2044:
BLOOD INDUSTRY FUTURES

What if the blood industry did away with plastic tomorrow?

SCENARIO

It is the year 2044. Over the past 20 years, public authorities have successfully rejected the use of PFAs, PVCs and polyolefins. Accused by parts of civil society of posing an "imminent environmental and health risk," the fight against petrochemical derivatives has escalated. As such, member countries have worked together intensively to reintroduce a deposit return scheme. Thanks to next-generation glass containers that are both lighter and more shatter-resistant, many industries have replaced single-use packaging with the Euro Deposit System (EDS).

GLASS IS BACK FOR BLOOD COLLECTION AND STORAGE

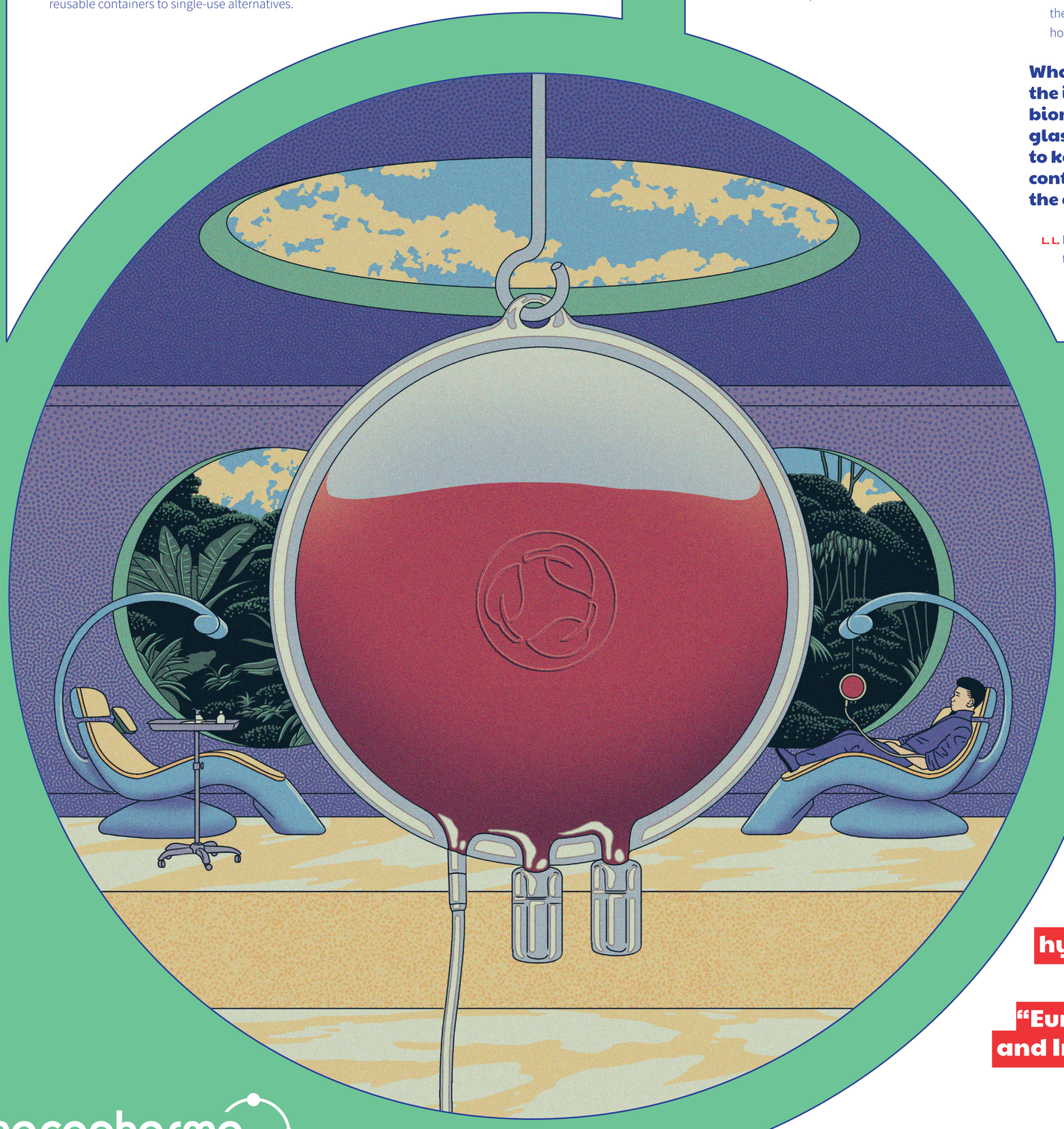
Following the first directive of 2034 on the gradual phase-out of petroleum-derived (fossil-based) plastic packaging in the health sector, the Plastic Ban Regulation also imposed a radical turning point in the blood industry. In certain countries, the sector embraced the widespread adoption of deposit return schemes to enjoy economies of scale which are transforming all markets. New operators have emerged, infrastructure has been adapted, and blood has rediscovered the joys of glass bottles, just like at the beginning of the previous century. However, the return to the use of glass bottles is not without challenges. Many factors — such as the risks of cross-contamination, ensuring a sterile connection without the use of plastic connectors, and glass resistance when separating blood components in a centrifuge — have ended up reviving the debate opposing reusable containers to single-use alternatives.

