H&T PRESSPART

CUTTING THE CARBON IMPACT: CREATING A MORE SUSTAINABLE pMDI COMPONENT SUPPLY CHAIN

In this article, Wim Kehoe, Global Key Account Manager, and Ameet Sule, Director of Inhalation Product Technology Centre, both of H&T Presspart, discuss the company's approach to sustainability, and the developments that are helping to reduce the carbon footprint of pMDIs.

INTRODUCTION

Sustainability has presented itself as a key talking point[1] within the pharmaceutical industry over the last few years, with intense scrutiny regarding the contribution that pharmaceutical companies make towards a sustainable health sector. An ageing and growing world population and improved healthcare systems are driving demand for an industry that is increasingly aware of the need to pursue sustainable development, whilst delivering a wider range of pharmaceutical products.[2] H&T Presspart is currently implementing process and product innovation to drive sustainability within the respiratory drug delivery market, whilst continuing with long-term commitments to manufacture responsibly for its global customer base.

Chiesi (Parma, Italy) was the first company to publicly announce its plans to bring a solution to market to address the carbon footprint of pressurised metered dose inhalers (pMDIs), with its development of a carbon minimal pMDI device by the end of 2025.[3] AstraZeneca (Cambridge, UK) unveiled an investment programme of up to US$1 billion (£773 million) at the start of 2020 to achieve zero carbon emissions, including the development of the next generation of respiratory inhalers with near-zero global warming potential (GWP) propellants.[4] Dubbed "Ambition Zero Carbon", the strategy outlines plans to eliminate carbon emissions by 2025 and to be carbon negative across the entire value chain by 2030, bringing forward decarbonisation plans by more than a decade.[4] Other pharmaceutical companies producing pMDIs are likely to follow by announcing their own commitment to developing a carbon minimal pMDI.

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Controversies surrounding the green credentials of pMDIs are at the forefront of conversations and, with over 85% of the world's pMDIs featuring an H&T Presspart component, there is an increasing responsibility to acknowledge the significant impact manufacturing these components has on the environment.

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H&T PRESSPART'S APPROACH TO SUSTAINABILITY

Sustainability has been an important element of H&T Presspart's strategy for many years. Manufacturing pMDIs with aluminium has a high carbon footprint output, driven by the energy required to produce these components. In 2010, H&T Presspart began a programme that aimed to actively drive down carbon emissions at its sites in Blackburn, UK and Marsberg, Germany. Implementing key performance indicator (KPI) measures alongside sustainability initiatives ensured focus remained after initial success was achieved. H&T Presspart's sustainability team is dedicated to driving sustainability efforts forward with initiatives being regularly reviewed. As global leaders for supplying critical components to the industry, H&T Presspart acknowledges the company's responsibility in contributing to a more sustainable healthcare sector for current and future generations.

Sustainable Supply Chain

The appetite for change is large, with environmental issues becoming the focus of business activity. Creating a forward-looking, sustainable supply chain is at the heart of H&T Presspart's strategy for a greener manufacturing future. The company's sustainability vision and strategy will be launched at the end of 2020 and will facilitate a much stronger approach to sustainability within the supply chain.

Figure 1: H&T Presspart's new MDI can wash plant.

Figure 2: Plasma MDI can manufacturing facility.

As part of this strategy, H&T Presspart will launch a sustainability survey for its suppliers to monitor their own efforts towards creating a greener supply chain. KPIs will be defined for suppliers to focus on key areas such as carbon footprint, emissions, recycling and energy efficiency, with suppliers expected to reduce their impact on the environment.

H&T Presspart supports customers with sustainability topics by sharing carbon metrics and energy consumption data to help customers understand the company's environmental maturity and impact as a supplier. In addition, employing energy efficient practices to permit attractive pricing to be passed onto the customer, whilst adapting to industry trends and completing customer audits, is a proactive approach taken by H&T Presspart when continuing to drive sustainability activities to the forefront of operations.

Substantial changes within the supply chain have already been made. H&T Presspart's manufacturing sites in the UK and Spain will be using 100% renewable energy sources by the end of 2020. Currently, 40% of all substrates used by H&T Presspart are from a recycled source and all scrap metal created during the manufacturing process is recycled.

Sustainable Device Manufacturing

H&T Presspart has a long-term commitment to focus on all aspects of the manufacturing process to improve sustainability. A number of key multimillion-pound investments have been undertaken in order to reduce carbon footprint and environmental impact across all H&T Presspart manufacturing sites.

pMDI Can Wash Plant Investment

In 2016, H&T Presspart's Blackburn site replaced pMDI canister wash plant equipment with multimillion-pound state-of-the-art wash plants (Figure 1). The old equipment used a hydrocarbon-based solution to remove oil, which was then washed off with water. This not only generated a large amount of CO_2 emissions, but used thousands of litres of water during the process. The new wash plants mitigated the need for water, so reduced water usage by over 100,000 m^3 a year, equivalent to 40 Olympic swimming pools. This led to a 95% reduction compared with previous years (Figure 2).

