Studies On The Adsorption Of Methylene Blue Dye From The Production Of Activated Carbon Using Spathiphyllum Wallisii Leaves, Dolichus Lablab Peal, And Cycas Circinalis Leaves.

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Abstract: The term *pollutant*, in a broad sense, refers to a substance/material that changes the natural quality of the environment by physical, chemical, or biological means. Thus, we may have pollution in air, water, and soil. As this review article deals with their removal of pollutants from wastewater, only pollutants generally present in effluents are described here. The three main activities that mankind indulges in are domestic, agricultural, and industrial. in all of these activities, a large amount of fresh water is used, which is discharged as wastewater containing different pollutants . Type of activity these may be various inorganic and organic chemicals and biological agents as well as heat and radiations. Methylene blue is the most soluble dye in water in general used for printing cotton and tannin, dyeing leather, antiseptic and medical purposes. Cationic dyes like methylene blue (MB) are more toxic than anionic dyes. Dyes are complex and sensitive chemicals. A dye is a colored substance that has an affinity to the substrate to which it is being applied.

Key words: Activated carbon, waste water, Adsorption, Methylene blue dye, Low cost adsorbent, EDX, FT – IR.

Review of literature:

The dye is generally applied in an aqueous solution and may require a mordant to improve the fastness of the dye on the fiber. The dyes are obtained from animals, vegetables, mineral origin, plants, roots, berries, bark, leaves and wood. Both dyes and pigments appear to be colored because they absorb some wavelengths of light more than others. In contrast with a dye, a pigment generally is insoluble, and has no affinity for the substrate. But dyes are soluble, some dyes can be precipitated with an inert salt to produce a lake pigment, and based on the salt used they could be aluminum lake, calcium lake or barium lake pigments. Colored wastes may contain chemicals which exhibit toxic effects towards microbial populations and can be toxic and/or carcinogenic to mammals. In general, dyes are poorly biodegradable. (azam taufik mohd din et al., 2008). Methylene blue is a dark green (or black-green) solid, slightly soluble in water, where it gives a deep blue solution. It is more soluble in glacial acetic acid, chloroform, ethanol. Methylene blue, also known as methyl thioninium chloride, is a medication and dye. Trade names are Urelene blue, Provayblue and Proveblue. It is a cationic dye, redox indicator, and photosensitizer. (Ali et.al., 2018) Conventional biological treatment processes are not very effective in dye removal. Basic malachite green (MG) dye has been widely used for the dyeing of leather, wool, jute and silk, as in distilleries, as a fungicide and antiseptic in aquaculture industry to control fish parasites and disease. Malachite green has properties that make it difficult to remove from aqueous solutions and also toxic to major microorganisms. Though, the use of this dye has been banned in several countries and not approved by US Food and Drug Administration, it is still being used in many parts of the world due to its low cost, easy availability and efficacy and to lack of a proper alternative. The adsorption process is effective, cheap and flexible which makes it feasible in many wastewater treatment applications (Azam Taufik Mohd Din et al., 2008). The dyeing process involves a lot of water, so that waste water from textile dyeing is a huge pollutant around the world. Some dyes do not ever degrade in water. Others turn into harmful substances as they decompose. The ingestion of dye-contaminated water can cause serious problems due to their toxicity, highlighting the mutagenicity of its components, which strongly damage the health of living organisms (Truong. T. T. C et .al., 2018). To overcome these problems, exploring novel porous adsorbents for efficient adsorption and the removal of dyes is still of great significance and a technical challenge (Cheng Li. et. al.,2018). Effluents from dyeing and other related industrial processes are known to contain highly colored species. Over 10,000 dyes with a total yearly production over 7 × 105 MT are commercially available. It is estimated that approximately 15% of the dye stuffs are lost in industrial effluents during manufacturing and processing operations (Pathania. D. et. al., 2017). The presence of these colouring contaminants (methylene Blue) in water inhibits photosynthesis which in turn affects the green aquatic ecosystem. It has been reported worldwide that dyes are associated with skin, lungs and respiratory disorder. (Obuge et. al., 2014). In the face of rising water demands and dwindling freshwater supplies, alternative water