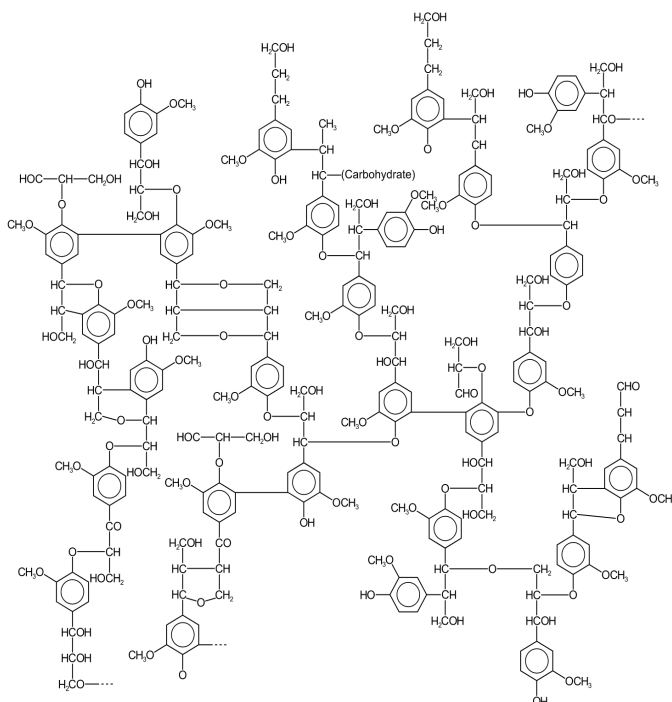


LIGNIN PROJECT - change makers

Marina Costa, Paula Camarero, Bea Forteza.

We are three Queens college students willing to make our contribution to SAVE THE MED.

When we started this project, we decided amongst the three of us that our purpose was not exactly to reduce the usage of plastics, but to create a plan to directly substitute and abolish them; getting to the root of the problem in order to overcome it. Thanks to our knowledge in Chemistry, Biology and Physics through our A-level courses, we were able to get a clear understanding of the problem and to learn new ways of tackling it, as well as developing critical thinking skills. We were aware that this process required a great deal of time and dedication, so after a lot of research, we finally found a way of changing things immensely: LIGNIN.



What is Lignin?

Lignin is an **organic polymer** that forms structural materials in the support tissues of most plants. Lignins are particularly important in the formation of cell walls, especially in wood and bark, because they **lend rigidity** and do not rot easily.

Why Lignin?

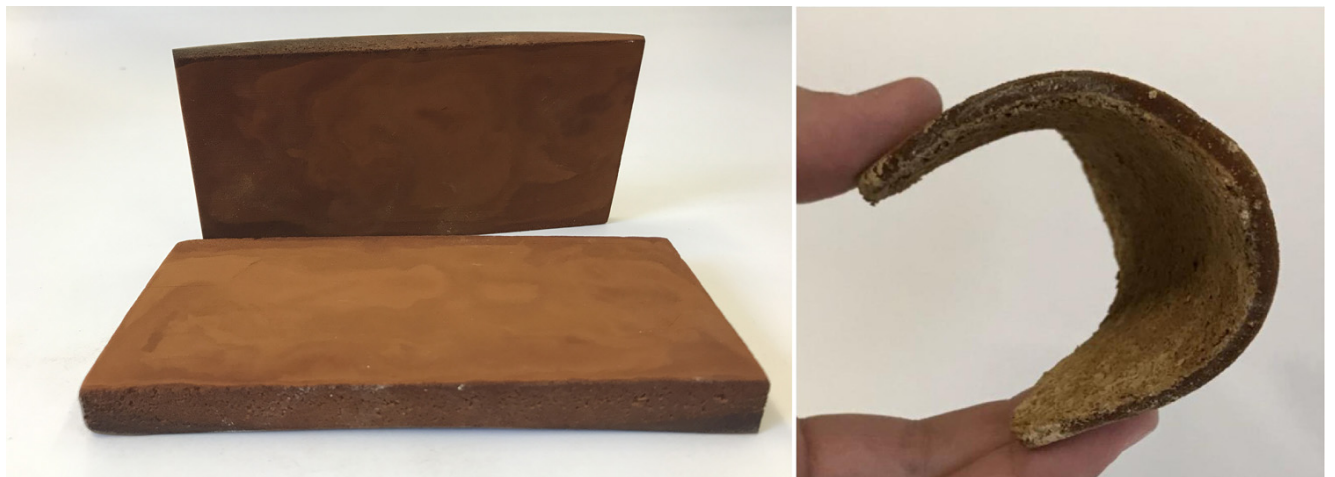
These are the reasons why Lignin is the best candidate for a future substitution of harmful fossil-fuel based plastics:

- 1.** Its ability to biodegrade relatively quickly (180 days), as opposed to plastics, which can take up to 500 years to decompose into microplastics, which don't ever fully biodegrade.
- 2.** Lignin is a waste product of many plant-based industrial processes like paper making. Paper mills create great amounts of lignin which end up burnt. This means that not only is it easy to obtain, as there is no need to implement a new process for its extraction, but we are also simultaneously being environmentally friendly, by making use of waste materials.
- 3.** Lignin-based products cost 650 € to 1,000 € per tonne, close to the cost of normal plastic.
- 4.** It's impermeable to water. This is because the polysaccharide components of plant cell walls are highly hydrophilic and thus permeable to water, whereas lignin is more hydrophobic.

Utilities and Applications.

As described earlier, it takes some time (180 days) for Lignin to biodegrade (even though this period of time is infinitely shorter than the one of a plastic). In addition to this, its implementation would result in **rigid substances**. This is why we reached the conclusion that Lignin products would work best as **multi-use**.

Out of the 6 main types of plastics (Polyethylene Terephthalate High-Density Polyethylene, Polyvinyl Chloride Polypropylene and Polystyrene/Styrofoam), lignin could potentially replace 4 out of the 6 of them. It would be especially great at replacing and acting as thermosetting plastics. One example would be phenolic resins for wood bonding. We would centre this project on building materials with a similar physic to the material shown below:



Material produced with Lignin

Further Examples:



Lignin-based Chair and Carbon Fibres

Production of Lignin.

Even though the production of Lignin nowadays is not sufficient for the use that we plan to give it, it would not be hard to obtain. It makes up 10–25% of lignocellulosic biomass, depending on the kind of plant, and is the second most abundant natural polymer.

We have found that there are many ways to get Lignin. Some methods can even be done in a school lab like ours: extracting Lignin from grass, peanuts, hazelnuts... For a mass production of the Lignin substance, a high yield can be obtained, as it is abundant in all plants and trees.



How can Lignin save the Planet?

This is just the start of something new. Our proposal is based on facts. We wish this project success, because we firmly believe in it and its potential to save the Earth. We hope that this can develop into something big, and are willing to put in the effort to make this work.

Our ideas are infinite. From tupperware and pens, to circuit boards and fibres. Lignin could be everywhere. All it needs is a little nudge to show itself to the world. It is about time. Its ideal structure and properties have led us to believe that it is a big step forward towards our goal: Getting rid of plastics, once and for all.

Future Plans.

Our intentions with this project are to create a product that can replace the harmful materials used in the objects which we use in our daily lives, thus creating a sustainable environment to protect our planet.

Due to the COVID sanitary conditions this year, we have not been able to work to our fullest potential.

However, being able to present our ideas and put together future plans for "saving the med" has helped us in many ways. The large amount of research has opened our minds and showed us that we, as a team, can help make our planet a better place. In the future, we would like to spread

awareness across schools and share our gained knowledge with younger generations.

One of our ideas was to do a beach clean-up and record “before and after”. Collecting these plastics from the sand and putting them all together would show how much there actually is. These recorded videos, together with explanations and images, would then be presented to younger students. This is a chance to open their minds, teach them and challenge them to join our journey towards a better planet.

The goal is to make children, teachers, entrepreneurs, investors and eventually everyone aware of the situation. Helping them understand the impact of a simple plastic water bottle and how it affects our surroundings is key. This would then lead them to take our “lignin project” into consideration.

Please click on the link below and download the copy to watch the video :

<https://www.icloud.com/iclouddrive/03DPuJu5QzturmLT4d-Dj3iwA#LIGNIN>

Thank you for your time.