Over 250,000 L of hydrocarbon were removed each year from H&T Presspart's washing process as a result of the new plants recycling the solvent-based washing solution;

this is equivalent to 620 tonnes of CO_2 per annum. Eliminating the safe disposal of the hydrocarbon waste also resulted in a saving of 300 tonnes of CO_2 per annum.

In just three years, these initiatives helped H&T Presspart reduce its carbon footprint by over 60%. Redefining H&T Presspart's sustainability vision and strategy by the end of 2020 will help us to set even more ambitious targets for the future.

Sustainable Surface Treatment for pMDI Cans

Sustainability issues regarding coating pMDI cans with materials such as fluorinated ethylene propylene (FEP) are well known to the industry. The energy-intensive coating process, due to the cleaning and baking step that is needed, requires effective actions to protect the environment, which is why H&T Presspart installed a biofilter system.

H&T Presspart's unique plasma process – manufactured under licence from Portal Medical (Cambridge, UK) – for treating the internal surfaces of pMDI canisters was developed as a more sustainable option than coated cans (Figure 3).

The plasma surface treatment process treats the internal surface of the pMDI canister wall with a low-energy fluorocarbon polymerised nanolayer. The result is a surface barrier between the canister wall and API, which enhances drug stability in formulations, where interactions with the aluminium substrate of the canister wall can lead to product degradation and reduced shelf life. This helps to ensure the patient receives a consistent dose through the life of the pMDI.

There are significant sustainability benefits of using the plasma process over coating for pMDI cans – the first being a reduction in the raw material needed for the pMDI canisters. Coated cans need to be thick walled due to undergoing a pre- and post-heating process during manufacture. A thin-walled can is unsuitable for coating as the can becomes too soft to stand the crimping pressure when the valve is attached to the canister.

The use of thinner aluminium on plasma pMDI canisters results in a 30% reduction in the carbon footprint of the aluminium strip production. There is also a reduction in energy consumption from the presses when manufacturing thin-walled pMDI cans compared with thick-walled ones. A further benefit of manufacturing thin-walled cans is a reduction in noise pollution for our employees and the surrounding environment.

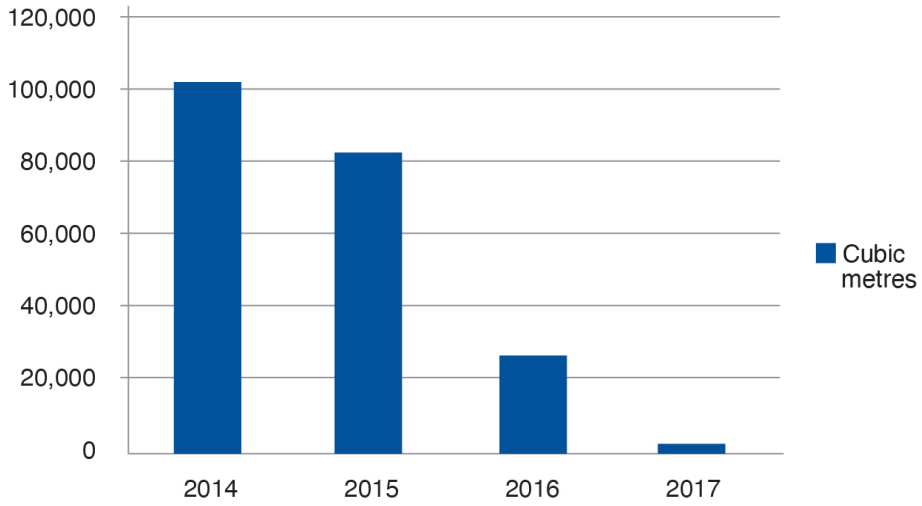

Figure 3: Water usage at H&T Presspart Blackburn, UK.

> "The major sustainable benefit of plasma-treated cans over coated cans is the reduction in energy consumption during the manufacturing process."

The major sustainable benefit of plasma-treated cans over coated cans is the reduction in energy consumption during the manufacturing process. The burn-off cleaning process and the baking of the coating onto the pMDI cans is very energy intensive. By switching to plasma, there is a reduction in energy consumption of 4,100 kWh per million cans, which is a reduction of nearly 50%. To put that into perspective, the energy reduced is the equivalent to running a washing machine over 1,700 times. Furthermore, plasma eliminates the use of solvents, leading to a further reduction in energy and water consumption as biofilters would no longer be needed. The plasma process uses standard industrial gases, so it is a future-proof technology, as the gases are REACH compliant.

Biofilter for Coated Cans

Emissions from manufacturing processes can affect the environment and public health, as well as cause global warming, and are an important area that drug delivery device manufacturers can make improvements in towards a more sustainable future.