sources are needed. Desalination of water has become a key to helping meet increasing water needs, especially in water-stressed countries where water obtained by desalination far exceeds supplies from the freshwater sources (Darre. C.N, and Toor S.G.). Dead leaves of Cycas, Hyacinth bean peel and spathiphyllum leaf were activated by using one mol L−1 KOH and used as an eco-adsorbent for the removal of methylene blue (MB) from aqueous solutions. The Cycas, Hyacinth bean peel and spathiphyllum leaf was characterized by chemical and physical measurements that confirmed the basic activation of Cycas, Hyacinth bean peel and spathiphyllum leaf biomass. The favourable conditions for MB adsorption onto the activated Cycas, Hyacinth bean peel and spathiphyllum leaf biomass were determined to be a pH range of 2–10 and <5mg, an adsorbent dosage of 0.5 mg and 5 mg, respectively, and a shaking time of 30 min, which are suitable for a wide range of wastewaters. (Elmorsi R.R., et. Al., 2019). Effluents from dyeing and other related industrial processes are known to contain highly colored species. Over 10,000 dyes with a total yearly production over 7 × 105 MT are commercially available. It is estimated that approximately 15% of the dye stuffs are lost in industrial effluents during manufacturing and processing operations (Pathania. D., et. Al., 2017). Textile industry is one of those industries that consume large amounts of water during the manufacturing process and, also, discharge great amounts of effluents with synthetic dyes to the environment causing public concern. Azo dyes are applied in textile industries, are considered to be serious health-risk factors. Several physico-chemical and biological methods for dye removal from wastewater have been investigated in the last decades. But, these treatment techniques need posterior separation process which significantly affects the economic performance of the plant. On the other hand, adsorption is one of the efficient methods and needs low capital and operational costs. Thus, this study investigates the potential use of low cost activated carbon prepared from the (spathiphyllum, cycas, and hyacinth bean peel) for the removal of Methylene Blue wastes. (Dargo. H. et. Al., 2014). The (Cycas, and Hyacinth bean peel, and Spathiphyllum leaf) was collected from home and washed repeatedly until the dirty was eliminated. Then, it was heated at 150 □C for 72 hours and the activated biomass had been activated with KOH in order to make the carbon porous. A batch experiments were carried out in order to investigate the effect of various parameters. Uv-visibile spectrometer was used for the analysis of final concentration of the effluent. Experimental results have shown that, the amount of dye adsorption increased with decreasing the initial concentration, adsorbent dosage, contact time and temperature. Over 99% removal efficiency were achieved for the given dosage. With respect to pH, pH value of 8-10 was found to be the optimal value (Dargo. H., et. Al., 2014). The utilization of economic, reused waste and eco-friendly adsorbent has been researched as an option process for substitution of presently unreasonable methodology for expelling dyes from waste water. In the present paper fly ash has been used as an adsorbent. Batch experiments have been done to observe the best adsorption by varying various parameters varying initial dye concentration, varying flow rate and varying the bed height (Deepshikha Sareen et. Al., 2014). In this work, batch adsorption experiments were carried out for the removal of methylene blue as a basic dye from aqueous solutions (Zohre Shahryari et. Al., 2014). The effects of major variables governing the efficiency of the process such as, temperature, initial dye concentration, adsorbent dosage, and pH were investigated. Experimental results have shown that, the amount of dye adsorption increased with increasing the initial concentration of the dye. Three samples of activated biomass with different specific surface areas and pore structures were prepared via two-step carbonization and steam activation and characterized by SEM observation, EDX observation, and FTIR Observation. Simplified kinetic models including pseudo first-order and pseudo-second-order equation were selected to follow the adsorption processes. The diffusion coefficient at various temperatures is also calculated and the effect of temperature on % removal of methylene blue is also established (VR Sankar Challa). Adsorption has been used extensively in industrial process for separation and purification. The removal of colored and colorless organic pollutants from industrial wastewater is considered as an important application of adsorption processes. At present, there is a growing interest in using low-cost, commercially available materials for the adsorption of dyes (Porselvi V.M et. Al., 2014).

