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University of Al-Qadisiyah

Collage of Science

Deparment of Chemistry

Green Chemistry and Environmental Pollution Removal

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بِسْمِ اللَّـهِ الرَّحْمَـٰنِ الرَّحِيمِ

(إِنَّمَا يَخْشَى اللَّهَ مِنْ عِبَادِهِ الْعُلَمَاءُ إِنَّ اللَّهَ عَزِيزٌ غَفُورٌ)

صدق اللَّه العظيم.

سُوَرة فاطر

أيه ٢٨

الإهداء

أهدي هذا البحث لرجل علمني الحياة بأجمل شكل ....والدي

لامرأة صنعت مني فتاة طموحة تعشق التحديات كما عشقتها هي .. لتلك التي منها تعرفت على ألقوه والثقة بالنفس .

لمن رضاها يخلق لي التوفيق ...لجنتي ..أمي

لرجل ذكراه دائماً تتردد بالخير على ذاكرتي ..رجل أتمنى اللقاء معه بجنات النعيم ..... الدكتور عباس جواد كاظم

الى من عرفت كيف أجدهم وعلموني أن لا أضيعهم... أصدقائي

الشكر والتقدير

(من لا يشكر الناس . . . لا يشكر الله)

أتقدم بالشكر أولاً وأخيراً لله سبحانه وتعالى ..

لـ أساتذتي ...حتىوإن كانت هذه الكلمة قليلة في حقكم، ولكن

أنتم السبب المهم ليكون هذا البحث واقع ملموس وليس حلم من أحلامي

البسيطة ..

شكرًا لكل إحساس صادق التمسته بعيونكم وقلوبكم طوال فترة دراستي،،

وبأشد الكلمات الطيبة اقدم شكري وامتناني لمن كانت السبب في استكمال هذا

البحثولتحفيزي على المثابرة والاستمرار وعدم اليأس لأستاذتي ..

مشرفة البحث الدكتورة زينا محمد كاظم...

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Abstract

The present study included utilization of low cost industrial waste sawdust as a green chemistry for energy sourses.

2.2 The effect of some parameters was studied such as agitation time, the density. The effect of contact time, the specific gravity for samples were analyzed. The API for samples were determined. The refractive index for samples were analyzed.

.It was implied that sawdust may be suitable as an adsorbent for clean removal for the waste of energy sources.

Chapter one

The theoretical part

Introduction

Green chemistry is the design of high-performing, cost-effective technology that is safer for theenvironment and human health. Green chemistry is another bright aspect of chemistry. The concern for environmental balance and the provision of life requirements and protection has lead to many calls for attention to ecology and chemistry. These sciences can address many of the causes of environmental imbalances. In addition, new curricula at the level of university education and before, to support the outputs of education and encourage scientific research and provide scientific fact and studies on which is based on sound planning.The Green chemistry seeks to make chemistry an integral comprehensive science by reducing chemical industrialization and chemical processes, through the pharmaceutical, pharmaceutical, petroleum and plastic industries to the maximum extent, as well as preventing pollution in the first place. This means avoiding any kind of damage Industrial and technical progress can be accompanied by the introduction of a clean environmental concept.

Green chemistry looks to produce more efficient and less expensive chemical materials and processes. In addition, what green chemistry seeks to reshape our world and manufacture products from natural materials is an important step towards stopping environmental pollution and gradually returning to nature, but with minimal material costs,taking into account the ecological system for maintaining the Earth's biological balance.

1.1 Green chemistry Definition

- The term green chemistryis defined as the invention, design and application of chemical products and process to reduce or to eliminate the use and generation of hazardous.[1][2]

- Looking at the definition of green chemistry, the first thing one sees is the consent invention and design.by requiring that the impacts of chemical products and chemical processes are included as design criteria, the definition of green chemistry inextricably links hazard considerations to performance criteria.

Another aspect of the definition of green chemistry is found in thephraseuse and generation. Rather than focusing only on those undesirable substances that might be inadvertently produced in a process, green chemistry also includes all substances that are part of the process.[3]

Therefore, green chemistry is a tool only for minimizing the negative impacts of those procedures aimed at optimizing efficiency, although clearly both impact minimization and process optimization are legitimate and complementary objectives of the subject.

