

“ADSORPTION STUDIES OF Co(II) AND U(II) ON CITRUS FRUITS PEELS”

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ABSTRACT:

Adsorption of a solute from solution on to a solid adsorbent in a solution is treat differently than corresponding adsorption of gases on solids. The surface of solid has a tendency to attract and hold the molecules of gas or liquid with which is comes in contact. This phenomenon of surface is known as adsorption¹.

This phenomenon can be used in different applicatios like chromatography, controlling Humidity, in lubrication, different industrial application and others ⁷. So by the interest in adsorption phenomenon using Freudlich Equation , Langmuir Equation, BET Theory³ and other experimental process the adsorption of Co(II) and U(II) on the citrus peels are get known at different temperature as 30⁰C and 40⁰C with different concentration as 0.002M ,0.004M, 0.006M , 0.008M and 0.01M.

In a result, rate of adsorption increase with decrease in temperature and increase in pressure. So study need to be done.

KEYWORDS :

BET Theory, Spectrophotometer, Freudlich Equation, Langmuir Equation.

INTRODUCTION

The atoms or molecules in the surface to solid behave like the surface molecules to liquid. The surface molecule of solid and liquid are in a state of strain due to their unsatisfied residual valences. Therefore when solid surface is brought in contact with gas or liquid, the molecules from gas and solution accumulate at the surface. Thus, the surface of solid has a tendency to attract and hold the molecules of gas or liquid with which is comes in contact. This phenomenon of surface is known as adsorption¹. In the bulk of material (solid or liquid), the molecular forces are balanced i.e. a molecule at the centre or bulk of the material are attracted

equally from all directions. But the state of particles at the surface of a liquid or solid is different from that in the bulk i.e. centres of unbalanced forces are there at the surface or interface and molecular surface forces are in a state of ambivalence or insaturation. As a result of this insaturation, the solid and liquid surfaces tend to satisfy their residual forces by attracting and retaining particles (atoms, ions or molecules) of other substances, with which they come in contact.

This citrus peel contains citric acid, ascorbic acid, Limonene, α -Pinene, Sabinene, β -Pinene, Myrcene, Octanal, Linalool, δ -3-Carene, Decanal⁷. This helps in digestion, relieves constipation, prevents scurvy, has effective in healing oral and peptic ulcers, helps to keep respiratory problems at bay, improves the immune system, has anti-cancer properties, protection against rheumatoid arthritis, facilitates weight loss, has the ability to cure infections in the urinary problems, the antioxidants present help in flushing out uric acid, relief from motion sickness, treatment of sunstroke and dehydration, beneficial for pregnant women, to benefits to the nervous system, to treat jaundice, Other Benefits. Mosambi helps in increasing appetite, purifying blood and raising sperm count. It cools the body and quenches thirst⁷.

DETAILS OF Co(II) AND U(II)

Co(cobalt) is 3d transition series in 4th period element which has 27 atomic number and 331.21 atomic mass. U(uranium) is 7th period element of actinides series which has 92 atomic number and 502.13 atomic mass⁸. Both are present in solid state. For this work it used with its nitrates $\text{Co}(\text{NO}_3)_2$, $\text{UO}_2(\text{NO}_3)_2$ as Co(II) and U(II) ions respectively⁶.

This get used in batteries of cell phones, computers, hybrid vehicles, portable tools,
Super Alloys - Turbine blades, mainly jet engines, Chemicals - Includes pigments and dyes,
Wear Resistant Alloys - Hard facing and cobalt carbide, Catalysts - Includes Gas-to-Liquid conversions, Magnets - High performance applications. Depleted uranium is used to create high-density penetrators such as those projectiles⁴. shielding in containers that store radioactive materials. also used as the fissile explosive, as a yellow coloring for pottery and glassware, in photographic chemicals, lamp filaments, to improve the whiteness of dentures and in the leather, as stains to increase the contracts between virus and other cells, as a target for high-powered x-ray machines⁷.