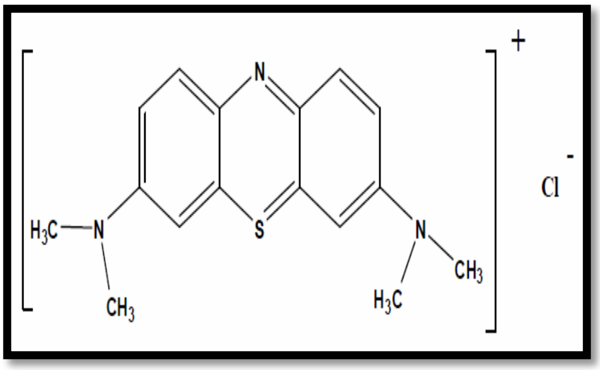

***Fig - 1:** Chemical structure of Methylene blue ($C_{16}H_{18}CLN_3S$).*

Dyes are synthetic aromatic water-soluble dispersible organic colorants with potential applications in various industries. The use of dyestuff materials has increased gradually due to the tremendous increase in industrialization and due to the general desire for color in everyday objects (Manoochehri M. et al., 2013). In present day, the most important problems affecting on people live are inorganic and organic pollutants. The increase of pollution in recent years is due to growing industry, several people die from the penalties of unsafe water. Textile industry plays an important role in the economic development in non-oil and gas sector of many developing countries. Apart from its significant role, however, textile industry also creates serious problems to environment, particularly disposal of colored dye wastewater (Noor A. Abd Al-Hussein, 2017). Dye contaminated wastewater contains colored compound from residues of dyes and various chemical additives (Mahammedi Fatiha, 2015). Activated biomass are the amorphous form of carbon characterized by high internal porosity and consequently high adsorptivity. Adsorption capacity of activated carbon mainly depends on its porosity and surface area. The textural property of activated carbon depends on the method of preparation and starting material. Activated biomass are versatile adsorbents. Their adsorptive properties are due to their high surface area, a microporous structure, and a high degree of surface reactivity. Discharge of dyes into water sources has raised global concerns over their detrimental impact on the environment. Dyes present in liquid phase increase the toxicity and chemical oxygen demand (COD) and also affect the inherent light penetration. The effect of dye toxicity may be transmitted to future generations through genetic mutations, birth defects, and inherited diseases. Ion exchange, phyto-extraction, ultra filtration, membrane separation and photocatalysis are the usual methods for removal of dyes from aqueous solutions. These treatment processes are very expensive, time consuming, the process is tedious and could not be effectively used to treat the wide range of complex dyes from wastewaters. However, adsorption process was proved to be an alternative and simple method for the removal of toxic chemicals like the dyes. Adsorption process was extensively used for removal of dye from aquatic medium using low cost adsorbents such as plant materials and cellulose materials. Among them activated carbons prepared by agricultural by-products and biomass are relatively cheap and show very high adsorption capacity, due to simplicity and ease of operational conditions adsorption is a widely used process (Mahadeva swamy M. et al., 2017).

STUDY OF ADSORPTION:

Adsorption is a surface process that leads to transfer of a molecule from a fluid bulk to solid surface. This can occur because of physical forces or by chemical bonds. Usually it is reversible (the reverse process is called desorption). In most of the cases, this process is described at the equilibrium by means of some equations that quantify the amount of substance attached on the surface given the concentration in the fluid. Adsorption has a fundamental role in ecology, it regulates the exchanges between geosphere and hydrosphere and atmosphere, accounts for the transport of substances in the ecosystems, and triggers other important processes like ionic exchange and enzymatic processes. Waste water generated from industries related to the use and synthesis of MB is always contaminated by this organic pollutant. MB is a toxic and carcinogenic material. The toxic effects that have been described in animals exposed to MB include hypothermia, haemo-concentration, acidocis, hypercapnia, hypoxia, increases in blood pressure, and Heinz body formation, changes in respiratory frequency and conjuctival damage (Hatem *et.al.,* 2014). The purpose of this work is to investigate the ability of adsorbent and MB in aqueous solution. A batch model experiments are conducted to determine the effect of pH and initial concentrations of methylene blue solutions, adsorbent dosage and its contact time in methylene blue solutions towards the efficiencies and adsorptive (%) of plant materials used for the production of activated carbon from plants used (*Cycas circinalis* leaves, *Dolichus lablab* peel, *Spathiphyllum wallisii* leaves). The response of the designed experiment was evaluated through adsorption capacity against methylene blue. An attempt has been made on (*Cycas circinalis* leaves, *Dolichus lablab* peel, *Spathiphyllum wallisii* leaves) these plants as a cheap and renewable precursor for activated carbon preparation (Danish *et. al.,* 2018).

EFFECT OF PESTICIDES ON WASTE WATER:

Whereas many other pollutants are only important in the urban setting, pesticides are preeminently a problem arising from rural activities. Depending on their function, pesticides are subclassified as insecticides, molluscides, nematicides, rodenticides, avicides, piscides, fungicides, Bactericides, slimcides, algicides, and herbicides. Among these, insecticides and fungicides are important pesticides with respect to human exposure in food because they are applied shortly before or even after harvesting. Herbicide production has increased significantly, as chemicals are being increasingly used during the cultivation of land for controlling weeds and now accounts for the majority of agricultural pesticides. Although DDT has been banned, various substitutes such as toxaphene, lindane, parathion, malathion, heptachlor, and endrin can also cause environmental pollution. The problem of pesticide pollution arises not only due to agricultural operations but also from pesticide manufacturing plants.

NECESSITY OF ADSORPTION:

1) To gain maximum efficiency in pollutants removal.
2) It is used in water treatment, waste water treatment and in many industries.
3) Applied in both physical and chemical process in pollutant removal.
4) To reduce the load of waste water treatment plants.
5) To remove the color from the water.
6) To reduce solid waste disposal due to dumping of solid waste material available locally.

OBJECTIVES:

1. Conduct literature and field survey to collect the information regarding the different plants like Cycas, Hyacinth beans and *spathiphylum wallisii*.
2. Preparation of low cost adsorbent to study the characteristic property of the activated carbon from selected plant materials (SEM, EDS and FT-IR analysis).
3. To investigate the physio-chemical analysis, effect of pH, variation of dose and agitation time on the adsorption of Methylene blue dye.
4. A preliminary Organo-leptic test of Cycas leaves, Hyacinth bean peel and *spathiphylum wallisii* leaves.

