Cracking the Waste Problem

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What began as a personal observation of household egg consumption quickly led to a deeper investigation into the environmental impact of eggshell waste on an industrial scale. This realisation became the starting point for Ceramegg, a project that transforms calcium-rich waste into biodegradable material.

The idea for this project emerged from the large amounts of eggs used in my household and the opportunity for the sturdy shells to be utilised. However, the amount of waste my family produced was rather insignificant compared to that of the food industry.

I've come to learn that eggshell waste has been marked as a major and hazardous food industry pollutant by the Environmental Protection Agency, with 8.58 million metric tons of eggshells being discarded annually on a global scale.

According to the Food and Agriculture Organisation, 75% of that waste ends up in landfills without much, if any, pre-treatment. This means that 6.4 million tons of raw material is being discarded without much consideration.

The sheer volume of eggshell waste remains a significant environmental concern as improper disposal creates perfect grounds for breeding harmful bacteria. Not only does this create potential for soil and water contamination but also uses up already limited landfill space.

The worrying scale of waste production calls for more sustainable practices to be implemented and for natural by-products to be introduced into the circular economy model as a means to minimise the earth's burden and to conserve traditional resources.

The abundance of this calcium-rich material has inspired the creation of 'Ceramegg' - a biodegradable tableware composed of finely ground eggshells, sodium alginate and naturally derived glycerine. All the eggshells used within this project have been collected over a few months from local households, mainly friends and family, which gave access to free raw material. All the eggshells underwent a two-step sterilisation process – boiling and heating – before being ground up to a fine powder.

What gave shape and form to these processed eggshells is the addition of sodium alginate, a naturally deriving biopolymer extracted from brown algae that acts as a natural binder.

The final ingredient is glycerine, which provides the structure of the material to retain just enough flexibility to prevent it from crumbling into pieces.

The Making Process

The 'Ceramegg' material was developed through an extensive series of prototyping and testing. Experimenting with different binding agents and different quantities of the same components was vital for ensuring that the final product was rigid enough to withstand moderate pressure.

This involved testing ground up shell particles of different sizes, with a larger grind size causing more brittleness – this led to a discovery that the finer the powder, the more rigid the structure was.

This also applied to the amount of water content found within the ground up shell mixture, demonstrating that the less viscous the mixture was, the less it would shrink and distort. This can be attributed to evaporation during the drying process, which happens at room temperature but can be accelerated through moderate heat.

With a consistency of a thick paste, the mixture is applied to plaster of Paris moulds to allow for initial moisture to be absorbed while taking on the shape of the mould itself. The contact between the paste and the plaster allowed for a smooth-to-touch surface and thus a pleasant tactile experience.

Each mould was created using hand sculpted and hand carved ceramic pieces, which the final product would mimic. In that sense, the eggshell tableware imitates the delicate form of traditional ceramics while retaining its unique material appearance.

Design Process

Inspired by the Polish tradition of decorating Easter eggs, also known as pisanki, the design etched into the surface embodies the symbolisms often repeated throughout the traditional markings.

The sun found on each eggshell piece represents new beginnings and the cycle of life, which the whole project tries to embody by giving waste a new purpose before being returned back to earth to nourish it. In that sense, the design and the product itself pays homage to the circularity of life as seen in nature.

Composting

The eggshell ceramics upon fulfilling their intended use, whether at a fancy banquet or a wedding, can be later returned back to earth as calcium-rich fertilizer for plants and pest deterrent. When crushed into fine pieces, the material would decompose within approximately 90 days in a composting facility.

The addition of eggshell matter into the compost provides many benefits to the soil, including enhanced soil nutrient content as calcium is released into the soil, pH regulation of acidic soil and better water retention thanks to sodium alginate.

BA Product Design

During my academic education, I've come to learn that I can use my creativity to challenge and reshape how we view things within our society, and that it is our responsibility to do so. The eggshell project was brought to life during a sustainability module in my final year of BA Product Design and emerged from the need to implement more sustainable practices within our society. Since then, I've embarked on a research journey, undertaking 'MA by Research in Design', that places social sustainability at its forefront. The study investigates the role of interactive installations in engaging the public in difficult conversations around Islamophobia and the role of media.

Link

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