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JUSTH2

PRODUCING GREEN HYDROGEN FROM ORGANIC WASTE TO GENERATE ELECTRICITY

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• **ملخص:**

وفي ظل الوتيرة المتسارعة لتحول الطاقة العالمي، برز الهيدروجين الأخضر كحل واعد، ومثير للجدل في بعض الأحيان، للتخفيف من تداعيات تغير المناخ وتنويع مصادر الطاقة. وضعت مصر نصب عينيها أن تصبح لاعبًا عالميًا رئيسيًا في هذا المجال بفضل موقعها الاستراتيجي وسوقها المحلية الكبيرة ووفرة الطاقة الشمسية. وتشمل الدوافع المهمة لإنشاء قطاع هيدروجين مزدهر ضمان أمن الطاقة والحماية من تقلبات الأسعار. تسعى مصر إلى الارتقاء لتصبح رائدة عالميًا في مجال الهيدروجين الأخضر من خلال تنفيذ مجموعة من الآليات لإنتاج الهيدروجين بعدة طرق. وعلى النقيض من الحكومات المصرية السابقة التي لم يكن دعمها لإنتاج الطاقة المتجددة كافيا، فقد تبنت إدارة الرئيس عبد الفتاح السيسي استراتيجية طموحة ومتعددة الأوجه للوفاء بالتزامات البلاد المناخية وتعزيز... النمو الاقتصادي الهيدروجين الأخضر حددت الاستراتيجية المصادر الرئيسية للطلب المستقبلي على الهيدروجين، حيث

أجرينا العديد من الأبحاث حول إمكانية إنتاج الهيدروجين الأخضر بتكلفة أقل من التحليل الكهربائي للمياه من خلال التخمير الداكن للنفايات العضوية لحل أزمة الطاقة وتقليل انبعاثات الكربون باستخدام بكتيريا التخمير الداكن (الإشريكية القولونية). لإنتاج الهيدروجين الحيوي

الكلمات المفتاحية: التخمير الداكن – الهيدروجين الاخضر - بكتيريا التفاعل الهيدروجيني – الامتزاز – التكثيف – الكهرباء - التكنولوجيا الحيوية - تثبيط المنتج

- **Abstract**

In light of the accelerating pace of the global energy transition, green hydrogen has emerged as a promising, and sometimes controversial, solution to mitigate the repercussions of climate change and diversify energy sources. Egypt has set its sights on becoming a major global player in this field thanks to its strategic location, large local market, and abundance of solar energy. Important motivations for establishing a prosperous hydrogen sector include ensuring energy security and protection from price fluctuations. Egypt seeks to rise to become a world leader in the field of green hydrogen by implementing a set of mechanisms to produce hydrogen in several ways. In contrast to previous Egyptian governments whose support for renewable energy production was not sufficient, the administration of President Abdel Fattah El-Sisi has adopted an ambitious, multi-faceted strategy to fulfill the country's climate commitments and enhance... Economic growth The green hydrogen strategy identified the main sources of future demand for hydrogen, as we conducted many researches on the possibility of producing green hydrogen at a lower cost than electrolysis of water through dark fermentation of organic waste to solve the energy crisis and reduce carbon emissions using dark fermentation bacteria (Escherichia coli). To produce biohydrogen

Key words:Dark fermentation - green hydrogen - hydrogen reaction bacteria - adsorption – condensation – electricity - For biotechnology - product inhibition