Materials and Methods

Study location: Plant materials for this study were collected from JSS mutt

Field survey for collection of plant materials: Collect the appropriate amount of samples (1kg) and take them directly to the testing laboratory. Field survey was carried out in 27th January 2020 in mysore . During field visit generally, we concentrate weeds for the biological study and adsorption of dye.

Preparation of adsorbent:

The plant materials was collected from JSS mutt mysore. The plant materials were cleaned and cut into uniform pieces. The plants materials were dried under the sun for 3 days to completely remove its moisture content. After 2 days, the plant materials were again dried in the hot air oven at 105□ c for 6 hours. Then, plant materials were treated with Potassium hydroxide (KOH) for 8 hours for activation of the biomass. Again, the KOH solution was discarded the plant materials was continued drying in the hot air oven at 150□ c for 3 hrs and then raised to 180□ c until the plants materials was dried into black hard biomass. Later the biomass was crushed with mortor and pistle and was finely grounded into amorphous powder. Then the biomass of the used plant materials was weighed according to the dosage of 5ppm, 10ppm, 15ppm, 20 ppm, 25ppm, 30ppm, 35ppm, 40ppm, 45ppm and 50ppm.

PREPARATION OF METHYLENE BLUE SOLUTION

A stock of methylene blue solution was prepared by dissolving 10mg of methylene blue powder in 1000 ml distilled water in a volumetric flask. The solutions were shaken vigorously for a few minutes to ensure complete dissolution.

Preparation of adsorbent:

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4.1 Characterization of adsorbents:

1. Fourier transform infrared spectroscopy:

a fourier transform infrared (ftir) spectral analysis of the plant materials with adsorbent was performed to reveal the possible functional groups that may participate in methylene blue adsorption. The dried adsorbents (after dye loading) ftir spectra was recorded.

4.2DETERMINATION OF PHYSIO-CHEMICAL ACTIVATED CHARCOAL ANALYSIS:

1. Moisture content analysis:

A petridish was washed and oven dried, exactly 2gm of sample *Cycas circinalis* leaves, *Dolichus lablab* bean peel, *spathiphylum wallisii* leaves (AC) was weighed separately in the petridish. Then petridish along with the sample were put in the oven for another 30 minutes and weight was noted. The drying procedure was continued until a constant weight was obtained. The difference in mass constitutes the amount of moisture content of the adsorbent is given by:

$$\text{Moisture content} = \frac{w_1 - w_2}{\text{weight of sample}} \times 100 \quad \ldots\ldots\ldots\ldots\ldots 1$$

Where w_1 –weight of petridish and sample before drying w_2 weight of petridish and sample after drying Ash content.

2. ASH CONTENT ANALYSIS:

Principle: The ash of foodstuffs is the inorganic residue remaining after the organic matter has been burnt away. It should be noted, however, that the ash obtained is not necessarily of the composition as there may be some from volatilization.

Procedures:

Empty platinum crucible was washed, dried and the weight was noted. Exactly 2g of wet sample Cycas leaf, Hyacinth bean peel, *spathiphylum wallisii* leaves (AC) of was weighed into the pores lien crucible and placed in a muffle furnace at 100□c for 3 hours.

The sample was cooled in desiccators after burning and weighed.

Calculations

$$\text{Ash content} = \frac{W_3 - W_1}{W_2 - W_1} \times \frac{100}{1} \quad \ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where:

W_1- weight of empty pores lien crucible

W_2- weight of pores lien crucible and sample before burning

W_3-weight of pores lien crucible and ash.

3. Specific surface area:

Saer's method was used for the determination of the surface area. A sample Cycas leaves, Hyacinth bean peel, spathiphyllum leaves (AC) containing 0.5g activated biomass of was acidified with 0.1M HCl to pH 3-3.5, the volume wasmade up to 50cm3 with de- ionized water after addition of 10.0g of NaCl. The titration was carried out with standard 0.1M of NaOH. Th volume V required to raise the pH from 4.0-9.0 was noted and the surface area was calculated from the expression.

$$\mathbf{S\ (m^2/g) = 32\ V - 25} \quad \ldots\ldots\ldots\ldots\ldots 3$$

4. Determination of bulk density:

The determination of Bulk density the bulk density of Cycas leaves, Hyacinth bean peel, spathiphyllum leaves (AC) was determine using Archimedes' principle by weighting a 10cm3 measuring cylinder before and after filling with the sample Cycas leaves, Hyacinth bean peel, spathiphyllum leaves (AC). The measuring cylinder was then dried and the sample was packed inside the measuring cylinder, and weighed. The weight of the sample Cycas leaves, Hyacinth bean peel, spathiphyllum leaves (AC) packed in the measuring cylinder was determined from the different in weight of the filled and empty measuring cylinder. The volume of water in container was determined by taking the difference in weight of the empty and water filled measuring cylinder. The bulk density was determined using the equation,

$$\text{Bulk density} = \frac{W_2 - W_1}{V} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

W1=weight of empty measuring cylinder W2 = weight of cylinder filled with sample V=volume of cylinder.