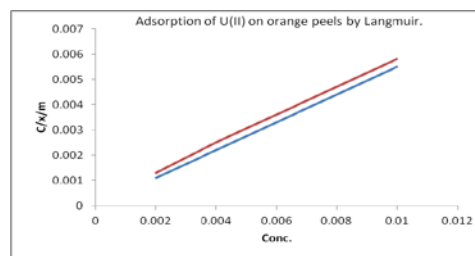
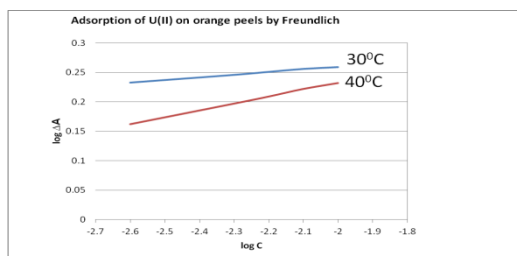
METHODS AND MATERIALS

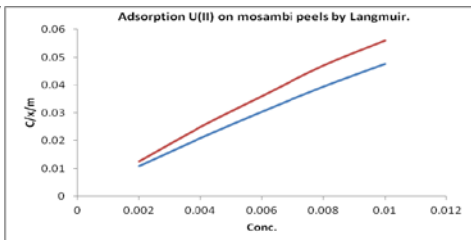
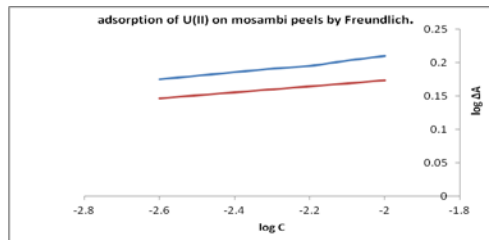
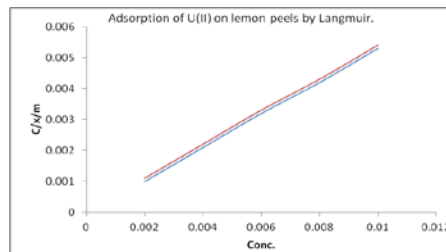
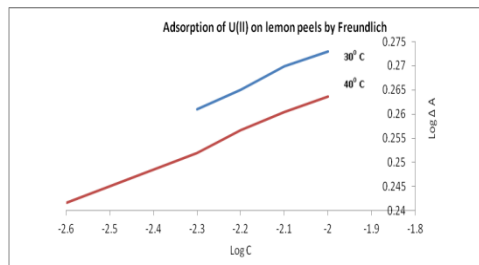
Orange, Lemon and Mosambi were collected, exposed to sunlight for seven days. Subsequently they were ground, exposed to sunlight for 24 hours and were preserved in airtight bottles with corks. The solutions of different concentrations of Co(II) and U(II) were prepared in different conical flask. The absorbance of each metal ion at λ_{max} is recorded. 1 g of each of the adsorbent was weighed and placed in each conical flask. The flasks were corked and shaking for one hour then solutions were filtered, pH of filtrates was measured and filtrates were preserved in airtight glass bottles. The changes in absorbance of metal ions before and after adsorption at two different temperatures 30°C and 40°C were measured by spectrophotometer⁵. The data obtained for % adsorption along with concentration of metal ions are listed & detained the various parameters and used to make the conclusions.

RESULT AND DISCUSSION

ADSORPTION OF U(II) ON CITRUS PEELS

| Sr no. | Conc. | Orange | | | | Lemon | | | | Mosambi | | | |
|--------|-------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|------------|----------------------|------------|
| | | 30°C | | 40°C | | 30°C | | 40°C | | 30°C | | 40°C | |
| | | A | ΔA | A | ΔA | A | ΔA | A | ΔA | A | ΔA | A | ΔA |
| 1 | 0.002 | 1.781 | 1.741 | 1.473 | 1.454 | 1.901 | 1.845 | 1.771 | 1.745 | 1.803 | 1.529 | 1.611 | 1.443 |
| 2 | 0.004 | 1.811 | 1.766 | 1.586 | 1.563 | 1.916 | 1.853 | 1.813 | 1.782 | 1.848 | 1.552 | 1.637 | 1.447 |
| 3 | 0.006 | 1.838 | 1.786 | 1.655 | 1.629 | 1.932 | 1.861 | 1.844 | 1.806 | 1.891 | 1.574 | 1.683 | 1.472 |
| 4 | 0.008 | 1.863 | 1.806 | 1.699 | 1.671 | 1.941 | 1.867 | 1.865 | 1.822 | 1.834 | 1.596 | 1.709 | 1.477 |
| 5 | 0.01 | 1.879 | 1.817 | 1.743 | 1.709 | 1.951 | 1.875 | 1.886 | 1.835 | 1.982 | 1.622 | 1.765 | 1.572 |





