Advancing Sustainable Science with Plastic Consumables made with Biobased Materials.

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The life science industry is a staggeringly high-volume consumer of single-use plastics – whether it's petri dishes, pipettes and pipette tips, sample tubes or flasks, using and discarding crude oil-based plastic consumables has become an everyday part of life for scientific researchers. It's been estimated that biomedical and agricultural labs are responsible for some 5.5 million tons of plastic waste per year.

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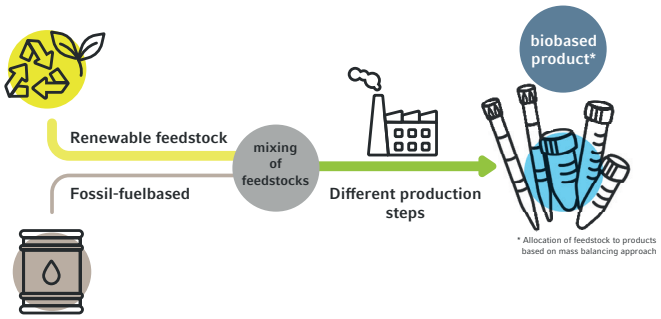
While plastic consumables are crucial to the laboratory processes that drive breakthroughs, the science community is becoming increasingly aware of its disproportionate environmental footprint and is seeking ways to improve sustainability by minimizing the negative impact of plastics. Improving the sustainability of plastic lab consumables (e.g. pipette tips, reaction tubes, plates) presents numerous challenges versus plastics for general use (e.g. gloves), since they must meet the high specifications required for sensitive lab applications. This means that traditional means of improving sustainability such as reusing/recycling consumables are are often challenging or not even possible.

One major strategy to improve the sustainability of plastic lab consumables, is to bring renewable constituent materials into the manufacturing process. This is the goal of a recent collaboration between Finnish company Neste and Eppendorf, that has seen the development of a new line of plastic lab consumables made with renewable feedstock. With Neste's expertise in renewable feedstocks for plastics and Eppendorf's extensive scientific consumables manufacturing experience, the cooperation is well-placed to explore sustainability pressure points and solutions throughout the production workflow, from raw material input to final product manufacturing and beyond.
The collaboration has overcome a host of challenges to produce a line of high-quality plastic consumables made with renewable materials, that meet the rigorous specifications required for experimentation. The BioBased product range comprises Eppendorf Tubes® with screw caps, as well as epT.I.P.S.® BioBased filter pipette tips, made of a certified polypropylene based upon renewable raw materials like used cooking oil.

By switching to renewable materials in their lab plastics, labs and corporations can significantly reduce their climate impact and contribute to the circular economy. In this article, we will highlight the benefits of switching to renewable lab plastics, preferably from 2nd or 3rd generation feedstock, and describe how the partnership between Eppendorf and Neste is paving the way towards more sustainable, and also circular solutions.

Understanding plastics made with biobased materials

"Biobased plastics" or "renewable plastics" refer to plastics featuring bio-based raw materials in their production and value chain. A wide variety of biomass sources may be used in the production of such plastics, including waste and residue fats and oils, corn starch, woodchips, potatoes, sugar cane and more. In the case of the new line of Eppendorf, the feedstock for renewable polypropylene is provided by Neste.



The certified mass balance approach used to determine the percentage of renewable content in Eppendorf consumables BioBased.

From used cooking oil to lab plastics

The manufacturing process involved in the production of Eppendorf's "BioBased" line of consumables is robust and transparent to ensure that the final polypropylene product is allocated at least 90% renewable feedstock and a maximum of 10% fossil origin. Let's take a look at the process of turning waste cooking oil into high-quality lab plastics:

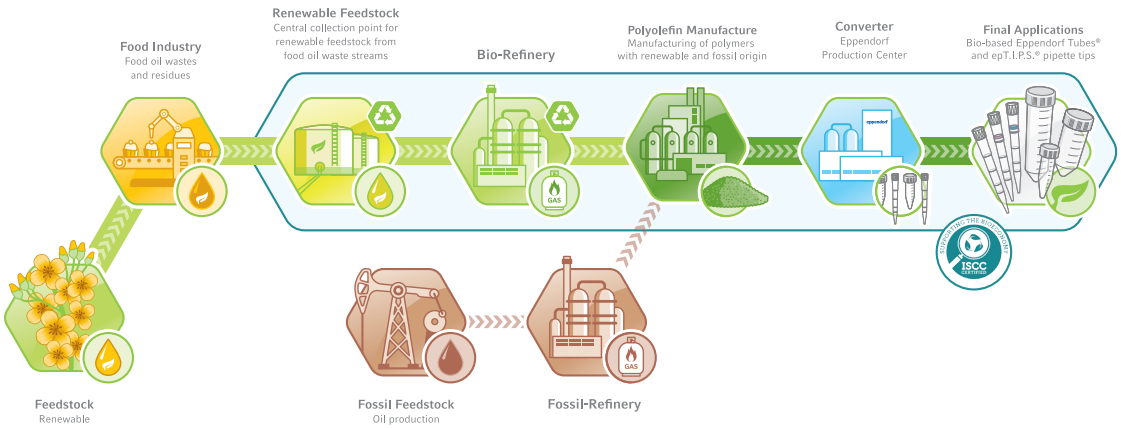
1. Eppendorf consumables BioBased start mainly out as used cooking oil – a waste product from the food industry. Once collected, the used cooking oil is used to produce renewable Neste RE™, the feedstock that will then be turned into polypropylene.

