

BUILDING TOWARDS A GREENER FUTURE BY IMPLEMENTING SUSTAINABLE MANUFACTURING PRACTICES

Amid huge strides towards developing innovative and effective therapeutics for patients across the pharmaceutical fine chemicals (PFC) industry, drug developers and contract development and manufacturing organizations (CDMOs) are increasingly adapting their manufacturing processes to be sustainable and eco-conscious. Due to the complexity of chemical synthesis of pharmaceuticals and the amount of waste produced, the carbon footprint and waste-to-product ratio in PFC is among the highest in the chemical industry. To combat this, CDMOs are assessing where green innovation can be applied.

In a recent webinar hosted by Ajinomoto Bio-Pharma Services, Geert Schelkens, R&D Manager Early Phase API, and Peggy De Clercq, Key Account Manager, discussed different process adaptations to help build greener, more sustainable workflows in drug development. The experts provided their insight into how manufacturers are leveraging renewable raw material sources, green chemistry strategies, and innovative technologies. In the following Q&A, Schelkens answers attendees questions on how continuous manufacturing, aqueous chemistry, and process development can aid in reducing biopharma's carbon footprint.

Q: Could you speak to how continuous manufacturing contributes to sustainability?

Geert Schelkens: It opens up new process windows enabling chemistry that was not previously possible. Photochemistry, electrochemistry, and mechanochemistry can do new stuff that was virtually impossible in the pharmaceutical industry. I would like to add that in bulk industry where efficiency is very high and waste is very low, everything is continuous. We as a sector need to look to the bulk industry and the petrochemical industry and learn from them.

Q: You mentioned aqueous chemistry as an important focus. Could you talk more about workup and the use of loads of solvents during workup?

Schelkens: I think this question relates to the idea where non-aqueous chemistry has been done and then a solvent is pulled into the extractions and then continued with the solvent switch, et cetera, so you're generating a complex process. If you do aqueous chemistry, you should not elaborate on the workup, but rather make sure that you can isolate the compound very effectively. For example, this can be affected by precipitating out the desired compound directly or by using a single solvent that can be recycled to crystallize the target compound.

Q: Do you think it is better to concentrate on establishing the most efficient route prior to locking it down and developing it, or is it better to do process development hand in hand with the evaluation of route design options?

Schelkens: That's a great question and a very difficult one. They should absolutely go hand in hand. You can imagine a lot of things on paper, but the proof is typically in the lab. Come up with more

than one idea. Start with several ideas then discard some of the less promising ones. [Finally,] go into the lab and check whether your ideas work or not.

Q: What about the availability of green solvents that are in line with the quality requirements posed by the pharmaceutical Industry?

Schelkens: The field of green solvents is still immature and is at the same time rapidly growing. Besides the green solvents that have been accessible for a long time, such as MeOH, EtOH or acetic acid, more solvents are becoming available at an affordable cost. This moves slower than we would like it to, so we are progressing with a limited number of solvents for now. We aim to accelerate this effort at the pace of market availability.

Q: How do you approach energy savings in the PFC industry?

Schelkens: In general, energy consumption is a minor contributor in the footprint of a complex chemical process. We target energy savings by promoting simplified processes, where extractions and distillations are reduced to the absolute minimum. Shorter processes do save considerable energy. Secondly, continuous flow chemistry offers easy options to circulate exothermicity in one place of the process to heat up other process streams. The technique opens new possibilities because of the short heat circuits used.

The content of this Q&A originally appeared in a webinar hosted by Ajinomoto Bio-Pharma Services. To watch the webinar in its entirety, [click here](#), or to read a summary article, [click here](#).