4.3EXPERIMENTALS CONDITIONS:

Dosage effect of Adsorbent:
Measure 5, 10, 15, 20, 25,30,35,40,45 and 50ppm of carbon biomass of plant samples Cycas leaves, Hyacinth bean peel, spathiphyllum leaves and mix it with the prepared stock solution of 100ml of methylene blue solution in 100 ml of beaker and then, stir the solution of different dosage of adsorbent and dye solution on the magnetic stirrer for 30 minutes. After, centrifuge the given solution for 10 minutes at 1200 rpm. Take UV-Spectrophotometer reading for each concentration of the solution.

Percentage of Adsorption = C_0-C_t /C_o X100

Effect of pH analysis
The effect of pH on the uptake of dyes was investigated with the initial dyes concentration of 50 mg/L and the adsorbent dosage of high percentage (from dosage effect) 0.1 M HCl and 0.1 M NaOH were used to adjust the pH values to form a series of pH from 2 to 10. The suspensions were shaken at room temperature at a speed of 1200 rpm. Measure carbon biomass of samples *Cycas circinalis* leaves , *Dolichus lablab* peel and *Spathiphyllum wallisii* leaves (AC) separately and mix it with the adjusted series of pH solution of 100ml of methylene blue solution in 100 ml of beaker and then, stir the solution of dosage of adsorbent and dye solution on the magnetic stirrer for 30 minutes. After, centrifuge the given solution for 10 minutes at 1200rpm. Take UV-Spectrophotometer reading for each concentration.

4.4ORGANO LEPTIC STUDIES OF POWDERED PLANT MATERIALS:

Organoleptic character:
Organoleptic evaluation can be done by means of sense organs, which provide the simplest as well as quickest means to establish the identity and purity to ensure the quality of a particular drug. Organoleptic characters such as shape, size, colour, odour, taste and fracture of stem bark, leaf structure like margin, apex, the base surface, venation, and inflorescence, etc. are evaluated of three different plants samples *Cycas circinalis* leaves, *Dolichus lablab* peel and *spathiphyllum wallisii* leaves.

Macroscopic study
The macroscopic study is the morphological description of the plant parts which are seen by naked eye or magnifying lens of three different plants samples *Cycas circinalis* leaves, *Dolichus lablab* peel and *spathiphyllum wallisii* leaves.

Powder analysis:
Leaves are air dried and powdered. The fine powder was used for microscopic characterization and also for macroscopic analysis. Drug powder was treated with different reagents and the colour change was noticed under day light. Dried powder took for studying the presence or absence of cellular contents (type / shape) by using a microscope. The microscopic evaluation also includes the study of constituents in the powdered drug by the use of chemical reagents. These reagents used due to the abundance of cellular contents, the presence of coloring matters, shrinkage or collapse of cell wall which creates hurdles in microscopic evaluation of three different plants samples (*Cycas circinalis* leaf, *Dolichus lablab* peel, *Spathiphyllum wallisii* leaf).

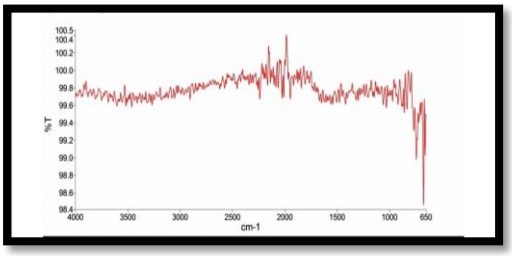
Fluorescent studies of powdered drugs
The dried powder of selected plants parts was sieved through the sieve plate No.120 and was used for fluorescent studies. A pinch of this powder was taken in a clean test tube with about 10 ml of solvent extract. Likewise, several tubes were made by adding various solvents like alcohol, acetone, water, and hydrochloric acid. All the tubes were shaken well and incubated for about 30min. The color of the drug solution thus obtained observed for their characteristic color reaction under the visible light and the ultraviolet light (UV_{365}) and were recorded by comparing with standard color charts.