Green chemistry ,however also recognizes that there are significant consequences to the use of hazardous substances ,ranging from regulatoryhanding transport ,and liability issues to name a few to limitthe definition to deal with waste only ,would be address only part of the problem.[4]

1.2 History

Green chemistry emerged from a variety of existing ideas and research efforts (such as atom economy and catalysis) in the period leading up to the1990,in the context ofincreasing attention to problems of chemical pollution and resource depletion. The development of green chemistry in Europe and the United States was attached with a shift in environmental problem-solving strategies:

1- A movement from command and control regulation.
2- Mandated reduction of industrial emissions at the "end of the pipe" toward the activeprevention of pollution through the innovative design of production technologies themselves.

The set of concepts now recognized as green chemistry coalesced in the mid-to late 1990, along with broader adoption of the term (which prevailed over competing terms such as "clean" and "sustainable'' chemistry). [5]

Briefly, we can say:

- Signing pollution prevention law at 1990 in USA.
- First environmental protection agency in USA.
- Launch of the journal green chemistry in United Kingdom.

1-3-The 12 principles of green chemistry.[6][7]

1- Preventionwaste

- The ability of chemists to redesign chemical transformation to minimize the generation of hazardous waste is an important first step in pollution prevention.by preventing waste generation; we minimize hazards associated with waste strong, transportation and treatment.

2- Maximize Atom economy

- Atom economy is a rations the total mass of atoms in the desired product to the total mass of atoms in the reactants.One way to minimize waste is to design chemical transformation that maximize the incorporation of all materials used in the process into the final product, resulting in few if any wasted atoms.Choosing transformation that incorporate most of the starting materials into the product is more efficient and minimizes waste.

3- Design less hazardous chemical synthesis

- Wherever practicable,synthetic should be designed to use and generate substances that possess little or no toxicity to people or the environment. The goal is to usehazardous reagents whenever possible and design processes that do not produce hazardous by-products. Often arrange of reagent choices exist for a particular transformation.

4- Designing safer chemical and products

- Chemical products should be designed to effect their desired function while minimizing their toxicity.Toxicity and ecotoxicity are properties of the products. New products can be designed that are inherently safer, while highly effective for the target application.

5- Use safer solvent / Reaction conditions

- Theuse of auxiliary substances (e.g: solvent or separation, act.) should be made unnecessary whenever possible and innocuous when used. Solvent use leads to considerable waste. Reduction of solvent volume or complete elimination of the solvent is often possible.

6- Increase energy efficiency

- Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized.If possible, synthetic methods should be conducted at ambient temperature and pressure, so that energy costs associated with extremes in temperature and pressure are minimized.

7- Use renewable feedbacks

- Whenever possible, chemical transformation should be designed to utilize raw materials and feedbacks that are renewable. Examples of renewable feedstocks include agricultural products or the waste of other processes. Example ofdepleting feedbacks include raw materials that are mined or generated from fossil fuels (petroleum, natural gas or coal).

8- Avoid chemical derivatives

- Unnecessary derivatives (use of blocking groups, protection / deportation,temporary modification of physical/ chemical processes)should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.

9- Use Catalysts

- Catalytic reagents (as selective as possible) are superior to stoichiometric reagent. Catalysts can serve several roles during a transformation. The can enhance the selectivity of a reaction, reduce the temperature of a transformation, enhance the extent of conversion to products and reduce Reagan-based waste.

10- Design for degradation

Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and don't persist in the environment. Efforts related to the principle focus on using molecular-level design to products that will degrade into hazard less substances when they are released into the environment .

11- Analyze in Real-time analysis to prevent pollution

- It important to monitor the progress of a reaction know when the reaction is complete or to detect the emergence of any unwanted by-products

