Abstract Implementation of biofuels as an alternative to fossil fuels has been established as an answer to climate change by limiting GHG emissions. Syngas fermentation has emerged as a promising process for the conversion of waste biomasses to valuable products with bioethanol being on the main focus. However, the bottleneck of the mass transfer of syngas compounds H₂ and CO along with low production yields has set barriers to the development of an industrial scale plant. Recent research indicates that many different methodologies spring up in order to face this important challenge. The aim of this review is to assemble all these techniques applied in syngas fermentation, focusing on the different bioreactor configurations operated in continuous mode for the production of liquid and gas biofuels. This article also outlines the so far entrepreneurial initiatives and the progress made towards the commercialization of the process.