RESULTS AND DISCUSSION:

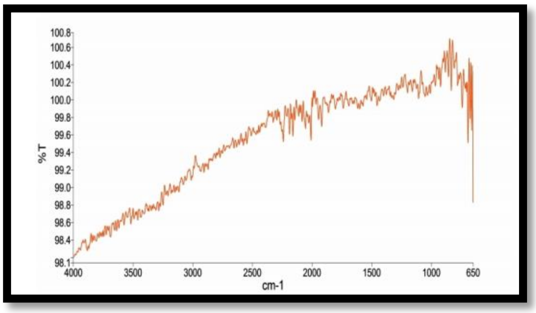
4.1.1. CHARACTERIZATION OF PLANT MATERIALS:

FTIR spectra of the sample analyzed for the sample is shown in figure and table infra-red spectra which serves as a characteristic medium for identification of compounds and its functional group, was thus found in the analyzed cycas circinalis leaf, dolichus lablab peel, spathiphyllum wallisii leaf sample. Thus the spectra lines gives rise to nine important compounds. The variation in surface morphology is evident in cycas circinalis leaf, dolichus lablab peel, spathiphyllum wallisii leaf sample (before and after dye loading) the sem images were taken at a magnification of 1500x. Eds the abscissa of the edx spectrum indicates the ionization energy and ordinate indicates the counts. Higher the counts of a particular element, higher will be its presence at that point or area of interest.

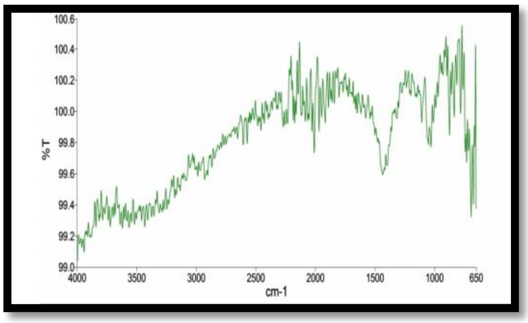
4.1.2 FTIR analysis of plant materials after dye loading:



Graph.no-1: FTIR spectrum analysis of cycas circinalis leaves.

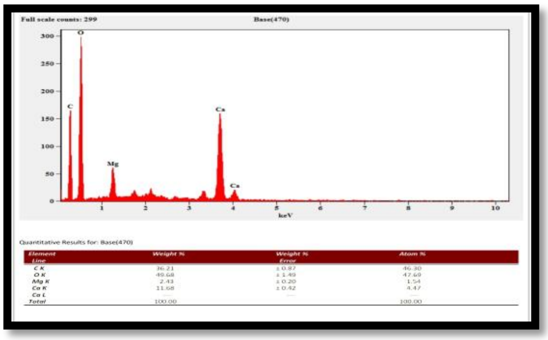


GRAPH.NO-2 FTIR spectrum analysis of dolichus lablab bean peel.

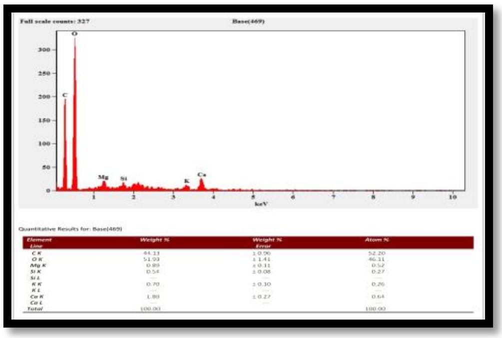


GRAPH.NO-3 FTIR spectrum analysis of spathiphyllum wallisii leaves

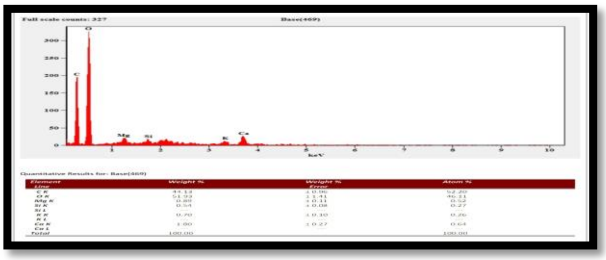
4.1.3 EDS analysis of dye powdered material



GRAPH. NO-4: EDX spectrum analysis of cycas circinalis leaves



GRAPH. NO-5: EDX spectrum analysis of Hyacinth Bean peel.



GRAPH. NO-5: EDX spectrum analysis of spathiphyllum wallisii leaves

4.2 PHYSICOCHEMICAL CHARACTERIZATION OF ACTIVATED CARBON FROM (CYCAS CIRCINALIS LEAVES, LABLAB PEEL, SPATHIPHYLLUM WALLISII LEAVES SAMPLE):

Physicochemical characterization of activated carbon from (*Cycas circinalis* leaf, *Dolichus lablab* peel, *spathiphyllum wallisii* leaf) are shown in table-1 , the value of the moisture content, is same with that of the range gotten by Obuge., *et. a.l*, (2014). The most important property of activated carbon is its adsorptive capacity, which depends largely on the specific surface area; the higher the specific surface area the higher the adsorptive capacity. The moisture content, shows a relative low value, this depicts that the (*Cycas circinalis* leaf, *Dolichus lablab* peel, *spathiphyllum wallisii* leaf) AC was properly prepared, dried and handled. It should be worth noting that when (*Cycas circinalis* leaf, *Dolichus lablab* peel, *spathiphyllum wallisii* leaf) AC is exposed to air is capable of adsorbing moisture from atmosphere. This normally could lead to high moisture content Obuge., *et. a.l,* (2014).

