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Research paper



Use of saturated green material in vaporic thermal atmosphere to absorb ions have negative impact

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Abstract

This design has been used to adsorb ions from industrial water of companies and factories. Our system has three integrated phases used to test efficiency of an unspecified number of residues of food as adsorbed materials. In this system, we adsorb copper and cobalt ions, these ions are available with high rates in Al Musayab thermal station, high concentration of these ions pose a threat to the health of the population. In general, the presence of these ions in the proportions set by the World Health Organization, namely, (1mg/L) are very useful for the com-pletion of the metabolic processes of the living cell, but a greater focus for this will lead to tremendous health risks. Testing processes a proved that there is an exact match between empirical and theoretical testes of (Freundlich and Langmuir) models. Through the mathematical analysis of the trial data under different thermal conditions, all testes proved that green algae powder is the best filtered material, because its high adsorption efficiency which equal to (77%) with Gips free energy equal to (-39 kJ/mol), followed by Pulp date powder has proven to be excellent efficiency (75%) with enthalpy equals to (-12 kJ/mol). In general, all food remnants have been selected to be test in our adsorp-tion system, this system has high capacity to adsorb various ionic roots of industrial water of Al-Musayab thermal station. All Adsorbents have thermal coefficient falls between one and zero (one<RL<0), this value represents the perfect choice of adsorption to be tested on this system. The total system cost is ($10000).

Keywords: *Ions; Thermal; Free Energy; Efficiency; Capacity.*

1. Introduction

Surface area of the active carbon in nature characterized by non-polar, but through the extraction and production processes are interacting with oxygen, which leads to the production of many effective and specific sites and can give polar vulnerable feature on the product of carbon substance. Because of natural activation, the carbon can be used widely in the treatment of ores using aqueous solutions to extract gold, silver, and other metals. Therefore, the most important industrial processes for the production of active carbon with high capacity and large sizes is the use of potassium hydroxide. Accordingly, the adsorption process is a process that is used to isolate the heavy metals from aqueous solutions, so there are many studies about the types of materials, which absorb ions of different metals from aqueous their solutions. Biomass of organic matter has proved that it has good ability to isolate and reduce the concentration of heavy metals from the aquatic environment; also, there are many studies, which have shown the ability of bacterial cell walls, fungi and algae on linking the heavy ions and attach it to their content of organic. The use of dead biomass to remove heavy metals from aqueous solution has been studied extensively in recent years. Also it proves that the plant cell walls which differ in their composition and characteristics according to the type of great importance plant cell to remove these ions from their solutions because of the a substance of the polymeric substance, which may lead to the effective surface activity. The most important of these is the rice bran fiber as one of the wastes, this rice bran is a by-product of milling process, and this material is very cheap, costing about ($ 1 for each $ 50) of the cost of the activated carbon material. There are two theories are essential to describe the relationship between the concentrations of metals before and after treatment processes, these theories are Langmuir and Freundlisch. Other researchers studied the effect of the active carbon manufactured from coconut charcoal to remove phenol from water of industrial plants, they found very good response, also found very congruence and compatibility between theoretical calculations using theories of Langmuir and Freundlisch and the results obtained.

2. Materials and methods

The researcher designed a bioreactor for conducting the process of interaction between the green leaf algae, available in abundance of the rivers, salt lakes and ciprofloxacin material. The interacting processes took place with the hot steam supplied by attached tank supplied by a tank with the hole diameter not exceed than (5 mm) filled with water and equipped with the severe a heating system steam supplied to tank from the top down. The tank supplied with closed keys. The water in tank stay period of time not less than (10 minutes), then filtering the water and pumped after measuring the flow rate to table food wastes filters, table is equipped with a whole system of keys to control the flow rate to each filter. Through this table, we can test the effectiveness of the hundreds of food wastes to demonstrate their ability to adsorption of free radicals and so we can utilize waste intended as one of the environmental waste for use in industrial purposes. We are tested (6 types) of food wastes like; powder of anguish palms, tea waste, coal powder, palm leaves, husks of peanuts, sunflower husks, peel of egg powder. System and adsorption materials in addition to tanks

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of Al- Musyyab industrial water are see in Fig.1(a,b).The schematic representation for system of adsorption materials is in diagram No.1 (in closed)0.

