Evaluation of Mechanical Properties of Packaging inserts and Liners

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Aim of the Project

The Aim of the project was to investigate the mechanical properties of various packaging materials such as, cardboard, Styrofoam, and bubble wrap etc.

Background

The purpose of this project was to evaluate the mechanical properties of various packages and liners.

For this Project we carried compression tests to evaluate compressive strength and % crushed of packing materials to determine how much force the material could resist before failing.

We also carried out impact tests to evaluate how the materials reacted under impact

These tests simulated the forces that a packaging material would undergo during the shipping process. These are key properties when designing packaging materials to prevent damage to the product

Impact Tester

An Impact tester is an easy-to-use, ergonomically designed instrument used to measure the impact resistance of a plated materials utilizing the free-falling dart method.

The impact tester was modified to used a 2kg steel alloy weight. This weight was used at a height of .83 meter or 1.73meter. Using the acceleration due to gravity to accelerate the dart we recorded the highest impact to be on average 1500N unassisted.

Figure 1: Impact Test Rig

Compression Tests

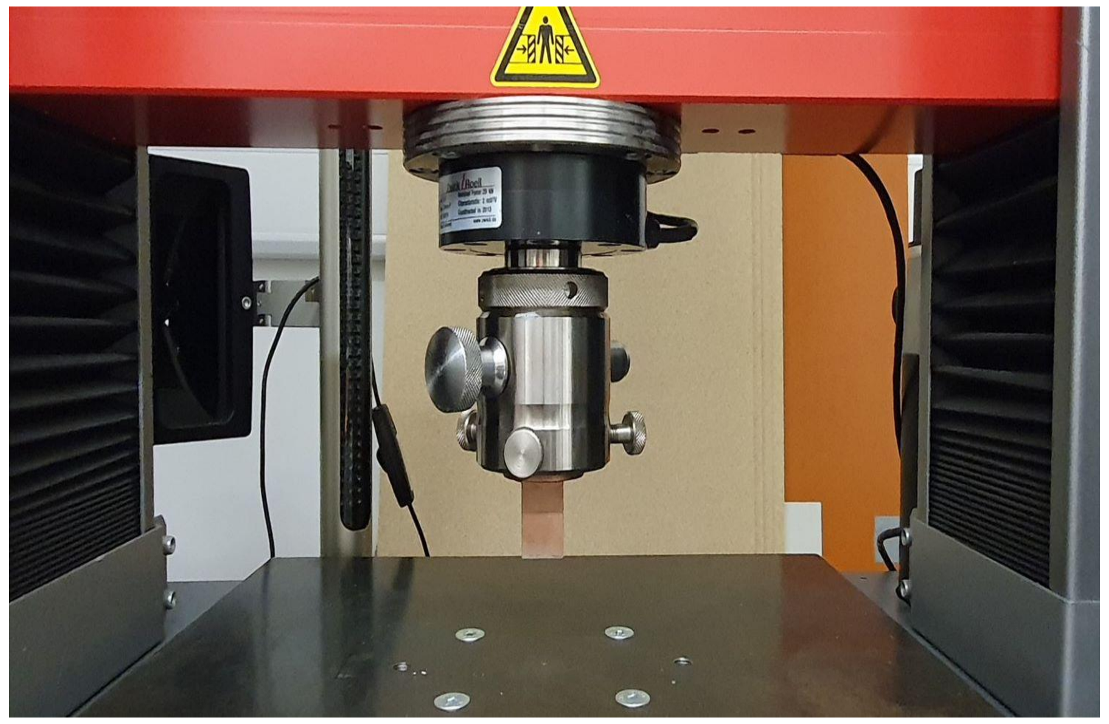

Figure 2: Tensile Tester

The Zwick Roell tensile machine was used to carry out the compression Tests for this project, the machine allowed for various plates to be attached in order to achieve a more accurate test e.g. small plate, large plate. The small plate was used for smaller objects such as bubble wrap and cardboard while the large plate was used for any materials that didn't fit in the small plate, however a modification was made on the large plate to allow for the test pieces to sit flush on the surface, this was achieved by machining countersink holes as seen above. A square shaped indenter was also designed to allow for more precise tests on specific areas of the specimen e.g. the corner, middle and edge. This allowed for a detailed comparison of the different sections of the packaging.

