Assessment of Carbon Capture, Utilization, and Storage in the Bioenergy Sector: Mapping Technological Alternatives and Market Analysis

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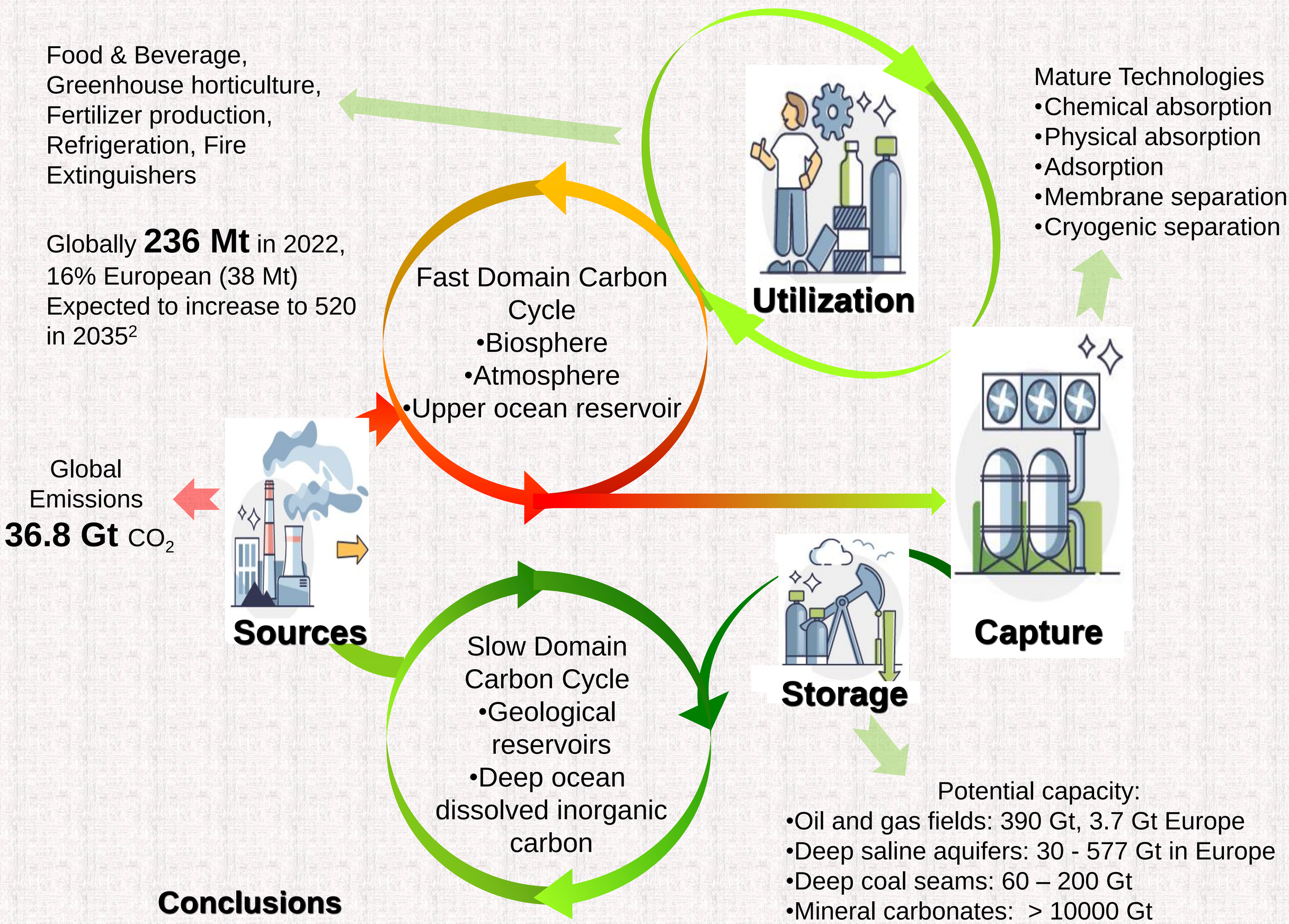
Introduction

Applied to bioenergy production CCUS is the chain of technologies required to capture, transport, utilize and store biogenic CO_2 from the emissions. Anthropogenic climate change, characterized by a sharp increase in atmospheric concentrations of greenhouse gases (GHG), stands as one of the foremost challenges of our era. Carbon dioxide (CO_2) emerges as the primary GHG, responsible for over 80% of total emissions. Bioenergy with carbon capture utilization and storage (CCUS) emerges as a pivotal climate change mitigation tool, not only curbing biogenic CO_2 emissions but also fostering the realization of a circular economy.

Materials & Methods

A comprehensive literature search was conducted using electronic databases including Google, Google Scholar, Scopus, and Web of Science. The search was conducted from 01/11/2024 to 31/12/2024, with language restricted to English. The search terms used were: carbon capture, carbon capture and utilization, carbon capture and storage, carbon capture utilization and storage, CCUS, CUS, BECCS, BECCU market for CO_2, CO_2 utilization, CO_2 storage, biogenic CO_2 utilization and Boolean operators (AND, OR) were employed to refine the search. Additionally, we manually screened the reference lists of relevant articles to identify additional studies not captured in the electronic search.

Results



Conclusions

The current demand for CO_2 utilization, totaling 236 Mt, falls short of compensating for global CO_2 emissions (36.8 Gt), covering less than 1% of emissions. Hence, there is a crucial need to develop large-scale conversion routes, such as the production of fuels, chemicals, and building materials derived from CO_2, to significantly contribute to the goal of achieving carbon neutrality by 2050. Additionally, with only 0.12% of global yearly CO_2 emissions currently being stored, it is imperative to prioritize the development of large-volume carbon storage to facilitate progress towards carbon neutrality by 2050.

Commercially stored Globally **0.045 Gt/y** in 2020

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