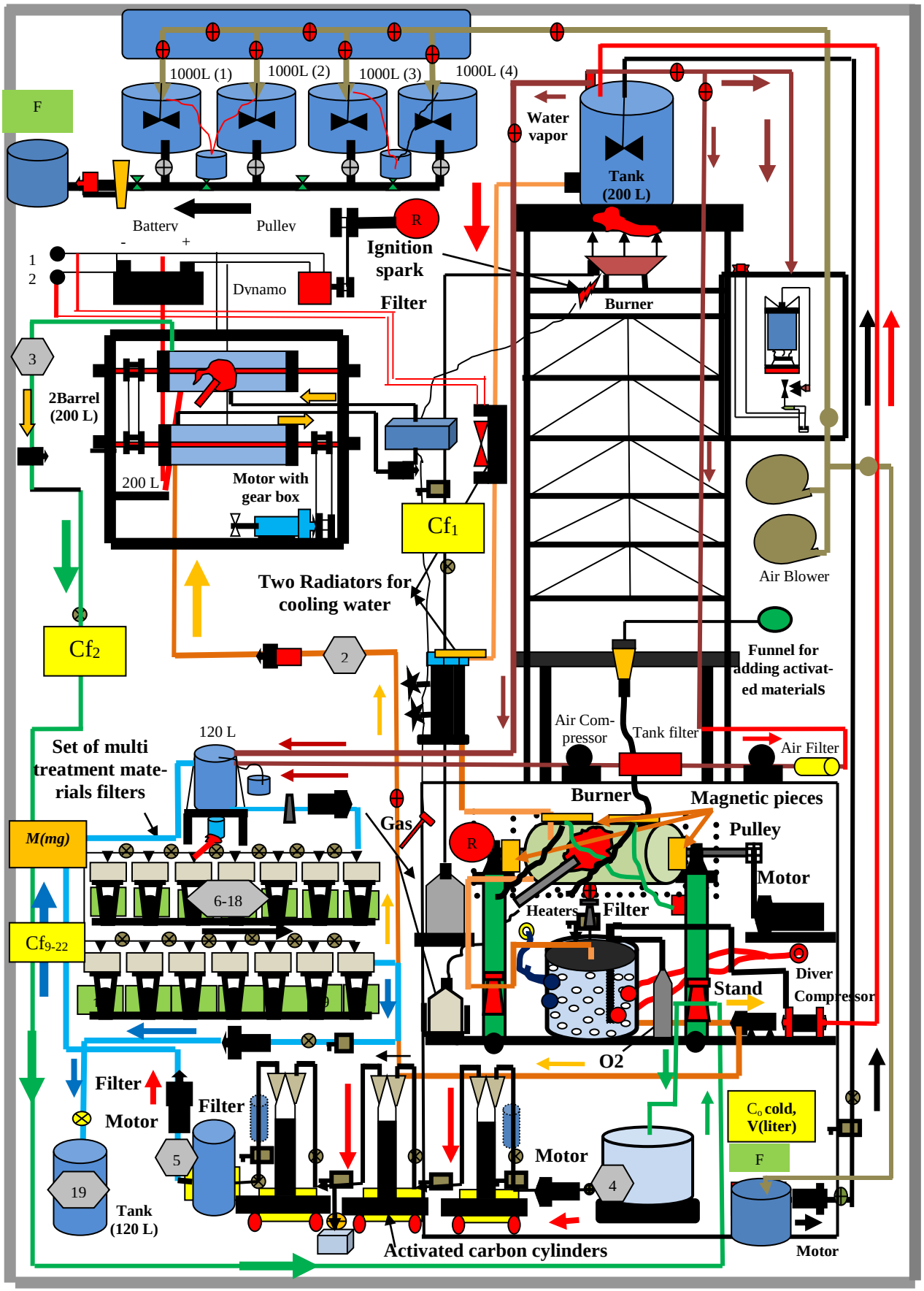


Diagram 1: Schematic Representation for System of Adsorption Materi-Als.

