

(12) PATENT APPLICATION PUBLICATION

(21) Application No.202511089196 A

(19) INDIA

(22) Date of filing of Application :18/09/2025

(43) Publication Date : 10/10/2025

(54) Title of the invention : AUTONOMOUS OCEANIC CARBON DIOXIDE (CO₂) SENSING SYSTEM AND METHOD THEREOF

(51) International classification	:A61B0005145900, G01N0021760000, C10G0001100000, A61B0005000000, G01N0015060000	(71) Name of Applicant : 1)Chitkara University Address of Applicant :Chandigarh-Patiala National Highway, Village Jhansla, Rajpura, Punjab - 140401, India. Rajpura Punjab India 2)Chitkara Innovation Incubator Foundation
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(86) International Application No	:	
Filing Date	:01/01/1900	
(87) International Publication No	: NA	
(61) Patent of Addition to Application Number	:NA	
Filing Date	:NA	
(62) Divisional to Application Number	:NA	
Filing Date	:NA	

(57) Abstract :

An autonomous oceanic carbon dioxide (CO₂) sensing system comprising genetically engineered algae with synthetic gene circuits configured to integrate nanosensors that detect dissolved CO₂ and process CO₂ concentration data via internal biochemical pathways, nanosensors embedded in or associated with the algae adapted to bind with dissolved CO₂ and generate a corresponding signal, bioluminescent proteins expressed by the algae configured to emit light signals in response to the CO₂ concentration, where the intensity and/or frequency of the emitted light encodes the CO₂ level, and optical receivers configured to detect and geolocate the emitted bioluminescent signals. The method includes seeding genetically engineered algae into ocean waters, detecting dissolved CO₂ via embedded nanosensors, transducing detected CO₂ levels into bioluminescent signals, optically detecting the signals using external receivers, decoding the signals into digital CO₂ concentration values using AI models, and mapping real-time CO₂ distribution across ocean regions.

No. of Pages : 21 No. of Claims : 10