Environmental Impact

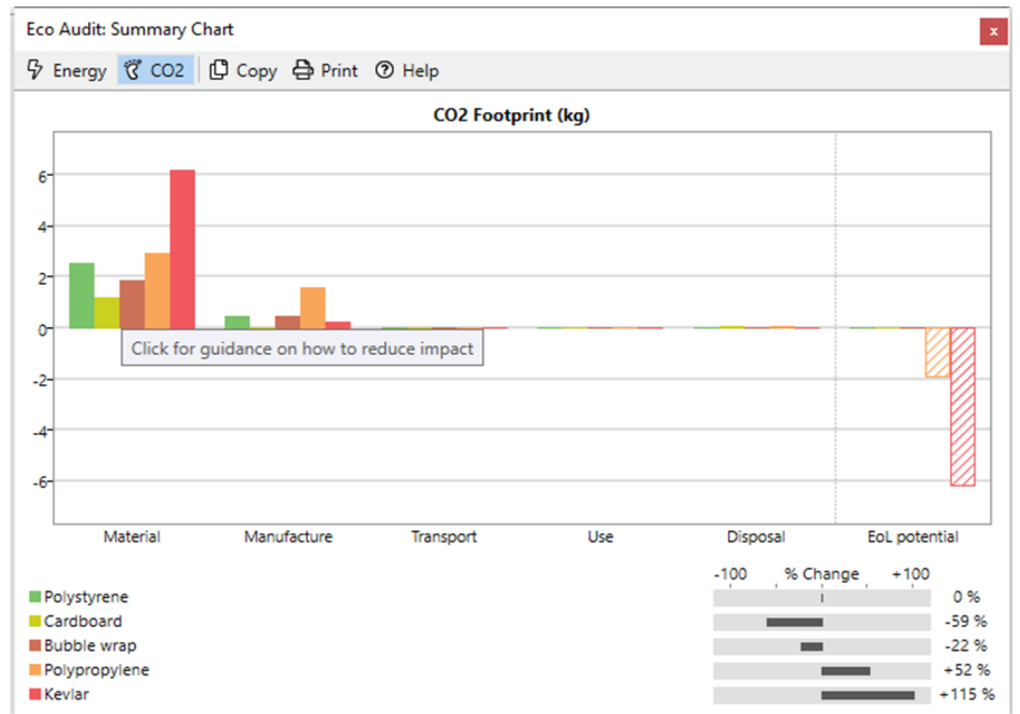

Figure 3: CO2 Graph

The above graph was generated using the eco audit function on "Granta Edu pack". This allowed us to generate a graph that would show how much Co2 is produced in the primary production of each material, it can also graph variables such as transport and uses which give a more in-depth graph on Co2 emissions. It can also be used to show the embodied energy in each material that has been selected again allowing us to see each variable