(A)



(B)



Fig. 1: (A, B) the Text System of Adsorption Materials and Tanks of Al-Masaya Industrial Water.

3. Result and discussion

3.1. The results of atomic absorption spectrometer device (aa-6300)

Samples were analyzed using a spectrometer of atomic absorption (AA-6300). Device technology based on the principle of absorption spectroscopy to determine the concentration of the sample depending on the extent of radiation absorbed. Operation based on the absorption wavelength and that is unique to each element of the metallic elements, heavy soluble as well as lower photometric at that wavelength, and based on that determines the concentration of the element under test. Atomic absorption spectroscopy (AA-6300) see in Fig.2, spectroscope test results before and after treatment and absorbent material can be seen through the Fig. 3.



Fig. 2: Atomic Absorption Spectrometer Device (AA-6300).

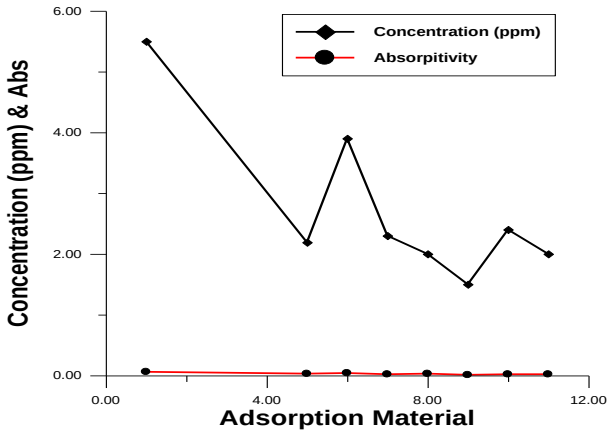


Fig. 3: Copper Ion Concentration Before and after Treatment.

3.2. Results of matching between practical and theoretical models

Design of multi stages for this system produced clean water without free radicals soluble ions by more than (73%) as shown in Fig.3 above, this percent is due to optimal use of the total equipment's which operated efficiently. Powders used are treated inside the furnace, carbon dioxide used in the oven at high temperatures to eliminate the substances that inhibit pores interfaces between molecules during the carbonization process, so that the pores are three activation processes depends on the time required to stay, whenever stay long time inside the oven was, the great size of pores formed. Nitrogen supplied inside oven to isolate and remove carbon dioxide for reducing harmful emissions ratio, also used to reduce the ratio of carbon combustion inside the furnace. The preference criteria for the selection best filtration materials depends on the number of supported variables on the analytical side of each of (Freundlich and Langmuir models), when thermal content (ΔG) is more negative, shape of isotherm is a value between one and zero, and enthalpy value was positive, the elected choice is the best among many working choices, when the inverse ability absorbance is the least, and the logarithm of equilibrium state is the highest, Langmuir constant is the highest the choice is the best also among many working choices, we see also from calculations that when maximum capacity is the highest, inverse of maximum capacity is at least, the choice is the better. Practical tests show that the Green Algae powder is the best efficient adsorbent materials with an efficiency equals to (77%) as shown in Fig.4 and Tables (6,8, and 9), this material also show a lower thermal coefficient as shown in Fig. 7, also seen less Gips free energy as shown in Fig. 5. Pulp date powder has proven to be excellent efficiency (75%) with enthalpy equals to (-12 kJ/mol).Mathematical model of (Freundlich), Langmuir, and thermodynamic specification for (Pulp date powder) is shown in Table (1). Mathematical model of Freundlich, Langmuir, and thermodynamic specification for (Garlic powder) shown in Table (2).Mathematical model of Freundlich, Langmuir, and thermodynamic specifications for (Alfalfa leaf powder) is shown in Table (3). Mathematical model of Freundlich, Langmuir, and thermodynamic specifications for (Seder tree powder) is shown in Table (4). Mathematical model of Freundlich, Langmuir, and thermodynamic specifications for (Calptoze tree powder) is shown Table (5). Mathematical model of Freundlich, Langmuir, and thermodynamic specifications for (Green Algae powder) is shown in Table (6). Mathematical model of Freundlich, Langmuir, and thermodynamic specifications for (Mixture of onion juice powder) is shown in Table (7). Comparison between (1/Qe, Log Qe, Log Ce) of adsorbent materials is shown in Fig. Comparison between Gips free energy, enthalpy, and entropy of adsorbent materials is shown in Fig.6. Comparison between Kl, RI of adsorbent materials as shown in Fig.7.

