Applied Energy 257 (2020) 114032

Contents lists available at ScienceDirect

Applied Energy

journal homepage: www.elsevier.com/locate/apenergy

Biological systems for CCS: Patent review as a criterion for technological development

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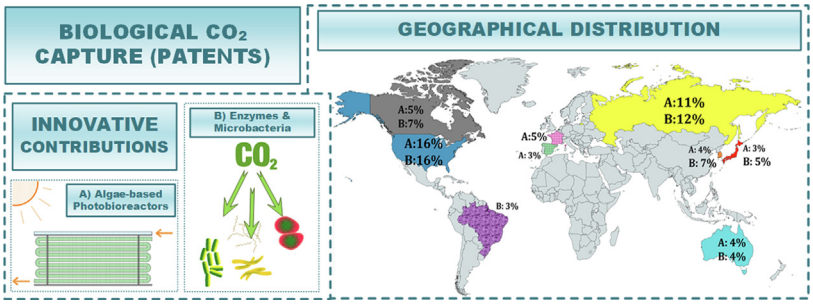
HIGHLIGHTS

- A review of the latest advances in biological CO_2 capture is presented.
- Most patents focus on the development of photobioreactors and novel enzymes.
- The high innovative character presented by both groups is highlighted.
- Most patent production is concentrated in companies of North-America and China.
- Photobioreactors appear as a promising alternative to obtain valuable sub-products.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Biological CO_2 capture
Patent
CPC code
Enzyme
Photobioreactor
Algae

ABSTRACT

One of the most useful mechanism for reducing and, if it were possible, reverting the global warming effects, consists on the development and use of new technologies for CO_2 capture, storage, and utilization. Their implementation is a technological objective, but it can be subject to considerable political and social obstacles which should not prevent a progress on its investigation. Many reviews on this topic are published in the literature; however, the evolution of the related patent activity has been much less studied. This paper aims to analyse the state of the art during recent decade of biological systems for CO_2 sequestration, according to the Cooperative Patent Classification criteria. An indicator of the innovative character of new patents, the "Innovation index-i", is proposed based on the number of citations and the year of publication. Patents were sorted into two main groups, depending on whether they were based on the design of photobioreactors working with algae or whether they focused on the development of enzymes and bacteria for the optimization of the CO_2 capture reactions. The results show a pronounced increment in innovative contributions through 2013, led by the USA and countries in Asia (China, Japan and Korea). In terms of companies involved in patent production, Alstom Technology Ltd. and CO_2 Solutions Inc. are the most noted companies, with 9% and 8% of the publications, respectively.

1. Introduction

Greenhouse gas emission levels have increased exponentially over the last few decades and are expected to grow at an annual rate of 1% until 2040 [1]. Taking this into account, one of the challenges of the 21st century is to limit the average global temperature increase to 2 °C

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https://doi.org/10.1016/j.apenergy.2019.114032
Received 2 April 2019; Received in revised form 29 August 2019; Accepted 15 October 2019
Available online 24 October 2019