Technological sustainability in garden and park furniture using textile fibers like banana and glass fibers to achieve high durability with the help of highly pure epoxy compounds

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Introduction:

Complex materials began to spread in the sixties of the last century, and these materials consist of two different materials, the first of which is a reinforcing material that can be in the form of fibers made of high-resistance materials (such as carbon fibers and glass fibers ..), and the second is one of the plastics or colloidal polymers , Which gives the product its desired final form and is called the incubator. The mechanical properties of the final product are different from those of any of the composites.

Bananas are considered a unique annual crop, and after the fruit grows, the leaves and false trunks die to make way for the buds and roots to be replenished from the rhizome. Harvesting the crop requires dispensing from all other parts of the plant except the fruit, so these small shoots replace the original plant.

In order to design sustainable public garden furniture, the units must be environmentally friendly and made from materials that are free from gas emissions and do not consume as much energy in the manufacturing and production process to the maximum extent possible and be recyclable or biodegradable.

Statement of the Problem:

- The inefficiency of many garden furniture and parks in special weather conditions such as heat and rain or hard use.
- Garden and park furniture are affected by constant pressure, which exposes them to damage and cutting.
- Most of this furniture is either light in weight, volatile. Or heavy in weight, so they are not removable and unsustainable.
- Often the traditional industrial raw materials are not environmentally friendly and do not take into account the economic side.

Study Significance:

The importance of research is evident in the following points:

- Producing garden furniture and gardens with technology suits the Egyptian atmosphere, and can tolerate weather conditions such as heat or rain and mechanical conditions.
- Maximizing the utilization of textile fibers such as banana and glass fibers as reinforcement fillings in the production of garden and park furniture.
- Adapting high-purity epoxies to achieve the foundations and requirements for sustainable garden furniture design.
- Shedding light on the economic aspects after the proposed production operations.

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Methodology of Research:

- The research depends on the deductive method and the methods of practical application and statistical analysis.

Objective of Research:

To provide Egyptian-made varieties produced with sustainable technology and materials using reinforced filling materials, including banana fibers, glass fibers and epoxy compounds.

Practical Experiences

- Tensile Test) Galdabini-Quasar 600-Made in Italy)ASTM D638 .
- Elongation Test) Galdabini-Quasar 600-Made in Italy)ASTM D638 .
- Pressure Test) Galdabini-Quasar 600-Made in Italy) ASTM D695 .
- Taber Abrasion (Taber Dual Abraser) ASTM D4060.

Procedural Steps for Research.

4 epoxy samples were produced with (two samples of banana and glass fibers, and two samples of glass fibers only) .

• The first sample : 50 grams banana fibers bristles, 100 grams glass fibers, 1 kg epoxies.
• The second sample: 50 grams banana fibers bristles, 200 grams glass fibers, 1 kg epoxies.
• The third sample : 100 grams fiberglass (1) woven layer, 1 kg epoxy.
• Fourth sample : 200 grams of fiberglass (2) woven layer, 1 kg epoxy.

Research results:

The strengths and weaknesses of the four species produced through this research were recorded, and the observations were as follows:

• The first sample: 50 grams of banana fibers bristles, 100 grams glass fibers, 1 kg epoxies

- The average tensile strength of the first sample is 32.69 N / mm^2. This means that the three added ores produced a sample with a significantly higher tensile strength. In contrast, the elongation was 11.30%, which is a suitable high elongation that helped to form the samples and manufacture them.
- Average fatigue strength of fold resistance is 118.87 N / mm^2. The significant development of epoxy compounds is evident after the addition of banana and glass fibers. The average pressure stress of the first sample is 106.14 N / mm^2, which demonstrates the importance of adding textile fibers to epoxy compounds to improve their application properties.
- Ground resistance of the first sample 20 mg with a weight of 1000 g and CS17 user stone and a number of cycles of 1000 cycles. It is a very small weight loss, due to the strengthening of the epoxy complex used with banana and glass fibers contained within the sample, which causes the strength of the samples, as this sample is the least weight of samples.
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• The second sample: 50 grams of banana fibers bristles, 200 grams glass fibers, 1 kg epoxies

- The average tensile strength of the second sample is 20.39 N / mm^2. The addition of banana and glass fibers to the epoxy compound improved the strength of the tension slightly. In

contrast, elongation was 9.36%, and there was a relative decrease in the elongation rate of the sample from the first sample, after adding more banana and glass fibers.