3.3. Results of mathematical model variables (Freundlich and Langmuir)

The results show full conformity between empirical variables and calculations of the mathematical models which demonstrates the validity of experience from both theoretical and practical, also the results show full compatibility with the results of other researchers in case of addition aqueous solution experiments. The two models and thermodynamic specifications are as shown below:

Table 1: Mathematical Model of (Freundlich), Langmuir, and Thermodynamic Specification of (Pulp Date Powder) For Adsorption the Free Radicals for Copper Ions at (313 Kelvin)

Freundlich model		
Variable	Value	Symbol
Removal Efficiency	75%	RE
Equilibrium Adsorption Capacity	1.6(mg/g)	Qe
Equilibrium Constant	1.9	Kf
Inverse of Equilibrium Capacity	0.62(g/mg)	1/Qe
Logarithm of (Qe)	0.2	Log (Qe)
Equilibrium Concentration	2.5(mg/l)	Ce
Logarithm of equilibrium Concentration	0.39	Log Ce
Initial Concentration	5.7(mg/l)	Ci
Inverse of Slope	0.7	n
Langmuir model		
Langmuir Constant	0.45	Kl
Shape of Isotherm 0<R<1	0.3	Rl
Maximum Absorbent capacity (mg/g)	2.9	Qm
Inverse of Maximum Capacity	0.344	1/Qm
Logarithm of Maximum Capacity	0.4	Log Qm
Thermodynamic specification		
Gips Free energy(KJ/mole)/ The best is the more negative	-12	GΔ
Enthalpy(KJ/mole)/ Endothermic processes	14	HΔ
Entropy(KJ/mole)/ Reaction by itself	39	SΔ

Table 2: Mathematical Model of (Freundlich), Langmuir, and Thermodynamic Specification of (Garlic Powder) For Adsorption the Free Radicals for Copper Ions at (313 Kelvin)

Freundlich model		
Variable	Value	Symbol
Removal Efficiency	68%	RE
Equilibrium Adsorption Capacity	1.89	Qe (mg/gm)
Equilibrium Constant	1.7	Kf
Inverse of Equilibrium Capacity	0.55	1/Qe
Logarithm of (Qe)	0.25	Log (Qe)
Equilibrium Concentration	2.4	Ce (mg/l)
Logarithm of equilibrium Concentration	0.33	Log Ce
Initial Concentration	0.4	Ci (mg/l)
Inverse of Slope	0.35	n
Langmuir model		
Langmuir Constant	0.51	Kl
Shape of Isotherm 0<R<1	0.29	Rl
Maximum Absorbent capacity (mg/g)	3	Qm
Inverse of Maximum Capacity	0.3	1/Qm
Logarithm of Maximum Capacity	0.47	Log Qm
Thermodynamic specification		
Gips Free energy(KJ/mole)/ The best is the more negative	-15	GΔ
Enthalpy(KJ/mole)/ Endothermic processes	33	HΔ
Entropy(KJ/mole)/ Reaction by itself	49	SΔ

Table 3: Mathematical Model of (Freundlich), Langmuir, and Thermodynamic Specification of (Alfalfa Leaf Powder) For Adsorption the Free Radicals for Copper Ions at (313 Kelvin).