THE BREAKTHROUGH OF BIODEGRADABLE ALTERNATIVES

In some member countries, industry leaders have favored more innovative solutions, investing in research and development to bring the first biodegradable kits to market. Most of the new solutions on the market are now composed of polylactic acids (made from corn starch), whose flexibility and thermal resistance have been increased using cellulose nanoparticles. The PVC used for transfusion bags has been replaced with silk proteins, which when transformed into a flexible film, offers enormous biocompatibility.

TOWARDS A EUROPEAN STANDARD FOR THE BIOKIT OF THE FUTURE

These new combinations of bio-based materials have been enthusiastically received by the scientific community. However, they do not always offer the same level of flexibility and resistance as PVC, especially against temperature variations. There is a plan to create a consortium of users, manufacturers, raw material suppliers and regulators, aiming at establishing the ultimate formula for a biokit, capable of becoming an interoperable European standard; but between deposit return schemes and biomaterials, authorities and industry stakeholders continue to waver. One thing is certain: petroleum-derived plastic is a thing of the past.



INTERVIEW

Luis LARREA

Hematologist at the Valencia Blood Transfusion Center (Centro de Transfusión de la Comunidad Valenciana).

Are there some discussions going on in the blood industry to get rid of plastic containers right now?

L. L. The main concern these days is the switch from DEHP to non-DEHP bags. DEHP are chemicals which are added to plastic in order to make it softer and more flexible. However, they've been connected to some medical issues. As a consequence, the use of DEHP in medical devices will be banned in 2030 in the European Union, and there's now a rush in the industry to get rid of those and switch to DEHP-free plastics.

In my opinion, the transition from plastic itself will take much longer. The issue is that, whilst we are contaminating the environment through the use of plastics, when it comes to the blood industry, they are very convenient and efficient to use. Apart from its environmental impact, plastic is a great material that fulfills our needs very well. So, ten years ago, we would not even have had this conversation. Nobody thought of this being a problem, but now we do, because of growing environmental consciousness.

So I think it's important to think about alternatives, and not just not only think, but also try to find other options.

In your opinion, what are the main obstacles in replacing plastic containers with glass ones?

L. L. The fear of having something really fragile, that can easily be broken, would be the first challenge. It's also not certain that glass would allow the same quality of storage as plastic, expiration dates could be lowered, for example. There is also the logistic issue. Glass jars are much more challenging to move from one site to another than plastic containers, even when they are empty. It's not the same as having plastic bags that can be piled, don't weigh anything, etc. They also take up much more space, which means increased costs.

Another potential issue is the fact that, when we get blood from a donor, we usually fractionate it into different blood components — red cells, plasma and platelets. With plastic bags, it's very easy to do that, since the bags can be interconnected with tubes. However, if you switch to glass containers, your only option is single bottles, which would also make this process much more complicated.

All these reasons explain why the industry switched from glass containers to plastic ones in the first place, and going back won't come without serious challenges and conundrums.

What do you think of the idea of using new biomaterials to replace glass? Could that be a way to keep the benefits of plastic containers whilst solving the environmental issue?

L. L. I would think that these kinds of innovative solutions are probably indeed where the future lies. I don't know which kind of materials they will be because I'm not an expert in that field, but it would probably be the path to follow, yes.

From a technical point of view, one thing that is quite important to keep in mind is that we will need to make sure that any kind of new material doesn't harm the cells. Inside these containers, you will store blood, a biological fluid that has cells and proteins. It is therefore very important that this material doesn't do anything bad to those cells. You have to be able to preserve the quality and quantity of the things that you have inside that bag. That would be the key point.

Secondly, you have to be sure that the material doesn't leach on the cells. Of course, the blood touches the inside of the plastic containers, but it doesn't go into the cells, because otherwise there would be a strange material inside that biological fluid. So we have to avoid that with future biomaterials as well, otherwise it won't work.

Finally, from a regulatory standpoint, you have to know that everything connected to blood is heavily regulated by law. As a consequence, any kind of new biomaterial would have to go through several rounds of trials, in order to prove that this solution is safe for human use, because you have to be sure that the quality will be the same as plastic, and that it won't harm the people you're trying to save with blood transfusions. In Europe, this process is now handled at the federal level, and these trials naturally take time.

For this reason, it would take at least a decade between the discovery of a new material and its approval for widespread use as a container by the blood industry. The changes definitely won't be happening in one day.

"Plastic Ban Regulation: European Commission President warns 'there will be no exemption'"
Euractu

"Euro Deposit System marks the great return of glass deposits"
The Macronomist

"Without plastic, can the blood supply remain fluid?"
World Correspondence

"A Leap Backwards or Ecological Advance? Bottled Blood Divides"
The New York Hour

"Plastic-free biokit: Alginate-reinforced hydrogel tubing results from 3 blood centers"
Vox Vitis

"European Consortium for the Standardization and Interoperability of Biodegradable kits to be Held in Strasbourg"
Transmission