The feedstock, branded Neste RE™, is made entirely out of renewable raw materials, including used cooking oil from the food industry. The close collaboration between Eppendorf and Neste enables the companies to improve sustainability throughout the entire value chain - from the very first raw materials (Neste) to the realization of the final product (Eppendorf).

For its BioBased product range, Eppendorf applies a certified and transparent mass-balance approach. Since the fossil-based component is indistinguishable from the biobased component in the finalized product, the mass balance approach determines the net amount of renewable versus fossil-based material by input feedstock mass. The renewable feedstock used to produce our raw materials can be traced back to the first collection points, and comes from carefully selected suppliers complying with clearly defined sustainability standards. The final polymers are certified for sustainability by ISCC PLUS – the leading global certification scheme for manufacturers of polymers made with biobased materials and downstream converters.

2. The entire value chain must be scrutinized and accredited by ISCC PLUS, who determine the percentage renewable content by mass balance.

3. Eppendorf then uses the certified renewable polypropylene to manufacture lab consumables to the same strict specifications, purity and performance characteristics as their long-established fossil-based plastic consumables.



The pathway from used cooking oil to Eppendorf consumables BioBased.

A partnership with vast possibilities

Forging a strategic cooperation, Eppendorf and Neste aim to better understand the challenges faced in searching for appropriate sustainable materials that meet the high physical specifications required for life science researchers.

The use of renewable raw materials to produce plastics for use in laboratory research offers a variety of benefits that extend beyond the boundaries of the scientific community. Sustainable materials reduce the reliance on fossil fuels and diminish the carbon footprint associated with fossil plastics. Making the change can contribute to mitigating climate change and conserving finite natural resources. By continuing to research and develop more sustainable lab plastic alternatives, Eppendorf and Neste can provide the industry and individuals with practical solutions for a more sustainable future and contribute to the defossilization of the science industry.

Towards a circular economy: recycling and beyond

Recycling lab plastics has been a long-standing issue for the life science industry and still is a challenge - consumables are routinely contaminated with the biological or chemical subject being investigated, rendering the plastic waste unsuitable for general recycling. For this reason, the vast majority of laboratory plastics is therefore mostly incinerated and not disposed of as regular household waste, leading to increased CO_2 emissions. Looking to the future, this linear model must be broken in order to reduce the impact of the science industry upon the environment.

Lab plastics made with renewable sources can be a complementary solution to a circular economy. Ideally, everything that can be recycled should be recycled, and whenever new materials are needed, they should come from renewable sources, preferably from 2nd or 3rd generation feedstock, instead of fossil ones.

Numerous challenges remain before we might see lab plastics reused/recycled or made from recycled plastics on a large scale: when recycling lab plastics, any contaminants have to be removed. When using recycled materials in lab plastics, impurities that may alter scientific results later on are a key consideration.

One way to tackle these challenges lies in new recycling technologies such as chemical recycling, that Neste is actively working on building large-scale facilities for. Chemical recycling enables the recycling of plastic waste that has been hard-to-recycle with conventional (mechanical) recycling solutions. In turn, this recycled plastic waste can be turned back into virgin-quality feedstock for new plastics. As such, chemical recycling may enable the recycling of contaminated lab waste in the near future. The cooperation between Eppendorf and Neste will therefore also include the evaluation of chemical recycling as a means to enable a circular economy for Eppendorf's lab consumables product offering.

Future prospects for renewable lab plastics

Looking to the future, Eppendorf's ultimate goal will be to see the use of biobased, renewable lab plastics adopted at a large scale in the life science and healthcare sectors. For this to be realized, corporations and consumers need to be better educated about the benefits of plastics made with biobased materials, and inspired to select them over crude oil-based options. Stakeholders might not be aware that Eppendorf's renewable lab plastics are designed to meet the high-performance requirements of laboratory applications, or that the transition from fossil-based plastics to renewables for consumers requires minimal-to-no changes to workflows and cost. As such, raising awareness and promoting the adoption of sustainable alternatives is crucial.

To further advance the adoption of such plastics in the lab, Eppendorf and Neste plan to grow the range to include additional lab consumable products. Furthermore, Eppendorf and Neste will jointly seek opportunities to increase the share of allocated renewable raw materials in Eppendorf's biobased laboratory consumables from >90% to 100%. This may be achieved by looking into the diversity of available polymers that can be made from renewable sources, and manufactured into high-performance lab plastics.

Time to go renewable?

The benefits of swapping crude oil-based lab plastics to renewable alternatives are manifold. By adopting Eppendorf's bio-based consumables, you could significantly reduce the environmental impact of your lab's day-to-day operations and promote sustainable practices for a cleaner, brighter future without the need to break the bank or adopt operational changes.

Discover more about our more sustainable plastic consumables range:
www.eppendorf.com/biobased

Are you ready to embrace sustainability?
Contact us:
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References

1. Urbina, M., Watts, A. & Reardon, E. Labs should cut plastic waste too. Nature 528, 479 (2015).

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