Freundlich model		
Variable	Value	Symbol
Removal Efficiency	40%	RE
Equilibrium Adsorption Capacity	0.7	Qe(g/mg)
Equilibrium Constant	0.5	Kf
Inverse of Equilibrium Capacity	1.4	1/Qe
Logarithm of (Qe)	0.15	Log (Qe)
Equilibrium Concentration	4	Ce(mg/l)
Logarithm of equilibrium Concentration	0.6	Log Ce
Initial Concentration	5.8	Ci(mg/l)
Inverse of Slope	0.6	n
Langmuir model		
Langmuir Constant	0.28	Kl
Shape of Isotherm 0<R<1	0.47	Rl
Maximum Absorbent capacity (mg/g)	1.6	Qm
Inverse of Maximum Capacity	0.6	1/Qm
Logarithm of Maximum Capacity	0.2	Log Qm
Thermodynamic specification		
Gips Free energy(KJ/mole)/ The best is the more negative	-7	GΔ
Enthalpy(KJ/mole)/ Endothermic processes	9	HΔ
Entropy(KJ/mole)/ Reaction by itself	13	SΔ

Table 4: Mathematical Model of (Freundlich), Langmuir, and Thermodynamic Specification of (Seder Tree Powder) For Adsorption the Free Radicals for Copper Ions at (313 Kelvin)

Freundlich model		
Variable	Value	Symbol
Removal Efficiency	45%	RE
Equilibrium Adsorption Capacity	1.4	Qe
Equilibrium Constant	1.41	Kf
Inverse of Equilibrium Capacity	1.71	1/Qe
Logarithm of (Qe)	0.3	Log (Qe)
Equilibrium Concentration	2.3	Ce
Logarithm of equilibrium Concentration	0.14	Log Ce
Initial Concentration	5,8	Ci
Inverse of Slope	0.6	n
Langmuir model		
Langmuir Constant	0.48	Kl
Shape of Isotherm 0<R<1	0.31	Rl
Maximum Absorbent capacity (mg/g)	2.8	Qm
Inverse of Maximum Capacity	0.35	1/Qm
Logarithm of Maximum Capacity	0.44	Log Qm
Thermodynamic specification		
Gips Free energy(KJ/mole)/ The best is the more negative	-13	GΔ
Enthalpy(KJ/mole)/ Endothermic processes	25	HΔ
Entropy(KJ/mole)/ Reaction by itself	38	SΔ

Table 5: Mathematical Model of (Freundlich), Langmuir, and Thermodynamic Specification of (Calptoze Tree Powder) For Adsorption the Free Radicals for Copper Ions at (313 Kelvin)

Freundlich model		
Variable	Value	Symbol
Removal Efficiency	06%	RE
Equilibrium Adsorption Capacity	1.8	Qe
Equilibrium Constant	2.8	Kf
Inverse of Equilibrium Capacity	0,5	1/Qe
Logarithm of (Qe)	0.25	Log (Qe)
Equilibrium Concentration	1.8	Ce
Logarithm of equilibrium Concentration	0.25	Log Ce
Initial Concentration	5.7	Ci
Inverse of Slope	0.08	n
Langmuir model		
Langmuir Constant	0.8	Kl
Shape of Isotherm 0<R<1	0.3	Rl
Maximum Absorbent capacity (mg/g)	3.5	Qm
Inverse of Maximum Capacity	0.28	1/Qm
Logarithm of Maximum Capacity	0.5	Log Qm
Thermodynamic specification		
Gips Free energy(KJ/mole)/ The best is the more negative	-36	GΔ
Enthalpy(KJ/mole)/ Endothermic processes	78	HΔ
Entropy(KJ/mole)/ Reaction by itself	111	SΔ

Table 6: Mathematical Model of (Freundlich), Langmuir, and Thermodynamic Specification of (Green Algae Powder) For Adsorption the Free Radicals for Copper Ions at (313 Kelvin)

Freundlich model		
Variable	Value	Symbol
Removal Efficiency	77%	RE
Equilibrium Adsorption Capacity	2	Qe
Equilibrium Constant	1.8	Kf
Inverse of Equilibrium Capacity	0.5	1/Qe
Logarithm of (Qe)	0.3	Log (Qe)
Equilibrium Concentration	2.9	Ce
Logarithm of equilibrium Concentration	0.46	Log Ce
Initial Concentration	6	Ci
Inverse of Slope	00.7	n
Langmuir model		
Langmuir Constant	0.9	Kl
Shape of Isotherm 0<R<1	0.4	Rl
Maximum Absorbent capacity (mg/g)	3.8	Qm
Inverse of Maximum Capacity	0.26	1/Qm
Logarithm of Maximum Capacity	0.57	Log Qm
Thermodynamic specification		
Gips Free energy(KJ/mole)/ The best is the more negative	-39	GΔ
Enthalpy(KJ/mole)/ Endothermic processes	78	HΔ
Entropy(KJ/mole)/ Reaction by itself	113	SΔ

