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# Novel aerobic chassis for the conversion of mixed CO/CO2 feedstocks

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There is an urgent need to develop ecologically and economically sustainable routes to the production of fuels and chemical commodities, as fossil resources are limited and continued release of greenhouse gases is threatening the stability of the world's climate.

One way towards this goal is the development of microbial-based processes for the conversion of non-food biomass and various wastes into desirable products. Current efforts focus mainly on the deconstruction of lignocellulosic biomass to liberate sugars and other compounds which can then be used by bacteria to generate a wide variety of interesting chemicals. Unfortunately, however, efficient lignocellulose breakdown relies on energy intensive pre-treatment procedures followed by the addition of costly enzymes, which makes the development of economic and sustainable processes very challenging.

A promising alternative solution is to subject non-food biomass and other wastes to a process termed gasification, which converts these materials into synthesis gas (syngas), consisting mainly of carbon monoxide (CO), hydrogen ($H_2$) and a low percentage of carbon dioxide ($CO_2$).

Synthesis gas, as well as several industrial waste gases of similar composition (such as steel mill off-gases), can be efficiently used by a variety of gas-fermenting bacteria. However, current syngas-based processes close to commercialisation are exclusively based on anaerobic species, i.e. bacteria which can only grow in the absence of oxygen. While this makes them well suited for the generation of certain compounds, such as ethanol, it does not allow the sustainable production of chemicals whose generation requires a higher level of energy input. Efficient production of such compounds can only be achieved with aerobic organisms capable of generating sufficient energy via respiration.

For this reason, researchers are now investigating a number of aerobic C1 bacteria. Unfortunately, the most promising candidates cannot utilise CO, the most abundant C1 compound present in syngas and steel mill off-gases. Although this obstacle could be overcome by converting it to $CO_2$, at commercial scale it would be much preferable to avoid the required additional investment in terms of time, energy and overall process costs.

We have therefore set out to isolate and characterise new bacterial strains with industrial potential, which can grow on CO and oxygen. This proved to be very challenging but a number of promising candidate strains were obtained, which can grow with CO in the presence of oxygen at 45 $^{o}$C. The ability to grow at this temperature is advantageous, as it reduces the costs associated with the cooling of large scale fermentation vessels.

The newly identified strains will now be further characterised and tested for future application in gas-based fermentations.