# Optimizing Growth Conditions for Lactic Acid Bacteria

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*My bacteria train for the Bio-plastic Olympics, and I'm their personal trainer and nutritionist!*

How does our bacterial gym look like, you ask? It's warm, underwater, woody and full of sugar. Our bacteria love it and they pay us with molecules that we will turn into bio-plastics. Keep reading to know more about our training plan!

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**Summary**

Ever heard of lactic acid? It's a molecule found in a lot of fermented foods, like yogurt or sauerkraut, but we can also produce it when we exercise. The best producers, however, are microbes! They can turn basic and complex sugars into lactic acid very efficiently. Now here's the thing: lactic acid is not only good for food or exercise, there's also a way to use it to produce bioplastics! However, this technology is not competitive with fossil plastics yet, because the production costs are too high. That's why there is a lot of research trying to optimize the production process, and a lot of it has to do with how the microbes produce the lactic acid. One line of work is to find or develop strains of microbes that can convert the sugars the most efficiently possible. Another, is to use renewable sugar sources which do not compete with our food, like wood! However, to use the sugars in wood, it first has to be treated so the sugars can escape the wood network and then the microbes can eat them.

In this study, we used the bacterial strain *Pediococcus acidilactici* TY112 to produce lactic acid because it can use the sugars very efficiently, but also because it can survive in the presence of toxic compounds found in wood! We studied how the bacteria behaved when we gave them oxygen to see if it was good as they produce lactic acid. However, we saw that when they have oxygen, they use the sugars to produce acetic acid instead of lactic acid, so of course we don't want that if our goal is to produce lactic acid!

We also studied how they react when we give them a very rich nutrient called yeast extract. Yeast extract is full of nutrients and vitamins, so we thought it would help them grow and produce lactic acid. We grew the cells and gave them three times the amount that they are used to, and we saw that they grew more rapidly. Yeast extract for our cells is like what gym supplements are for bodybuilders: they can work without it, but it sure helps them grow! The cells grew faster, which meant that they were a lot more and so they ate the sugar quicker to produce lactic acid. The good thing is that even though it was faster, they still did it efficiently! So this means that the production can be made shorter since the cells finish earlier producing lactic acid, which translates into lesser costs in the process. Sadly, yeast extract is really expensive, so there needs to be more research to understand what nutrient is making the cells grow, but it's a great start!

As a final experiment, we gave the cells liquefied wood little by little over 2 days to see how they reacted to the toxic compounds. The cells grew a lot and they still produced lactic acid efficiently, which meant they can survive increasing concentrations of the toxic substances so we can use wood to feed them!