Table 7: Mathematical Model of (Freundlich), Langmuir, and Thermodynamic Specification of (Mixture of Onion Juice Powder) for Adsorption the Free Radicals for Copper Ions at (313 Kelvin)

Freundlich model		
Variable	Value	Symbol
Removal Efficiency	68%	RE
Equilibrium Adsorption Capacity	1.8	Qe
Equilibrium Constant	1.9	Kf
Inverse of Equilibrium Capacity	0.5	1/Qe
Logarithm of (Qe)	.02	Log (Qe)
Equilibrium Concentration	2.1	Ce
Logarithm of equilibrium Concentration	0.32	Log Ce
Initial Concentration	5.7	Ci
Inverse of Slope	03.9	n
Langmuir model		
Langmuir Constant	0.54	Kl
Shape of Isotherm 0<R<1	0.32	Rl
Maximum Absorbent capacity (mg/g)	2.9	Qm
Inverse of Maximum Capacity	0.34	1/Qm
Logarithm of Maximum Capacity	0.46	Log Qm
Thermodynamic specification		
Gips Free energy(KJ/mole)/ The best is the more negative	-18	GΔ
Enthalpy(KJ/mole)/ Endothermic processes	38	HΔ
Entropy(KJ/mole)/ Reaction by itself	50	SΔ

Table 8: Comparison between Absorbent Materials Specifications at a Temperature (313 Kelvin), Liquid Volume at Final Test Equal to (1 Liter), Weight of the Adsorbent Material Is (250g)

Material	Efficiency	1/Qe	Log Qe	Log Ce	Gips	Enth.	Entr.	KL	RI
1	75	0.62	0.2	0.39	-12	41	39	0.45	0.31
2	68	0.55	0.25	0.33	-15	33	49	0.51	0.29
3	40	1.4	0.15	0.6	-7	9	13	0.28	0.47
4	45	1.71	0.3	0.14	-13	25	38	0.48	0.31
5	60	0.51	0.25	0.25	-36	78	111	0.8	0.3
6	77	0.5	0.3	0.46	-39	78	113	0.9	0.4
7	68	0.5	0.2	0.32	-18	38	50	0.54	0.32

Table 9: Comparison between Absorbent Materials Efficiency, Gips Free Energy, and Thermal Coefficient at a Temperature (313 Kelvin), Liquidvolume at Final Test Equal to (1 Liter), Weight of the Adsorbent Material Is (250g)

Gips free energy (KJ/mole-E)	Thermal coefficient (RL)< 10 < R	Efficiency (ζ %)	Material
-12	0.3	75	Pulp date powder (1)
-15	0.29	68	Garlic powder (2)
-7	0.47	40	Alfalfa leaf powder (3)
-13	0.31	45	Seder tree powder (4)
-36	0.3	60	Calptoze tree powder (5)
-39	0.4	77	Green Algae powder (6)
-18	0.37	68	Mixture of onion powder (7)

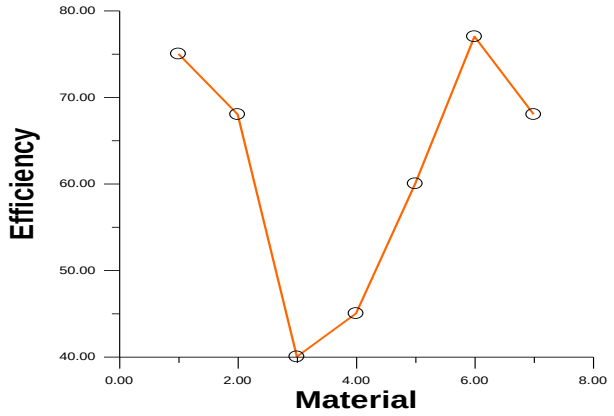


Fig. 4: Comparison between Adsorbent Materials Efficiencies.

