Title: Harnessing Hydrogen Production Through Photosynthetic Microorganisms: a Focus on Indigenous Freshwater Algae Species in Oman

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The study explores the possibilities of producing biohydrogen derived from native freshwater algae species Cladophora, A. quadricelluare, Chroococcus, and Coelastrum obtained from different wadis around the Sultanate of Oman. Samples were grown in a laboratory in a controlled environment under monitored and regulated conditions, including illumination, temperature, pH, oxygen concentration, and water clarity. The samples were then subjected to a pre-treatment procedure, which entailed being exposed to a temperature of 210°C for a duration of 15 minutes. Following this, the samples underwent dark fermentation for a duration of 11 days. The final stage involved the use of gas chromatography to check for the presence of hydrogen. The maximum hydrogen yield obtained was 0.562% produced by the Coelastrum substrate under dark anaerobic conditions, followed by the A. quadricelluare substrate (0.487%), the Chroococcus substrate (0.261%), and the Cladophora substrate (0.111%). The research findings indicate that biohydrogen production depends on the composition of algae and a combination of many elements, including food availability, pH levels, temperature, substrate concentration, and cell density. The results indicate that algal biohydrogen production through dark fermentation holds great potential as a sustainable and renewable energy source, in addition to the significant potential of indigenous algae species as viable producers of sustainable biohydrogen.