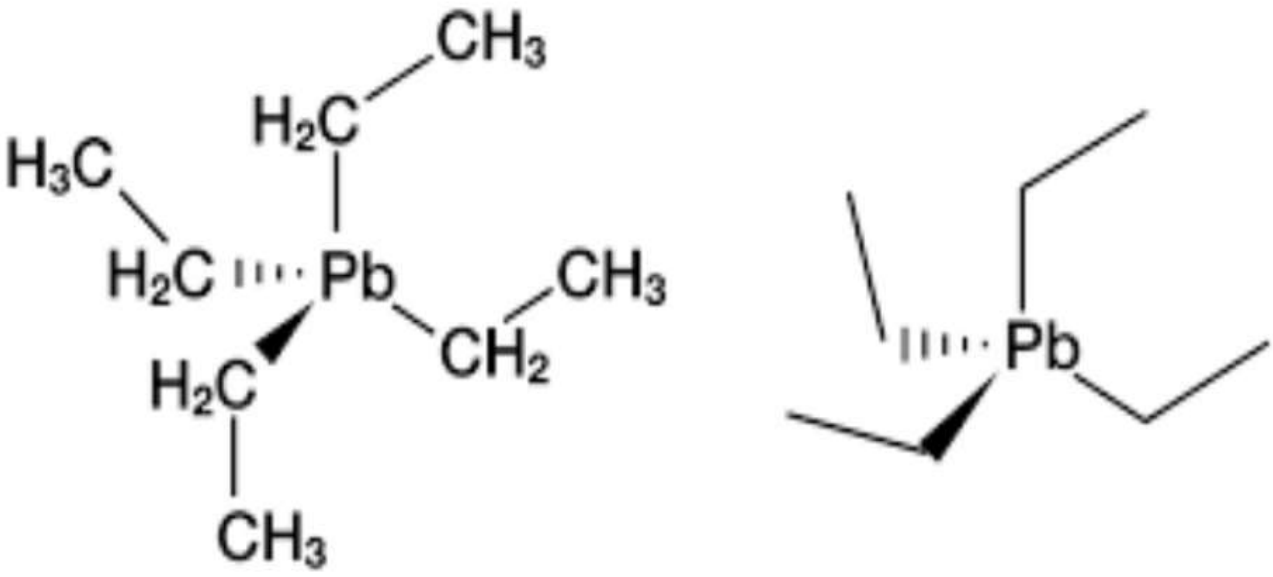
12- Minimize the potential for accident

- One way to minimize the potential for chemical accidents is to choose reagents and solvent that minimize the potential for explosions, fires and accidental release

2-4 Example of green chemistry

Use safer chemical: lead pollution has been decreased by ...

TetraEthel was mixed with gasoline (petrol) beginning in the 1920s as a patented octane booster that allowed engine compression to be raised substantially, which inturn increased vehicle performance or fuel economy.[8]



Replacing tetraethyl lead with less toxic additives(e.g, "lead-free"gasoline).

As a gasoline (petrol) additive, benzene increases the octane rating and reduce knocking. Therefore, gasoline often contained several percent benzene before the 1950s, when tetraethyl lead changed it as the most widely used antiknock additive. With the global phaseout of leaded gasoline, benzene has made a comeback as a gasoline additive in some nation.

2-5 The essential impact of the human onthe earth:

As of 2005, earth's people population stood at approximately 6.5 billion people and that of the U.S at approximately 249 million people. These are staggering numbers to be sure. However,the good news is that these numbers are not nearly so high as those from projections made 40 or 50 years earlier. The increase in world population that has occurred over the last has been more due to decreasing death rates than to increasing birth rates.(9)

The burden placed upon earths systems can be expressed by the equation

Burden = (Number of people) * (Demand per person)

This equation shows that both the number of people and the demand that each puts on earth's resources must be considered in reducing the impact of human on earth. Both must be addressed to achieve sustainability.

2-6 Energy

Energyis the ability to do work.[10]Energy is a conserved quantity.

Energy comes in the different forms:

- Heat (thermal) .
- Light (radiant)
- Motion(kinetic)
- Motion.
- Electrical.
- Chemical.
- Nuclear energy.
- Gravitational.

There are two types of energy:

1- Stored (potential) energy.

2- Working (kinetic) energy .

Energy sources are divided into two groups:

- Renewable (an energy source that can be easily replenished.
- No renewable (an energy source that can not be easily replenished.

Some forms of energy (that an object or system can have as a measurable property)[11]

Type of energy	Description
Mechanical	The sum of macroscopic translational and rotational kinetic and potential energies
Electric	Potential energy due to or stored in electric fields
Magnetic	Potential energy due to or stored in magnetic fields
Gravitational	Potential energy due to or stored in gravitational field
Chemical	Potential energy due to chemical bonds
Ionization	Potential energy that binds an electron to its atom or molecule
Thermal	Kinetic energy of the microscopic motion of particles, a form of disordered equivalent of mechanical energy.