| |
|----------------|
| Temp 30C(Blue) |
| Temp 40C(Red) |

Constant for U(II) Adsorption system

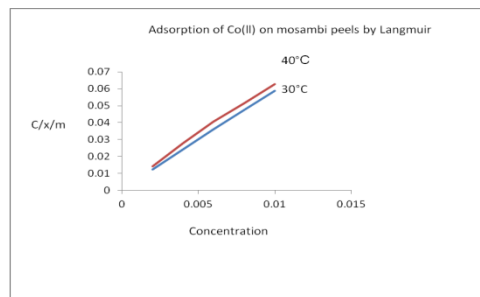
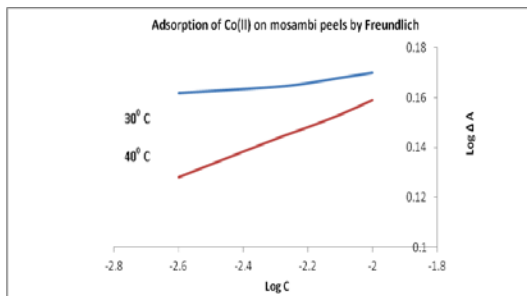
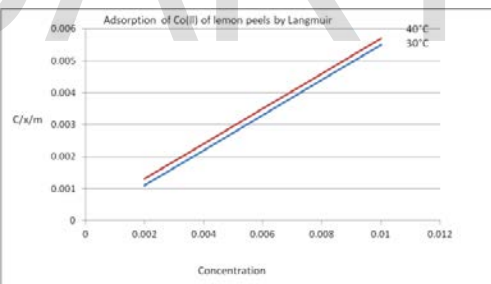
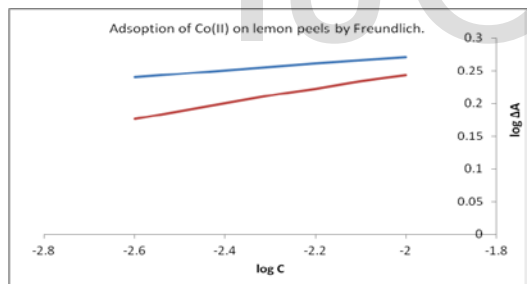
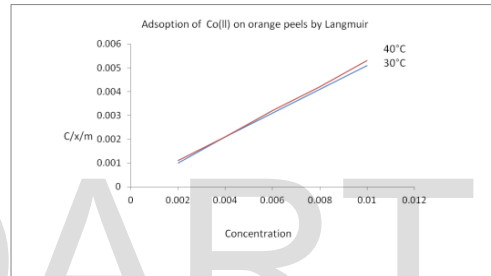
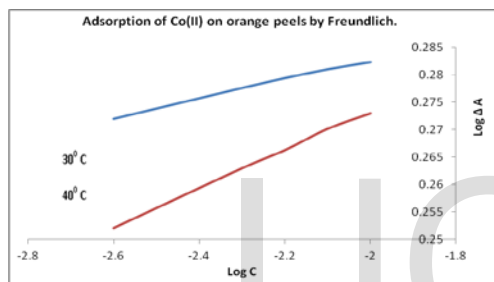
| Element | Peels | Temp. | By Freundlich | | By Langmuir | |
|---------|--------|-------------------|---------------|--------|-------------|--------|
| | | | 1/n | K | A | B |
| U (II) | Orange | 30 ⁰ C | 0.043 | 1.6943 | 0.550 | 0.00 |
| | | 40 ⁰ C | 0.116 | 1.4157 | 0.550 | 1.0004 |
| | Lemon | 30 ⁰ C | 0.0173 | 1.8155 | 0.275 | 0.00 |
| | | 40 ⁰ C | 0.0365 | 1.7258 | 0.550 | 1.000 |
| | Mosmbi | 30 ⁰ C | 0.016 | 1.4791 | 4.750 | 0.00 |
| | | 40 ⁰ C | 0.0445 | 1.3861 | 5.750 | 1.0002 |

Values of Parameter for U(II) Adsorption system

| Element | Peels | ΔH | ΔG | ΔS |
|---------|---------|---------------------------|-----------|----------|
| U (II) | Orange | 4.4747×10 ⁻⁶ J | 6.0268 J | - 0.0198 |
| | Lemon | 5.2071×10 ⁻⁶ J | 4.2068 J | - 0.0138 |
| | Mosambi | 9.5407×10 ⁻⁷ J | 50.7672 J | - 0.1675 |

