Smart fermentation:
a step towards next generation material transition

Our world is suffering from unequal distribution of resources and a pollution crisis. Till date, most of the synthetic chemicals and materials rely on fossil resources which can become more scarce as early as in 2052[1]. The biobased economy tries to replace fossil based products by plant based materials. The high energy and land demanding costs of producing food via cattle and greenhouses are limiting this progress. Under such a pressing urgency, as a key technology for the circular economy, fermentation will be a promising solution for alternative chemicals and biobased materials[2].

In the past decades, beyond making beer and sauerkraut in tanks, fermentation has evolved into an essential industrial method to produce all sorts of fine chemical compounds and raw materials by using microbial cell factories. Embracing molecular biology and biotechnology advancements, the currently raising precision fermentation technology is developing towards bulk chemical and biobased material productions. Particularly due to the potential microbial utilization of agro-food residual stream as the feedstocks, precision fermentation could be a game changer in circular economy. This extends the horizon of next generation material transition to be truly animal free.

Besides for acids, enzymes and bioplastics, fermentation could produce numerous animal derived materials including dyes, wax, leather, wool, glue and silk. In fact, precision fermentation has the potential to produce any type of molecular if designed properly. Currently, many types of the high value fine chemicals are from animals, they are usually used by cosmetic or pharma-food industries, e.g. retinol (from animal livers) is used in anti-aging skin cares, carmine (from cochineal bugs) is used in make-up products, and estrogen (from the urine of pregnant animals) is used as medicine and food supplements. Such animal derived materials could be produced by fermentation by using wildtype or genetically improved microbial species. Actually, a global wholesale market size for next-gen materials of US$2.2 billion in 2026 has already been predicted. This takes 3% share of the $70 billion plus complete market and is expected to grow vigorously in the coming years[3].

[1] https://group.met.com/en/mind-the-fyouture/mindthefyouture/when-will-fossil-fuels-run-out
[2] https://www.agro-chemistry.com/news/fermentation-as-key-technology-for-the-circular-economy/
[3] https://www.theveganindians.com/animal-free-materials-market-to-be-us2-2-bn-in-2026-predicts-new-industry-report/

It is said that next-gen materials industry is about 5-10 years behind the alternative protein/food industry, that means, if we don't start now, we would have already missed the boat.

Therefore, are you more curious about precision fermentation now? Don't you wonder why are we not replacing all refinery factories by fermenters already? In this lunch and learn online session, Dr. Miaomiao Zhou (associate professor, Smart Fermentation, MNEXT) will share her knowledge of precision fermentation with you. She will describe the current status of the technology concerning alternative material production and beyond. She will also, together with you, characterize the current technological, political and economic bottlenecks hampering the development of precision fermentation. Lastly, we will exchange opinions via the discussion session. We hope this lunch and learn moment will bring inspiration and collaboration to everyone who wants to ferment smartly, in this way, we could move forward together to create a cleaner and more sustainable future, before it is too late.