- Average tensile strain strength is 77.15 N / mm^2. This makes the sample very suitable for making garden and park furniture. The average pressure stress of the second sample is 57.28 N / mm^2. It is an average less than the first sample, and the addition of banana fibers and glass fibers and the lack of the adhesion coefficient between the textile fibers and epoxy compounds resulted in a lower tolerance of the second sample to pressure on them by less than the first sample.
- Ground resistance of the second sample, 71 mg. It is a relatively high loss in weight loss between samples.

• The third sample: 100 grams of fiberglass (1) woven layer, 1 kg epoxy.

- The average tensile strength of the sample was 38.53 N / mm^2. That is, adding the fiberglass to the epoxy compounds increased the tensile strength of the sample more than all the other samples. The third sample recorded the lowest elongation ratio among the samples, as the elongation decreased to 8.20%, which makes it the least elongation of the samples.
- The average tensile strength stress is 122.28 N / mm^2. The significant development of epoxies after the addition of glass fibers is evident.
- Average effective stress 129.72 N / mm^2. It is the highest pressure stress on the samples.
- Ground resistance of the third sample, 93 mg. It is the highest weight loss among all samples.

• Fourth sample: 200 grams of fiberglass (2) woven layer, 1 kg epoxy.

- The average tensile strength of the sample was 35.06 N / mm^2, which is one of the highest ratios of tensile strength recorded between the samples. There was an increase in elongation that reached 12.21%, which is the highest elongation amount between the samples.
- The average tensile strength is 170.47 N / mm2. The significant development of epoxies after the addition of glass fibers is evident. The average pressure stress of the fourth sample was 119.89 N / mm2, which is one of the highest stress tolerances on the samples.
- Ground resistance of the fourth sample, 85 mg. It is a relatively high weight loss, and this is often due to the increase in the amount of woven fiberglass present inside the sample, which causes the strength of the samples, and sometimes a separation occurs between the layers of the fiberglass and the epoxy compound, which makes the weight loss high.

Interpretation of the results.

- The fourth sample is the ideal sample for the work of garden and park furniture, due to the high tensile strength; high elongation, very high increased resistance and high pressure resistance although it is one of the highest samples in terms of weight loss and ground resistance. They are very suitable qualities for making garden and park furniture, which allows for a higher use in daily life, and resistance to variable use conditions, and not affected by conditions of weather such as high temperature, cold and rain.
- The second sample is characterized by a decrease in the amount of stress it has, less than the rest of the samples, and its relatively medium elongation and its resistance to weak folds compared to the rest of the samples, low resistance to pressure, its loss of relatively high weight

and less resistance to land, so it is considered the least susceptible sample for the manufacture of garden furniture and parks, Which does not allow it to have a large scale of use in daily life, and does not allow it to resist the variable use conditions such as stress, flexion, pressure and land, and makes it easily affected by conditions and weather factors such as high temperature, cold and rain.

- The third sample is considered very ideal in the strength of tensile strength, flexural strength and compression resistance, but it is the least of the samples in the elongation ratio and the most specimen of weight loss and ground resistance. Therefore, it is possible to take advantage of these properties in making garden and parks furniture, that are not subjected to elongation or ground conditions, such as some works of artistic decorations in gardens or internal fences works in these gardens and parks.
- As for the first sample, it is an economic sample in the first place. It appears to us in the case of wanting to get the lowest cost of raw materials, because it contains only 50 grams of banana fibers with 100 grams of glass fibers added to epoxy compounds, high tensile strength, high elongation and high bending stress. Relatively high pressure fatigue and very little weight loss. It is a very ideal economic sample for garden and park furniture.
- It is clear from the results of the samples, the important economic aspect in producing this type of garden furniture and parks in a simple and pure Egyptian style, where the material of banana fibers and glass fibers was used instead of burning or disposing in a way that achieves an important environmental aspect. The glass fibers are used for reinforcement, which gives a large part of the continuity of the furniture with some maintenance. As for the epoxy material, it is very suitable compared to other materials used in making this type of furniture for gardens and parks.

Recommendations.

The research recommendations are summarized in the following points:

1. Achieving cooperation with the Ministry of Industry to produce garden furniture and parks and resist weather and usage conditions.
2. Shed light to take advantage of the textile fibers used in industrial purposes such as banana fibers and glass fibers to make strengthening pads with the help of epoxy compounds.
3. Attention to the high purity epoxy due to its great industrial importance.
4. Highlighting the economic aspects after the proposed production operations.

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