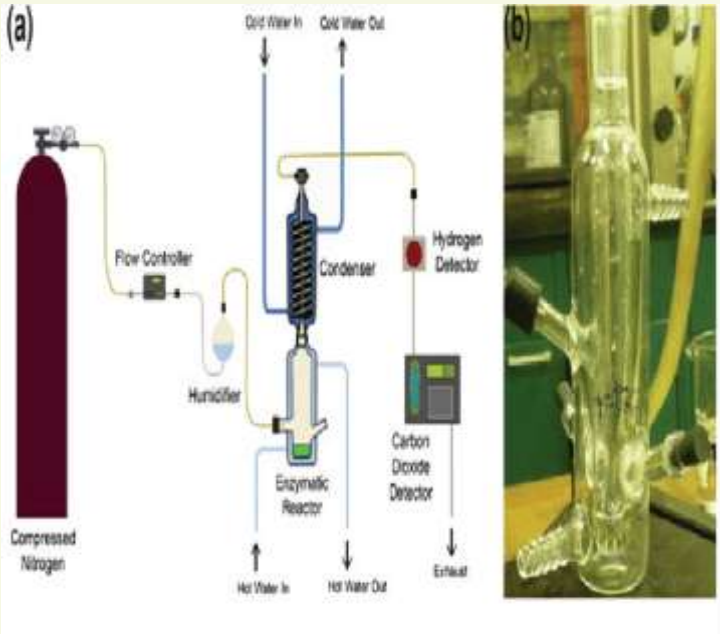
- **The goal of the project:**
  - Creating renewable energy
  - Generating electricity
  - Saving money
- **Materials and tools used:**

Organic waste

E

scherichia coli bacteria

Hydrogen distillation device from dark fermentation



Green hydrogen condenser device

- **Social benefits**
  - Creating renewable energy
  - Generating electricity
  - Saving money
  - Dispose of waste in a safe manner
  - Reducing harmful carbon emissions
  - Using green hydrogen to generate electricity
  - Creating inexpensive renewable energy
  - Use the remaining biomass as organic fertilizer
- **EDP steps**
  - Identify the problem.
  - Gathering information.
  - Possible solution.
  - Great the prototype
  - Evaluation
  - Refine
  - Communications
- **demo model**



- **Final model**


مدرسة المتفوقين للعلوم و التكنولوجيا بالمنيا
Minya STEM School

At STEM School to follow up on the results of green hydrogen extraction in the laboratory

- **Experimental steps**
  - 1- We identified the challenge facing Egypt and through research we refined our efforts on the energy and climate crisis
  - 2- Each team member researched these two problems, which allowed us to collect the greatest amount of information in terms of the causes of the problem and how you feel.
  - Possible solutions and choosing the best ones.
  - 3- After collecting and analyzing information, we were able to determine one path that can confront these two problems, which is green hydrogen as a renewable energy source for generating electricity. Before starting the project, we consulted Professor Amal Amin, who helped us determine the appropriate source for generating hydrogen, which is waste.
  - 4- To solve the climate problem, we searched for the main source of climate problems, and the most important source is waste and pollution
  - Therefore, we identified the used waste that contains hydrogen they are plastic waste and organic waste
  - 5- After meeting and sharing opinions, we selected the organic waste and then determined the mechanism used, which is dark biological fermentation using coliform bacteria.

We conducted a home experiment to ensure the possibility of producing it after leaving the bacteria and organic waste for a week. We opened the end of the straw and connected it to a balloon and found that the size of the balloon increased as a result of the entry of gases resulting from bacterial digestion.

To detect its presence by knowing that it is a flammable gas, we approached a match and found that it had exploded.

6- It was difficult to deal with green hydrogen and these chemical experiments at home, so we contacted the STEAM school to use the laboratory and conduct the experiments in a safe way. We selected two members from the group to follow up on the experiment and consult the teachers, and then we meet to analyze the course of the experiment.

7- The solution to the energy problem is to use green hydrogen extracted from organic waste to generate clean electricity in a safe, convenient and inexpensive laboratory manner.

8- The remaining biomass from the waste was added with worms to be used as organic fertilizer, so there will be no harm

In this way, carbon dioxide can be removed from the atmosphere and obtained as a renewable energy source for generating electricity and as fuel. Therefore, this strategy is an alternative to the high cost of using water electrolysis.

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