Chapter

Introductory Chapter: CO_2 Sequestration

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1. Introduction

The Special Report from the Intergovernmental Panel on Climate Change (IPCC) [1] revealed that recent trends in greenhouse gas (GHG) emissions and the level of international ambition indicated by nationally determined contributions, within the Paris Agreement, deviate from a track consistent with limiting warming to well below 2°C. This will require a drastic reduction in greenhouse gas emissions by 2030 and thereafter removal of carbon from the atmosphere in large quantities. The IPPC reports found that many climate models can only meet the two-degree Celsius goal when carbon removal strategies are included among the potential policy options.

There are several strategies to promote carbon dioxide (CO_2) sequestration by agriculture and industry. So, it is necessary to evaluate the methodologies that have been used and to understand the gaps to achieve more sustainable production systems.

In agriculture, the management of agricultural systems that promote soil carbon sink depends on depth, clay content and mineralogy, plant available water holding capacity, nutrient reserves, landscape position, and the antecedent SOC stock [2]. As the soil carbon fluxes vary according to environmental and anthropogenic driving factors [3], soil carbon sequestration can be a short-term solution of reducing CO_2 concentration in the atmosphere.

In addition to agronomic practices, several effective methods of carbon capture and storage (CCS) have been proposed to reduce the amount of emitted CO_2 in the atmosphere. Adsorption processes can be performed using activated carbon [4] where the adsorptive process can use adsorbents derived from low-cost agro-wastes. Another way to reduce CO_2 emission into the atmosphere is by capturing CO_2 from the flue gases and storing that in deep geological formations [5]. The CCS provides financial offsets in terms of CO_2 sequestration cost.

Therefore, this book provides a comprehensive overview of the current state of the art about the strategies that contribute to reducing GHG emissions and promote CO_2 sequestration by agricultural techniques and carbon capture and storage.

2. Opportunities and challenges for CO_2 sequestration

Several studies have indicated the storage in biomass, soils, adsorption processes, and geological formations as viable techniques for CO_2 sequestration. All these technologies have the potential to mitigate global warming and climate change [2–6].

Improving agricultural land management techniques is an efficient way to increase carbon uptake and storage. Strategies to ensure soil carbon sequestration can be obtained through the adoption of different agronomic management practices [2]. Land use with grassland species can also maintain and increase soil organic carbon storage over time [7]. Other studies have reported that land use with perennial crops can also be adopted to promote CO_2 sequestration in biomass, and soil is the main component storing the highest amount of carbon in these agroecosystems [8, 9].

Carbon removal can also be achieved through the technology of adsorption on activated carbon from low-cost raw material. Agricultural and forestry residues or biomass residue wastes could be used as suitable raw materials for the production of activated carbon [10]. Furthermore, CCS by geological sequestration is another technological form for carbon removal and can be applied to different industries [5].

3. Perspectives

As the population is growing around the world and indirectly contributes to global warming, several efforts have been made to mitigate GHG emissions. So, the adoption of CO_2 sequestration technologies in the agricultural and industrial sectors has become essential to reduce the impacts of global warming and climate change.

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