

The Impact of Different Concentrations of Formate and Lactate on *Escherichia coli* Growth Properties and H₂ Production

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ABSTRACT

Organic acids, such as lactate and formate, are one of the main organic acids produced during *Escherichia coli* fermentation. These acids can affect the physiological, biochemical, and bioenergetic properties of bacteria, and the effects are mainly dependent on their concentrations. In this study, different concentrations of formate and lactate (10 mM, 20 mM, and 30 mM) were examined during different growth phases (0 h, 3 h, and 6 h) to understand their impact on specific growth rate (μ), and redox potential (Eh, ORP in mV) in order to assess hydrogen production of *E. coli* BW25113 strain. According to the obtained data, μ decreased by approximately 30–35% when formate or lactate was added at 3 h or 6 h compared to the control (2 g/L glucose), whereas no significant changes in μ were observed with additions at 0 h. This suggests that *E. coli* BW25113 adapts more effectively to acids presence during the early growth stage. The ORP data varied with the addition of acids at different growth phases. The addition of 10 mM and 30 mM formate at 0 h extended H₂ production compared to the control, where H₂ production had finished. Interestingly, at the 3rd hour the addition of 20 mM and 30 mM formate also prolonged H₂ production. Similarly, the addition of all lactate concentrations at 0 h sustained H₂ production, whereas at the 3rd hour, only the 30 mM lactate addition extended H₂ production. Notably, the addition of all concentrations of formate and lactate at the 6th hour extended H₂ production compared to the control. Taken together, it can be suggested that formate presence activates formate hydrogenlyase (FHL) complex and thus extends H₂ production. Additionally, high concentration of exogenous lactate may lead to the accumulation of intracellular formate, and thus prolonged H₂ production.

Keywords: organic acids, redox potential, *Escherichia coli* BW25113, specific growth rate

References:

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