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Carbon conversion efficiency and population dynamics of a marine algae–bacteria consortium growing on simplified synthetic digestate: First step in a bioprocess coupling algal production and anaerobic digestion

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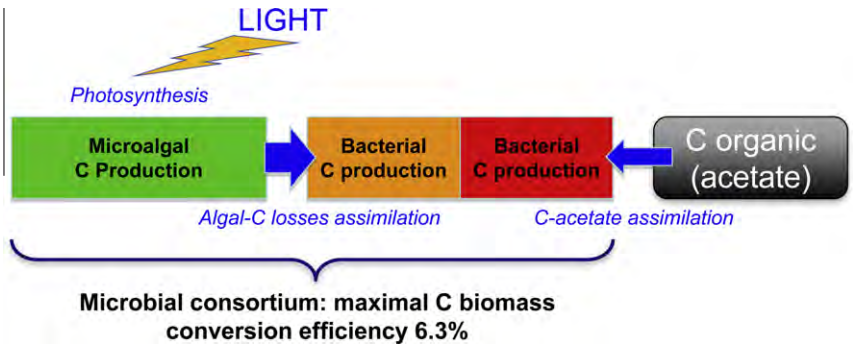
HIGHLIGHTS

- Carbon conversion efficiency of marine microalgae growing on a synthetic anaerobic digestate was 4%.
- Carbon conversion efficiency increased to 6.3% when bacteria were included into the carbon budget.
- Bacteria recycled the carbon lost during photosynthesis and originated from anaerobic digestion.

GRAPHICAL ABSTRACT



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ABSTRACT

Association of microalgae culture and anaerobic digestion seems a promising technology for sustainable algal biomass and biogas production. The use of digestates for sustaining the growth of microalgae reduces the costs and the environmental impacts associated with the substantial algal nutrient requirements. A natural marine algae–bacteria consortium was selected by growing on a medium containing macro nutrients (ammonia, phosphate and acetate) specific of a digestate, and was submitted to a factorial experimental design with different levels of temperature, light and pH. The microalgal consortium reached a maximum C conversion efficiency (i.e. ratio between carbon content produced and carbon supplied through light photosynthetic C conversion and acetate) of 3.6%. The presence of bacteria increased this maximum C conversion efficiency up to 6.3%. The associated bacterial community was considered beneficial to the total biomass production by recycling the carbon lost during photosynthesis and assimilating organic by-products from anaerobic digestion.

1. Introduction

Sustainable production of biogas by coupling microalgal mass production and anaerobic digestion is a promising technology for

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