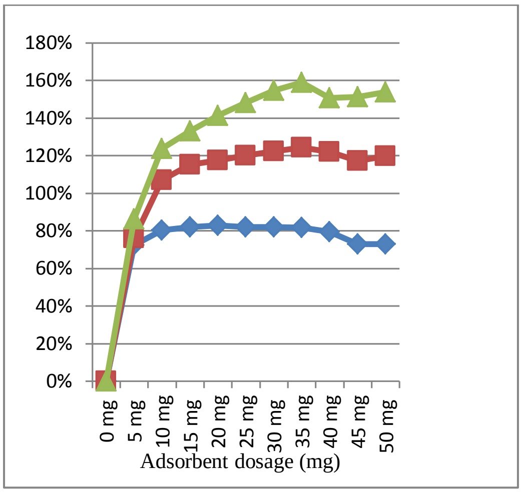
Table-1.: Physical Properties of Activated (*Cycas circinalis* leaf, *Dolichus lablab* peel, *spathiphyllum wallisii* leaf):

Properties	spathiphyllum leave	hyacinth bean peel	cycaleaves
Moisture content	13.845%	10.64%	8.775%
Ash content	46.73%	40.48%	34.97%
Specific surface area	64.6m2/g	64.6m2/g	39m2/g
Bulk density	0.9736 g/cm3	0.985g/cm3	0.9810 g/cm3

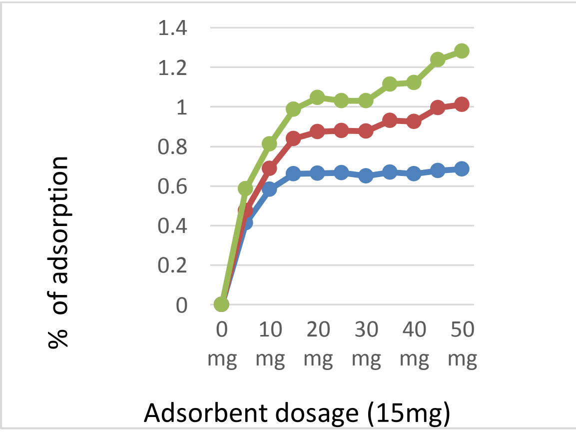
4.3 Effect of adsorbent dosage:

The effect of dose of adsorbent on the percentage removal of MB is shown in figure . The percentage removal of MB increased with increase in dose of adsorbent, this due to increase in availability of surface active sites resulting from the increase from the increased in dose of the adsorbent.. Effect of adsorbent dosage was plotted against percentage of MB adsorbed, the result shows that 25mg the highest adsorbent dosage as 85% and the lowest is g as 10 mg 34% therefore the best adsorbent dosage is 25 mg which gave the highest adsorption rate. This is due to increased carbon surface area as availability for more adsorption.

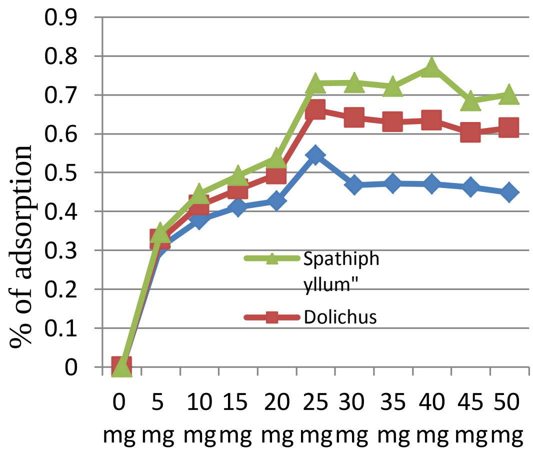
Graph-1 :Adsorption of methylene blue dye at adsorbent dosage of 10 mg :



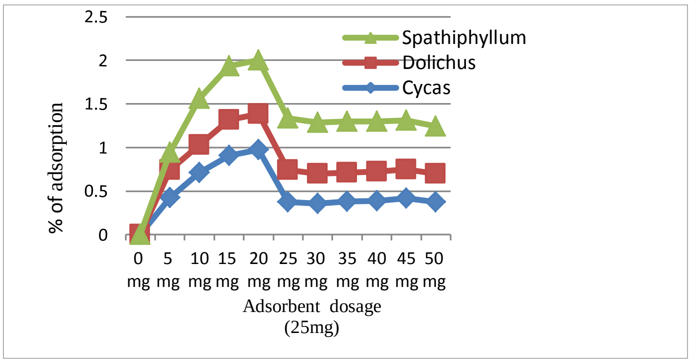
Graph-2 :Adsorption of methylene blue dye at adsorbent dosage of 15 mg :



