

Green hydrogen

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- **Abstract**

To achieve the idea we had to follow the EDP[Engineering design process] include research the problem, and search and find out a solution, make a brainstorm all of the details about the search, and make a good prototype to achieve that task by using it, at the end if it worked we can keep going on the idea and develop it if it was possible, if it didn't work we can start from the beginning to see if there something wrong. Otherwise, there is a very important step we should make which is the Design Requirements that we already make in the consent:

The energy out is more than energy in with a low cost of other ideas.

And all of the previous have been done in our prototype; because the process to make hydrogen gas is Ecology, the cost of the reactants is less than the products, and the energy that we made from {6 g} of hydrogen was { 6.3×10^{14} J}.

The cost of the input was less than the output.

The process was friendly to the environment {Ecological}.

As soon as we solve this problem with a good prototype as it said in the design requirements we would be able to make back the favor of our homeland even if it was a little bit of what the country gave us.



• ملخص:

الهيدروجين الأخضر

مشكلة الطاقة تعد واحدة من أكبر التحديات التي تواجه العالم، وخاصة فيما يتعلق بإنتاج الطاقة النظيفة مثل الطاقة الشمسية وطاقة الرياح. تعتبر هذه الأشكال من الطاقة أكثر تكلفة من الطاقة التقليدية، بالإضافة إلى أنها تتطلب تكنولوجيا متقدمة وقد تكون محدودة في الكميات المتاحة. ولحل هذه المشكلة، يتجه العالم نحو إنتاج الهيدروجين، حيث يحتوي على كميات عالية من الطاقة. بالإضافة إلى ذلك، يتميز الهيدروجين بالعديد من الطرق التي يمكن أن يتم إنتاجها بها.

أحد هذه الطرق هو استخراج الهيدروجين من الوقود الأحفوري، وخاصة الغاز الطبيعي والفحم، عن طريق معالجهما لإطلاق الهيدروجين من جزيئات الهيدروكربون. ومع ذلك، فإن هذه العملية تؤدي إلى إطلاق ثاني أكسيد الكربون في الغلاف الجوي، وهو مضر بالبيئة.

ومن بين الطرق الأخرى لإنتاج الهيدروجين هي استخدام الماء، حيث يتم تحليل الماء بواسطة التحليل الكهربائي، وهي عملية تفصل الماء إلى الهيدروجين والأكسجين. ومع ذلك، تواجه هذه الطريقة بعض المشاكل، مثل استخدام الطاقة الكهربائية التي قد تكون مولدة من مصادر غير نظيفة مثل الوقود الأحفوري أو الفحم. وإذا تم استخدام طاقة نظيفة مثل الطاقة الشمسية، فقد يؤدي ذلك إلى زيادة تكلفة إنتاج الهيدروجين.

وكان السؤال الأهم بالنسبة لنا عما إذا كان يجب إهدار الطاقة الكهربائية لإنتاج الهيدروجين. وقد قمنا بالبحث وتوصلنا إلى طريقة أخرى لإنتاج الهيدروجين، وهي باستخدام معادلة كيميائية تتكون من الماء وكمية صغيرة من هيدروكسيد الصوديوم، والألومنيوم ويتم تدويره من النفايات مثل علب الكانز وغيرها. يتفاعل الماء مع هيدروكسيد الصوديوم، ويعمل الألومنيوم كعامل حفاز لإنتاج الهيدروجين الخام في صورة بخار يمكن تجميعه بسهولة. كما يتم تحويل مادة ألومنيات الصوديوم إلى راسب من التفاعل، وهي مادة اقتصادية يتم استخدامها في صناعات مختلفة مثل صناعة الصابون والأسمدة. ويتم طرد الحرارة من هذا التفاعل، ولذلك قمنا باستخدام جهاز يسمى البلتير، والذي يحول فروق درجات الحرارة إلى كهرباء. وبهذه الطريقة، يمكننا إنتاج الهيدروجين بتكلفة منخفضة، بالإضافة إلى الحصول على مادة اقتصادية وإنتاج الكهرباء.

