic Acid treated cotton-polyester waste fibre / PES composite	18.0

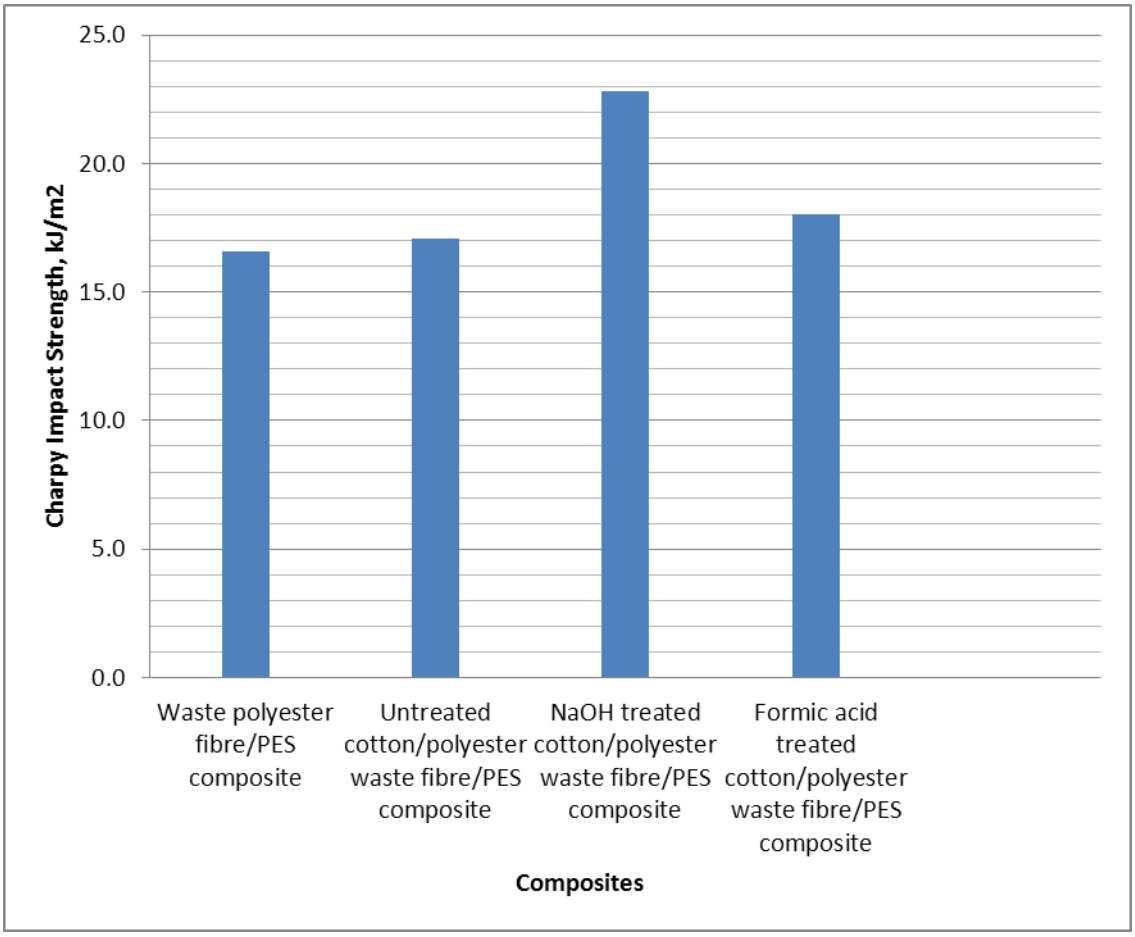

Figure 1. *Charpy impact strength properties of the waste fibre polymer composites*

According to the charpy impact results of the composites, NaOH and formic acid treatments of waste cotton fibre increased the charpy impact properties of the composites. The reason of that the treatment processes cleaned and roughed the surface of the cotton fibre, so better adhesion occured between the waste fibre and polyester resin. Higher charpy impact results were obtained from NaOH treated cotton-polyester fibre/polyester resin composites. Also addition of untreated and treated cotton fibre as reinforcing material instead of using waste polyester fibre alone, increased the charpy impact strength of the composites.

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