WHITE PAPER

Enhancing Sustainability in Clinical Diagnostics

ELGA VEOLIA

As a subsidiary of Veolia, ELGA is committed to creating environmentally sustainable products and improving the ecological sustainability of human activity. The group's fundamental purpose is to be the 'Benchmark Company for Ecological Transformation'.

Clinical analysers are medical devices used to analyse body fluids to diagnose and monitor various medical conditions. Due to the increasing and ageing global population, an increased focus on preventive and personalised care, and advances in technology globally, the use of clinical analysers is growing rapidly. With this comes an associated increase in clinical wastewater, which presents a variety of biohazards and environmental pollution issues which should be eliminated at source before they enter municipal drains. These pollution issues are investigated in detail in the associated technology note.

The MEDICA® BIOX has been designed to treat clinical wastewater in the most environmentally friendly way possible. If this wastewater were to be collected and incinerated, up to 10,000 L* water could be sent to incineration per year per analyser. With hundreds of thousands of active analysers globally, the resulting volume of wastewater is staggering. To heat 10,000 L water from 20oC to 100oC requires 3,340 MJ. For perspective, 3,340 MJ is enough energy to power an average U.S. household for around 3-4 months, or is equivalent to over half a barrel of oil (A barrel of crude oil contains around 6,000 MJ of energy). This does not include the collection and transport of the waste, and the many containers that would also be required.

The MEDICA® BIOX, in comparison, filters the wastewater to minimise the volume sent for incineration. Ultrafiltration is a relatively low energy treatment process, with an estimated power consumption of 470 MJ/year (for the treatment of 10,000 L by the MEDICA® BIOX). Further, ultrafiltration has low complexity, with limited mechanical components that could go wrong. The use of a single membrane element reduces plastic requirement for housing.

The cross-flow filtration used in the MEDICA® BIOX concentrates rejected components, such as nano- and microplastics (NMP), bacteria and viruses, into the internal tank. Aggregation of protein from the wastewater allows these to be collected by the enclosed coarser pre-filter, so that they do not continuously build up and recirculate through the ultrafilter, maintaining its filtration efficiency. The MEDICA® BIOX internal tank and filter comprise a ~800 g high density polyethylene (HDPE) NMP collection reservoir, polypropylene (PP) filter structure, and a polyether polyurethane foam pump suction filter. HDPE and PP have high chemical resistance, corresponding to the main reason for this choice of material. However, these plastics are also largely recyclable, and so it is anticipated that recycled plastics can be used for this component, lowering its environmental impact.

There is limited information about the effect of recycling on the chemical resistance of HDPE, but it has been shown that the mechanical properties of recycled HDPE (rHDPE) is close to that of virgin material (ref), and though there might be some molecular structural changes, there is no extensive crosslinking in the rHDPE, and in the first 4 cycles, there was no significant difference in the rheological properties of the plastic (ref). rHDPE is already used for many applications, such as shampoo bottles, milk jugs and recycling bins, but not all rHDPE is compatible with food packaging regulation (ref). It is anticipated that the collection reservoir could be an end of life use for rHDPE. PP and HDPE are also recommended for thermal combustion, burning at a lower temperature than alternative aromatic plastics (ref), and being aliphatic polymers without heteroatoms, burn with limited NOx production - NOx formation occurs when air is exposed to very high temperatures (>1,500°C) (ref). The incineration of these components with high calorific value can be undertaken in waste-to-energy units, increasing the cost-benefit ratio of this material choice.

Other sustainability considerations that were taken into account in the design and manufacture of the MEDICA® BIOX include:

UV LED Technology
The use of UV LED technology for the complete removal of bacteria and viruses - this has low energy requirements, and avoids the use of Hg, a new standard for ELGA products.

Metal Chassis
A predominantly metal chassis - the chassis of the unit is not designed to come into contact with the wastewater, and so is made of metal, for increased recyclability. This reduces the plastic burden of the unit. The metal chassis was also shelled out to minimise material usage, and to reduce the weight of the unit for transport.

Plastic Components
Natural coloured plastic components - where plastic components were necessary, they were typically designed to utilise their natural colour, eliminating the need for additional colouring agents or additives. Where these components do not come into contact with wastewater, the use of PP and acrylonitrile butadiene styrene (ABS) means they can be recycled at end of life.

The MEDICA® BIOX exemplifies ELGA's commitment to ecological transformation through sustainable product design. Its ultrafiltration system minimises energy and plastic waste compared to incineration for treating clinical wastewater. Careful material selection prioritises recyclability, while innovative features like UV LED disinfection enhance eco-friendliness. From a low-power filtration process to a predominantly metal chassis, the MEDICA® BIOX reflects ELGA's mission to provide cutting-edge solutions that mitigate environmental harm from industry and healthcare. This product represents a benchmark for ecological design in the clinical analysis industry.

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