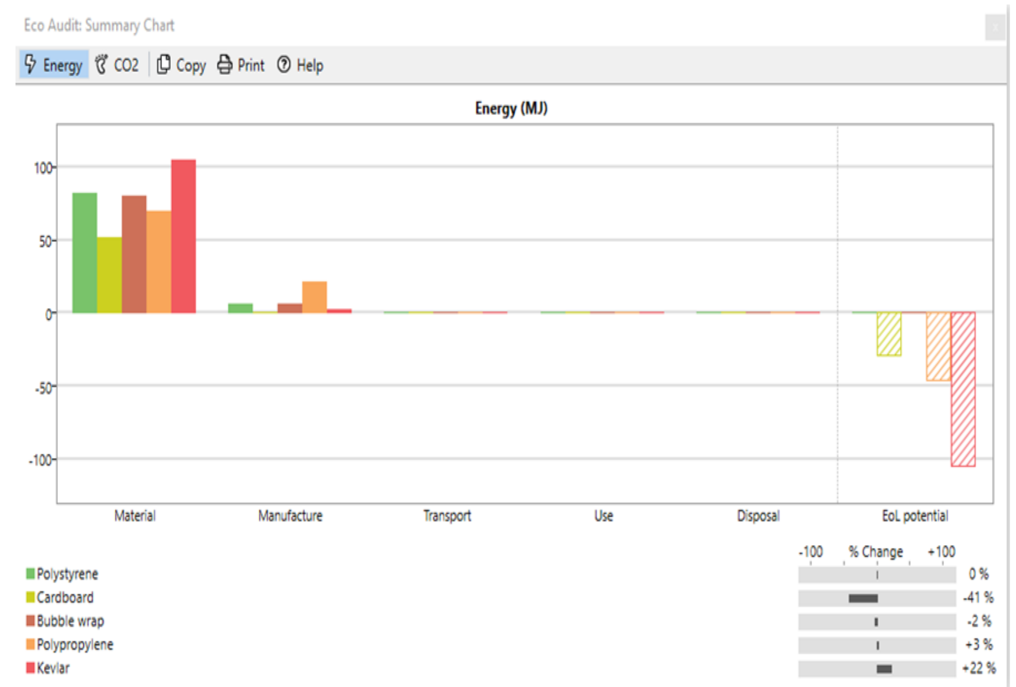

Figure 4 Embodied Energy Graph

Test Results

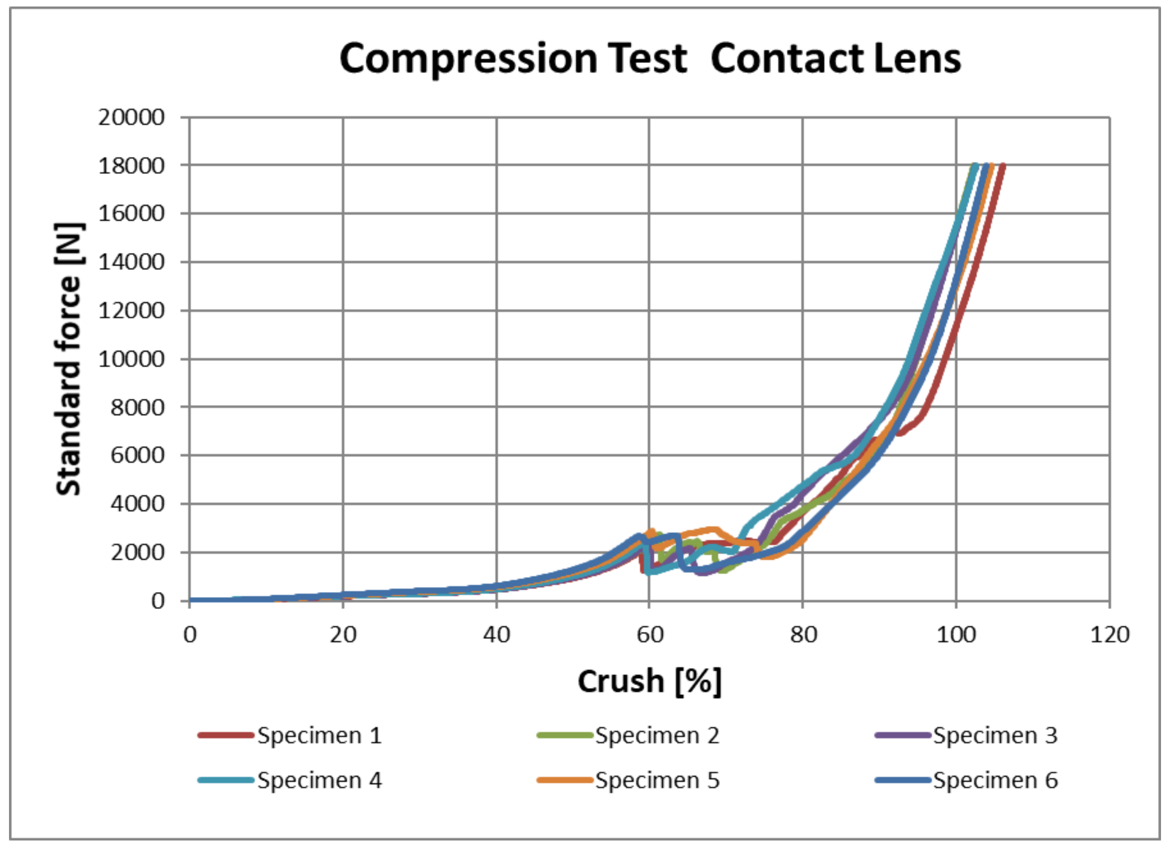

Figure 5 Compression Test Results

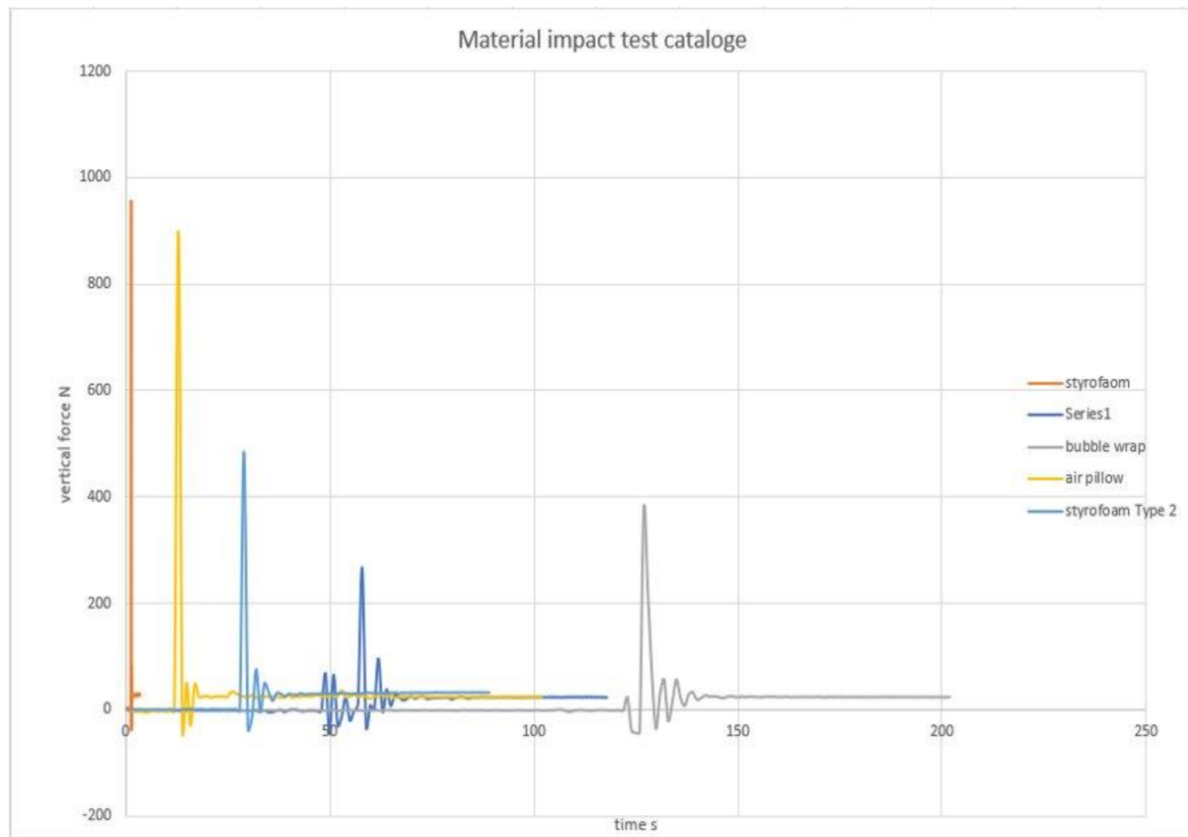

Figure 6 Impact Test Results

The two figures to the left show examples of graphs produced via compression testing and impact testing.

The first graph shows the curve of force in Newtons against the percentage crush for six tests on contact lenses within their packaging.

The second graph shows the maximum force experienced by each test specimen during the impact test.