ADSORPTION OF Co(II) ON CITRUS PEELS

| Sr no. | Conc. | Orange | | | | Lemon | | | | Mosambi | | | |
|--------|-------|-------------------|-------|-------------------|-------|-------------------|-------|-------------------|-------|-------------------|-------|-------------------|-------|
| | | 30 ⁰ C | | 40 ⁰ C | | 30 ⁰ C | | 40 ⁰ C | | 30 ⁰ C | | 40 ⁰ C | |
| | | A | ΔA | A | ΔA | A | ΔA | A | ΔA | A | ΔA | A | ΔA |
| 1 | 0.002 | 1.912 | 1.886 | 1.796 | 1.787 | 1.824 | 1.776 | 1.587 | 1.501 | 1.567 | 1.452 | 1.448 | 1.382 |
| 2 | 0.004 | 1.926 | 1.895 | 1.836 | 1.824 | 1.867 | 1.802 | 1.624 | 1.607 | 1.584 | 1.460 | 1.467 | 1.391 |
| 3 | 0.006 | 1.937 | 1.903 | 1.861 | 1.846 | 1.894 | 1.824 | 1.671 | 1.668 | 1.599 | 1.465 | 1.492 | 1.406 |
| 4 | 0.008 | 1.947 | 1.910 | 1.880 | 1.863 | 1.912 | 1.844 | 1.722 | 1.712 | 1.615 | 1.472 | 1.526 | 1.430 |
| 5 | 0.01 | 1.955 | 1.916 | 1.898 | 1.875 | 1.941 | 1.863 | 1.789 | 1.748 | 1.632 | 1.479 | 1.547 | 1.442 |



Values of Constant for Co(II) Adsorption system

| Element | Peels | Temp. | By Freundlich | | By Langmuir | |
|---------|--------|-------------------|---------------|--------|-------------|--------|
| | | | 1/n | K | A | B |
| Co (II) | Orange | 30 ⁰ C | 0.0156 | 1.8620 | 0.50 | 0.00 |
| | | 40 ⁰ C | 0.0352 | 1.7701 | 0.550 | 1.0002 |
| | Lemon | 30 ⁰ C | 0.0483 | 1.7179 | 0.550 | 1.0002 |
| | | 40 ⁰ C | 0.102 | 1.4859 | 0.550 | 1.0004 |
| | Mosmbi | 30 ⁰ C | 0.0205 | 1.4288 | 5.90 | 1.0004 |
| | | 40 ⁰ C | 0.039 | 1.3273 | 5.60 | 1.0092 |

Table No. 4.7

Values of Parameter for Co (II) Adsorption system

| Element | Peels | ΔH | ΔG | ΔS |
|---------|---------|---------------------------|-----------|-----------|
| Co (II) | Orange | 5.2219×10 ⁻⁶ J | 5.2695 J | - 0.0173 |
| | Lemon | 4.5704×10 ⁻⁶ J | 5.9837 J | - 0.0197 |
| | Mosambi | 4.5921×10 ⁻⁶ J | 55.3340 J | - 0.01826 |

Table No. 4.8

CONCLUSION:

It would be seen from tables that adsorption increased with increasing the concentrations of metal ions. The values satisfied as Freundlich isotherm. The Freundlich constant and parameters are obtained from the graphs between concentration and x/m. Because that is the formation of curve at higher adsorption. Hence the eq. $x/m = kC^{1/n}$

It is modified by Langmuir equation $\log x/m = \log k + 1/n \log C$

It is also confirmed Langmuir adsorption isotherm from the plot between log c and log x/m.

From the graph the values of slope(1/n) and intercept(k) which are shown in table No. 4.3,4.7 in the present investigation. The present investigation parameters such as, ΔH, ΔG, ΔS also determined. It is seen from table No. 4.4, 4.8. The values of ΔS are negative

i.e. less than zero and ΔG are found to be positive it showed that, the process is non-spontaneous. The order of above thermodynamic parameters is found as follow

| U (II) : | | | Co (II) : | | | | | |
|------------|--------|------------|-----------|------------|---------|------------|---|------------|
| Lemon | Orange | Mosambi | Orange | Lemon | Mosambi | | | |
| ΔH | > | H | > | ΔH | > | H | > | ΔH |
| ΔG | < | ΔG | < | ΔG | < | ΔG | < | ΔG |
| ΔS | > | ΔS | > | ΔS | > | ΔS | > | ΔS |

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