The Sustainability of 3D Printing & Microfluidics in Pharmaceutical Manufacturing

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Background

The global acceptance of human driven climate change has reframed the future priorities of many industries. Finding solutions to both limit and counteract the climate emergency has become a pressing matter of increasing concern. The pharmaceutical industry is not immune from either the concerns or innovations that are born from this emergency. To promote sustainability during pharmaceutical manufacturing, it's important to identify the factors within a supply chain and manufacturing process that could be altered to improve the overall environmental sustainability. This report assesses the sustainability potential of additive manufacturing (AM) and microfluidics (MF), and what impact this could have on the wider pharmaceutical industry.

Methods

To be sustainable, a technology or procedure must be beneficial not just environmentally, but also socially and economically. To provide a high-level analysis of the sustainability of the pharmaceutical industry, AM and MF, a PESTLE analysis was conducted.

Each emerging technology was then considered individually, and further detail and analysis carried out based on the PESTLE framework. Both AM and MF were compared with their traditional alternatives (e.g., moulding, hydration) for this more in-depth assessment.

Results

AM analysis and comparison indicated that there is high potential for sustainability improvements when compared with traditional methods. At this point in time, the AM market is rapidly growing; therefore, suggesting economic sustainability. Although variation exists based on printer type, AM dramatically reduces CO_2 emissions attributed to pharmaceutical manufacturing and its use is becoming a common sight in society. Thus, its sustainability is confirmed.

MF analysis indicates that the sustainability potential is high for this emerging technology, due to its small use of materials, efficiency and time saving properties. However, challenges remain with regards to its economic sustainability as it is difficult to scale up this technology for large scale manufacturing/use.

Conclusions

The emerging technologies assessed represent a significant progression in improving the impact that the pharmaceutical industry is having worldwide. Although further data is needed on each to solidify their credentials as sustainable technologies, it is clear that in comparison with their traditional alternatives, AM and MF are exemplary in highlighting the innovative options available to the pharmaceutical manufacturing industry to improve its overall sustainability.