2-7 Non renewable energy

- energy source are classified as nonrenewable because they do not form or replenish in a short

  period of time.[12]

The non renewable energy source are:

- Coal.
- Natural gas
- Uranium (nuclear energy)
- Oil and petroleum products
  - Gasoline
  - Diesel fuel

Nonrenewable energy sources come out of the ground as liquid,gases,and solid. We use crude oil to make liquid petroleum products such as gasoline,diesel fuel.Uranium ore, a solid, is mined and converted to a fuel used at nuclear power plants. Uranium is not fossil fuel, but it is classified as a non renewable fuel. All fossil fuels are non renewable, but not all non renewable energy source are fossil fuels.

2-8 Gasoline [13]

Gasoline or petrol is a derivative product of crude oil/petroleum. It is derived during fractional distillation process and has a translucent liquid from. It's not used in its crude form. Different additives are added like ethanol to use it as fuel for passenger vehicles. In the US and Latin countries, term gasoline is used, but in Europe and Asian countries it's called petrol. [14]

Some companies have different names for these grades of gasoline, such as unleaded, super ,premium, but they all indicate the octane rating, which reflects the antiknock properties of gasoline. Higher ratings result in higher prices before 1996, lead was added to gasoline as a lubricant to reduce wear on engine valves.

The chemical and physical properties of gasoline are highly variable depending on the specific product. As well, the hazards of gasoline are affected by the proportion of individual components. For example gasoline containing a significant proportion of n-hexane may have toxic effects attributable to n-hexane.

Physical properties of gasoline boiling point 20-200 c relative density (water):0.70-0.80 solubility in water, g/100 ml: none relative vapour density (air 1): 34 flash point:<-21c auto ignition temperature: about 250 c explosive limits, vol% in air: 1.3-7.1 octanol/water partition coefficient as log pow: 2-7.Chemical properties of gasoline the typical composition volume is as follows: 4-2% alkaline, 2-5% alkenes , 25-40% iso alkanes , 3-7% cycloalkanes ,4% cycloalkenes and 20-50 % total aromatic (0.5-0.5%benzene) TJ.

The objectives

1- Green chemistry aims to minimize emissions from chemical manufacturing It also aims to create new chemicals that are good for the environment and chemicals that act as alternatives to other chemicals processes to the lowest possible extent,

2- Green chemistry not a solution to all environmental problems, But the most fundamental approach to preventing pollution.

3- The use of energy source has an effect on the environment.

4- There is a measure in the world of fuel called the octane number, the more octane the more environmentally friendly.This means:

- (Good petroleum) : It has a high octane number.
- (Normal petroleum) :The octane number has a lower valuethan good petroleum.

Chapter Two

Experimental part

2.1 Chemicals,Devices , Materials and Used equipments:

- 2. 1 Asbestos Paper, Water bath, Balance. Beakers, Cylinders

  Deionized Water.Samples of Gasoline.Sawdust.

2.2 Samples of Gasoline:

	Stations	Position
1	Hai Al-Aamel	Baghdad (Cheap)
2	Al-Duja	Al-Qadisiyah (Cheap)
3	Al-Manssur	Baghdad (Cheap)
4	Al-Hatharah	Al-Qadisiyah (Cheap)
5	Al-Wafideen	Al-Qadisiyah (Cheap)
6	Al-Qadisiya	Al-Qadisiyah (Cheap)
7	Al-Bashara	Al-Qadisiyah (expensive)
8	Al-Bashara	Al-Qadisiyah (Cheap)

Figure 1 - Samples of Gasoline

2-3 Determination of density :

Density is determination by the following law :

D= m of sample/m of water * p of water

The procedure :

1-Take 8 sample of gasoline putting each10 ml of gasoline in the beaker.

2-Each sample is weighed after the device is tapped.

3-The following results were obtained.

Sample	Density
1-	0.62 g/mol
2-	0.66 g/mol
3-	0.65 g/mol
4-	0.65 g/mol
5-	0.69 g/mol
6-	0.66 g/mol
7-	0.68 g/mol
8-	2.3 g/mol

Figure 2- Determination of density

2-4 Effect of time on the adsorption

Sample	The weight after 15 min	The weight after 30min	The weight after an hour
1-	56.5	55.9	55.4
2-	37.9	37.6	36.3
3-	45.0	44.8	44.2
4-	38.3	38.1	37.5
5-	42.7	42.7	41.8
6-	39.0	38.7	38.2
7-	38.9	38.6	38.0
8-	36.5	36.2	35.7

Figure 3 - Effect of time on the adsorption

2.5 The effect of contact time

The effect of contact time was investigated. Figure 4 shows the contact time at different initial concentrations.