لذا، يمكننا أن نستنتج أن هناك حلاً متوفراً لإنتاج الهيدروجين بشكل نظيف وفعال من حيث التكلفة. وهذا سيساهم في تقليل الأثر البيئي لعملية إنتاج الهيدروجين وتحقيق استدامة الطاقة في المستقبل.

• Introduction

“Green Hydrogen” is the name of our idea which talk about increasing one of the energy sources in Egypt which are hydrogen.

And that we are making is a reliable and economical source, and there are two types of hydrogen that can be used in energy production but one of them is polluting the environment every time we use it; because of the negative impact of the industrial revolution and our daily life use, otherwise our product is economic which we can make easily and doesn't pollute the nature.

And the two main problems that we faced were [lack of energy resources, the problem of pollution that filled the air; because of all the incorrect use of some of the energy resources or the full count on the nonrenewable resource energy], so we concluded this solution which about a chemical reaction between Aluminum and sodium hydroxide and water \rightarrow Sodium Aluminate and Hydrogen {energy} and heat{energy}, but in the end, we would make a good step in the revolution of in the energy resource or the economical materials that would be created from the chemical formula \square

• Research problem

What about the risks that will be in the country with the lack of energy resources? the industrial revolution would decrease; because we will not be able to make enough energy to make the desired products To achieve population sufficiency or wouldn't be any jobs for the graduated students, and for a shortcut about the problems that would be there, they are all related to [Address and reduce pollution -- increasing industrial and agricultural paces--Recycling garbage and waste--the causes of the climate change.] that all will be found because we don't have a reliable resource of energy that doesn't pollute the environment.

The problem that we were facing in our idea was the lacking of energy resources in Egypt, so we search how we can make this be solving this problem by using a chemical reaction or convert in the type of the using material to make a good result to be further o pollution, finally, we could this formula has done which is making a reaction between sodium hydroxide and water{the industrial material} with aluminum (as helping agent) to make hydrogen(energy) and sodium aluminate(economic material)and heat(energy).

• Materials

Table 1: (used materials)

Items	Quantity	Cost	Picture
Flask	1	15 E.P	
Hose	20 cm	5 E.P	
Pace of iron	3*3 cm	5 E.P	

Table 2: (The tools used in making the prototype)

items	Quantity	Cost	Picture
Aluminum	500 g	Free	
Sodium hydroxide	1000 g	10 E.P	
Peltier	1	100 E.P	
Water	500 g	Free	

• Procedure

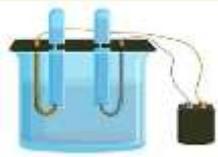
Using our data after selecting the design of the prototype collecting system, we decided to build up a prototype that considers a small scale of the real system. As we used to follow the steps before reaching the final stage of the prototype as Follow:

- 1) Bring 36 grams of water and then heat it
- 2) Put the thermos electric cooler
- 3) Put pace of iron to put water in it
- 4) Put the water in the jar, then add 70 grams of sodium hydroxide and stir well Add 50 grams of aluminum and then stir well
- 5) Put the hose on the jar lid and then close the lid well
- 6) Ignite the rising gas to make sure it's hydrogen

• Data analysis

- Graph (1) the mass of the materials involved in a chemical reaction by the unit in grams the material is (aluminum – sodium hydroxide – water) 1- aluminum >>> 53.6 g 2- water >>> 34 g 3- sodium hydroxide >>> 79.6 g
- Graph (2) the mass of products of the chemical reaction by the unit in grams the products are (sodium aluminate – hydrogen) 1- sodium aluminate >>> 164 g
- 2- hydrogen >>> 6 g
- From these two graphs, we found that the percent of hydrogen is 6% in the chemical reaction