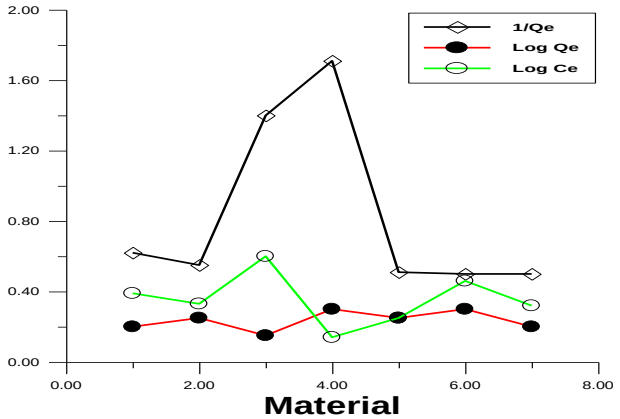


Fig. 5: Comparison between (1/Qe, Log Qe, Log Ce) Adsorbent Materials of.

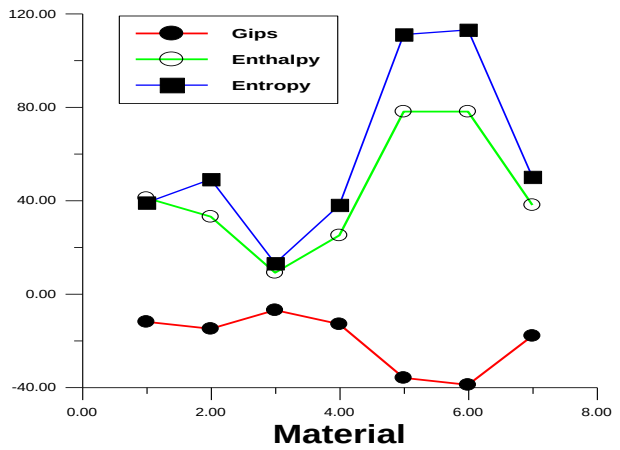


Fig. 6: Comparison between Gips Free Energy, Enthalpy, and Entropy.

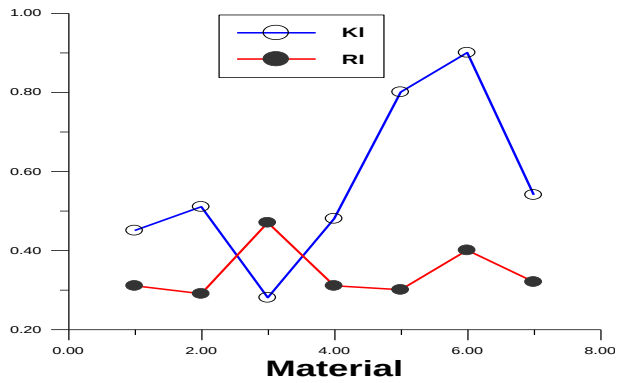


Fig. 7: Comparison between Kl, RI of Adsorbent Materials.

3.4. Results of bacterial and viruses tests

Random samples were taken from multiple treatment samples at a rate equal to (0.5 liter) for each sample of the test samples to the biological lab of University. The researcher aimed from this work to check the water content, and the extent of it is free from viruses and bacteria. The results provided from the treatment water proved the water free from any contaminants or bacterial Viruses after different treatment processes. The reason for this is due to the extreme case of heating and the impact of hot steam through the various stages of treatment. Devices used as shown in Fig. 8.



Fig. 8: Devices Used In Biological Testes.

4. Conclusion

All testes did, proved that there is an exact match between the empirical processes and results of mathematical modelling calculations, this know through the mathematical analysis of the trial data under different temperatures. Matching results with the models of (Langmuir &Freundlich) proved that the green algae powder is the best filtered material, because its high adsorption efficiency which equal to (77%) with Gips free energy equal to (-39 kJ/mol).Pulp date powder has proven to be excellent efficiency (75%) with enthalpy equals to(-12 kJ/mol). All Adsorbent materials have coefficient of thermal located between (zero<R<1), so this value represents the perfect choice to be test at this system. All food remnants choices have been tested in our ion adsorbed design system.

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