Shake flask methodology for assessing the influence of the maximum oxygen transfer capacity on 2,3-butanediol production.

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[Details]

Abstract

BACKGROUND:

Production of 2,3-butanediol from renewable resources is a promising measure to decrease the consumption of fossil resources in the chemical industry. One of the most influential parameters on biotechnological 2,3-butanediolproduction is the oxygen availability during the cultivation. As 2,3-butanediol is produced under microaerobic process conditions, a well-controlled oxygen supply is the key parameter to control biomass formation and 2,3-butanediolproduction. As biomass is on the one hand not the final product, but on the other hand the essential biocatalyst, the optimal compromise between biomass formation and 2,3-butanediolproduction has to be defined.

RESULTS:

A shakeflaskmethodology is presented to evaluate the effects of oxygen availability on 2,3-butanediolproduction with Bacillus licheniformis DSM 8785 by variation of the filling volume. A defined two-stage cultivation strategy was developed to investigate the metabolic response to different defined maximumoxygentransfer capacities at equal initial growth conditions. The respiratory quotient was measured online to determine the point of glucose depletion, as 2,3-butanediol is consumed afterwards. Based on this strategy, comparable results to stirred tank reactors were achieved. The highest space-time yield (1.3 g/L/h) and a 2,3-butanediol concentration of 68 g/L combined with low acetoin concentrations and avoided glycerol formation were achieved at a maximumoxygentransfercapacity of 13 mmol/L/h. The highest overall 2,3-butanediol concentration of 78 g/L was observed at a maximumoxygentransfercapacity of 4 mmol/L/h.

CONCLUSIONS:

The presented shakeflask approach reduces the experimental effort and costs providing a fast and reliable methodology to investigate the effects of oxygen availability. This can be applied especially on product and by-product formation under microaerobic conditions. Utilization of the maximumoxygentransfercapacity as measure for the oxygen availability allows for an easy adaption to other bioreactor setups and scales.

Involved units

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