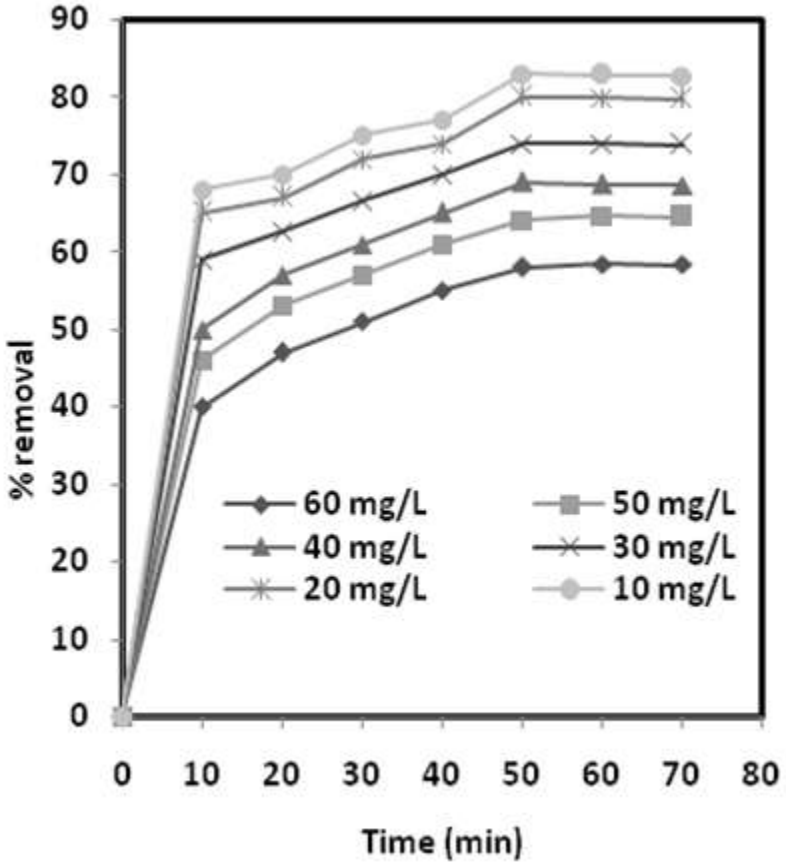


Figure 4: Effect of contact time on the removal at different concentrations. pH=7

2-6 Determination of specific gravity :

The determination of specific gravity was investigated. Table shows the specific gravity for different samples of Gasoline.

Sp.gr =d of sample/d of water

Sample	Sp.gr
1-	0.67
2-	0.71
3-	0.70
4-	0.70
5-	0.75
6-	0.71
7-	0.73
8-	0.76

Figure 5 - Determination of specific gravity

2-7 Determination of API gravity

- This property was determined at (15 ̊c) by American petroleum lnstitute of the following equation:

$$\text{API scale} = (141.5 / \text{sp.gr}) - 131.5$$

Sample	API
1-	78.75
2-	65.85
3-	70.64
4-	70.64
5-	57.167
6-	67.795
7-	62.335
8-	54.68

Figure 6- Determination of API gravity

2-8 Determination of (R.I):

The optical property, reflective index (R.I) was measured by Abbi refractometer which is regarded as indicator of light:

%H= 62-(15℃ Sp.gr)

Samples	D (g/ml)	Sp.gr	API
1-	0.62	0.67	78.75
2-	0.66	0.71	65.85
3-	0.65	0.70	70.64
4-	0.65	0.70	70.64
5-	0.69	0.75	57.16
6-	0.66	0.71	67.79
7-	0.68	0.73	62.33
8-	0.7	0.76	54.68

Figure 7 - Determination of (R.I)

Conclusions

Colour removal from textile effluents has been the subject of great attention not only because of its toxicity but mainly due to its clarity ·Through hundreds of years, the scale of production and the nature of these structures have changed hugely, so the negative force of waste on the environment has increased· The effect of some parameters was studied such as agitation time, the density. The specific gravity for samples were analyzed. The effect of contact time, The API for samples were determined. The refractive index for samples were analyzed.

.It was concluded that sawdust would be a suitable natural structure as an adsorbent for clean removal for the waste of energy sources.

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