To help reduce emissions produced during the manufacture of pMDI-coated cans, a multimillion-pound investment in a biofilter was introduced at H&T Presspart Marsberg, Germany. The can coating process produces vaporised solvent. Within the biofilter, these vapours are removed from the air flow by showers and subsequently cleansed by natural microorganisms. This process is constantly monitored online, ensuring H&T Presspart Marsberg meets all relevant EU environmental regulations.

Product Innovation and Patient Adherence

From an environmental point of view, pMDIs have been accused of being less sustainable compared with other devices, such as dry powder inhalers (DPIs), as a result of the propellant which acts as a drug carrier within the formulation. Previously, pMDI devices used chlorofluorocarbon (CFC) propellants which contributed to ozone depletion in the upper atmosphere until they were banned in 1996. As a result, the pharmaceutical industry switched to hydrofluoroalkane (HFA) which was believed to be a more environmentally friendly propellant. However, due to their higher GWP, these HFAs also contribute to increasing carbon emissions, which has led to the evaluation of propellants HFA 152a and HFP1234ze for medical use. This could potentially reduce the pMDI carbon footprint by 90% when compared with HFA-134a.[5]

GWP is high with pMDIs, however there are several other mechanisms, alongside a new propellant, which can be used to reduce the impact. This includes the use of biodegradable plastics and recyclable aluminium, dose-counter technology and the introduction of digital health to improve patient adherence.

Figure 4: Dose counter range.

"Product innovation such as H&T Presspart's eMDI smart inhaler and a range of dose counters and end of life indication systems, would allow patients to determine the amount of medication in doses remaining within their pMDI device."

In a study conducted in 2005[6], 70% of patients overestimated the number of remaining doses when shaking their inhaler device to determine the quantity of drug remaining. Nearly 20% underestimated the number of doses remaining and, as a result, were discarding their pMDI prematurely, adding to landfill waste and increasing demand for pMDIs with manufacturers.

Product innovation such as H&T Presspart's eMDI smart inhaler and a range of dose counters (a licensed design from Kindeva) and end-of-life indication systems, would allow patients to determine the amount of medication in doses remaining within their pMDI device. Reducing the number of inhalers that are prematurely disposed of will consequently reduce the carbon footprint of the pMDI market whilst improving patient adherence (Figure 4).

CONCLUSION

After 65 years, the pMDI remains one of the best portable devices for delivering drugs to the lungs. The patient's need for these devices still exists, with a number of big pharma companies working on the next-generation pMDI. With add-on technologies to provide safe and efficacious drug delivery, the longevity of pMDI devices remains certain.

Pharma companies and medical device manufacturers must continue to work together to reduce the carbon footprint of pMDIs. To achieve this, collaboration throughout the supply chain, from raw material suppliers to patients and drug manufacturers recycling devices, is required. This partnership will be significant if the industry is to be successful in creating a greener and more sustainable future for the next generation.

Both process and product innovation will need to be capitalised in order to make a considerable difference. Investments in new sustainable manufacturing techniques, such as H&T Presspart's wash plants, will help drive sustainability within the industry.

The introduction of new propellants, such as HFA 152a or HFO1234ze, will see the carbon footprint of a pMDI reduced by 90% which will be a big step towards sustainable business in the market. It is also important that the industry proactively addresses patient waste through product innovation such as dose counters, end-of-life solutions, smart inhalers (connected health) and the use of biodegradable plastics, as well as the introduction of an effective recycling system for pMDIs.

ABOUT THE COMPANY

H&T Presspart specialises in industrialising drug delivery devices and components. The products that the company offers its pharmaceutical clients include medical devices, metered dose inhaler components and a comprehensive range of dose-counting technologies. The company has 50 years' experience and a worldwide reputation for competence, quality and innovation in the pharmaceutical sector. H&T Presspart's Inhalation Product Technology Centre supports its customers' new inhalation product developments and strategic initiatives. H&T Presspart, part of the Heitkamp and Thumann Group, has three European manufacturing sites, in Germany, Spain and the UK, with sales offices in China, India, Singapore, South America and the US.

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Wim Kehoe, Global Key Account Manager at H&T Presspart, manages a number of large, strategic key accounts. Mr Kehoe joined H&T Presspart in April 2017 as Sales Manager, Europe. In January 2019, he assumed the role of Global Key Account Manager. He has over 10 years of experience in various sales management and business development roles within the pharmaceutical industry, with a focus on respiratory diseases during the past four years.

Ameet Sule, Director, Inhalation Product Technology Centre, H&T Presspart, is a pharmaceutical professional, having worked in the industry for more than 20 years, specialising in the development of inhalation products and devices. Mr Sule works closely with H&T Presspart's customers around the globe, understanding and mitigating the front-end development challenges of new and generic products for inhalation drug delivery.

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