• Data

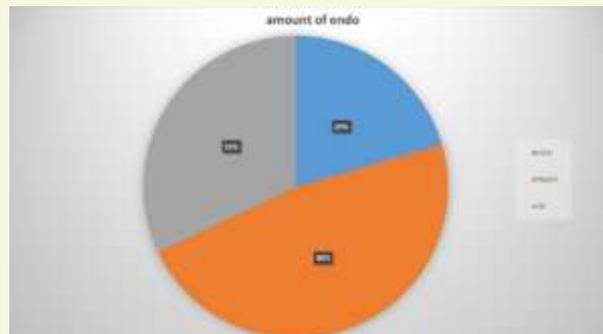
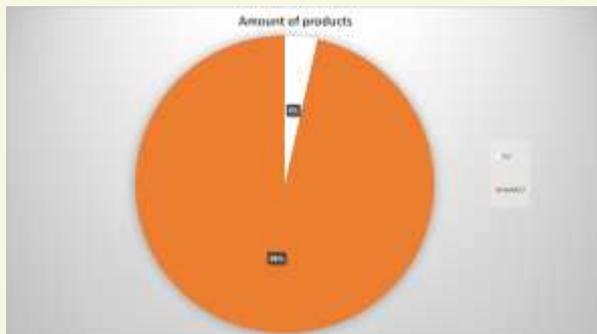
Before the experience	During the experience	After the experience
<p>We found that water can be divided into oxygen and hydrogen by electrolysis, but the hydrogen that exists is not clean because the electricity used comes from petrol and something like these, but in our project, we can get clean Hydrogen from a chemical reaction and a reliable expensive material which is Sodium Aluminate.</p>	<p>The chemical reaction was happening until we noticed heat energy came from the flask (exothermal), so we made a search and brainstormed about it if it is good or not with the other products. In the end, we concluded that we can use it to produce electric energy through the thermoelectric cooler. And all the contents that existed here are (NaOH, Al, and H₂O) and they were disappearing by the time, (H₂, Sodium Aluminate, and Heat Energy) they were appearing by the time.</p>	<p>After the experience, we found that the chemical reaction succeeds and we get three things :</p> <p>1- hydrogen 1- sodium aluminate 3-Electricity from Thermos electric cooler</p>
		

• Results

After doing the test plan, we obtained the following results:

- After we experimented, the results were ٦ g of hydrogen and ١٧ g of sodium aluminate, [We calculate the results from application the of hydrogen].
- We produce 23g of methane and 12g of oxygen when we add 7g of hydrogen to 28g of carbon dioxide.
- We use hydrogen as fire like metal welding.

- And we use sodium aluminate to produce soap, also.
- Sodium aluminate is used to accelerate the hardening of the cement.



• The amount of heat

We try to benefit from all thing in the project so we found that the chemical energy is exothermic we make the search and we arrived to use the tricthermoelec cooler (devise converts the different between heat and cool to energy by use semi conductor to electric) so we measure the temperature for the chemical energy every 5 and we make the graph for show that



□

• Applications

At the end of the idea, we should tell you the applications of the products to work with it which are: -

• Hydrogen:

- As energy resource like in fuel sell.
- As a matter to use in the chemical reaction between it and carbon dioxide to produce the synthetic methane; to use it as fuel or another energy resource.

- AS H₂ is a valuable and expensive material we could save it in the laboratory for scientific purposes.
 - **Heat:**
- we can use the heat energy which came out from the reaction; because it is an exothermic reaction to produce electric energy by making inter into the thermoelectric cooler which is a semiconductor device that uses the Peltier Effect to create a heat flux between the junction of two materials.
- And in the {T.E.C} it transfers the heat from one side to the other side of the device to the opposite side against the TEMP gradient and the more junction couple the device have it greater its transfer.
 - **Sodium Aluminate:**
- A catalyst in any reaction-it's a very good material to use as a catalyst, but we didn't use it; because it's very expensive- to make a quick reaction with a little energy ad time. Like accelerating the time of making cement in the building process.
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