Graph-3 :Adsorption of methylene blue dye at adsorbent dosage of 20 mg

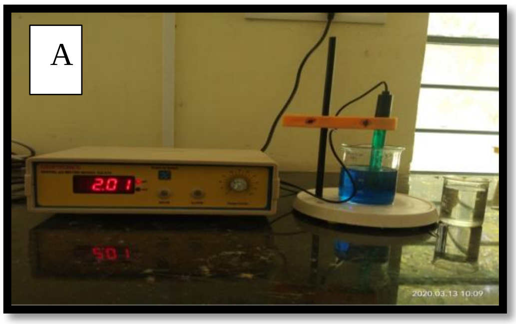


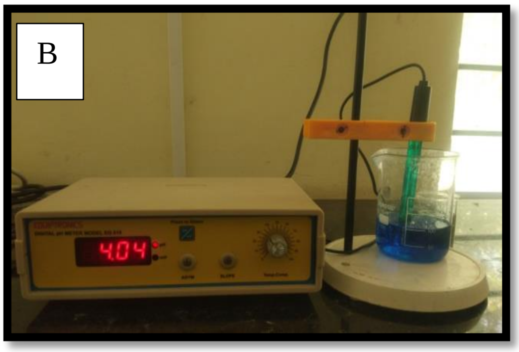
Graph-4: Adsorption of methylene blue dye at adsorbent dosage of 25 mg :



4.4 Effect of pH:
The pH of adsorption medium influencing the surface charges of the adsorbent and there by plays an important role in adsorption capacity. in addition, the degree of ionization of the material present in the solution and the dissociation of functional groups on the active sites of the adsorbent also affects the adsorption. the effect of solution pH on the amount of Methylene blue adsorbed was studied by varying the Ph under constant process parameters at equilibrium conditions. batch experiments were performed by varying pH from 2 to 10 at room temperature, the agitation time was 30 min and 10, 15, 25 µg of optimized quantity of ac was used and results are shown in fig. . it is observed that the Methylene blue adsorption was strongly dependent on pH. the maximum removal efficiency (80%) of the AC was found at the pH 8 in cycas, pH 6 in Dolichus and pH 8 in Spathiphyllum and at higher ph values, the removal efficiency decreases gradually, because Methylene blue is basic dye. **(Mahadeva swamy M. et al., 2017).**

F. Effect of adsorbent particle size
The effect of particle size on adsorption of MB was determined by changing the particle size from 150µm to 500µm with initial concentration of 40 µg /L and adsorbent dosage of 0.1g for 20minutes.





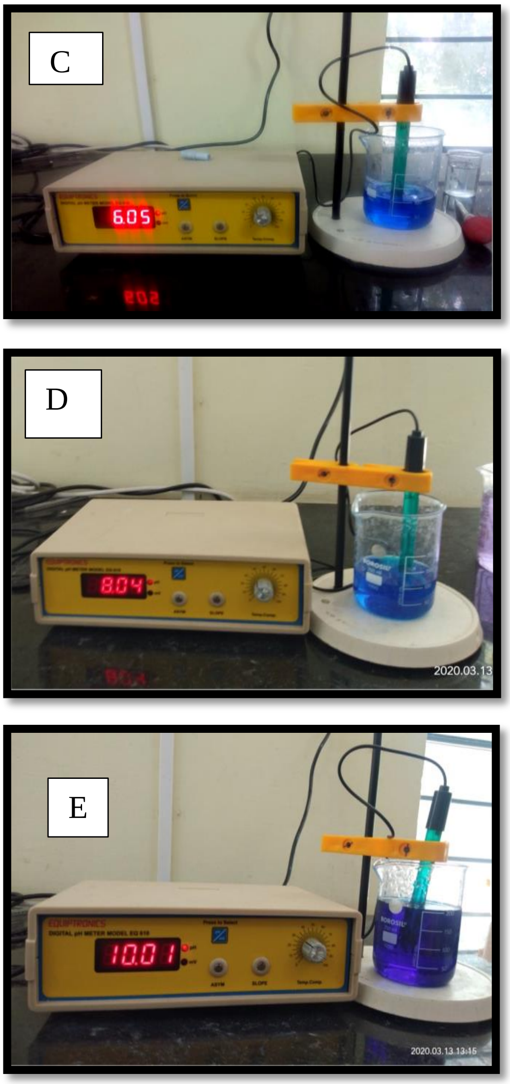


FIG -7: (A – E) SHOWS PH OF METHYLENE BLUE SOLUTION.

4.5 ORGANO LEPTIC STUDIES OF POWDERED PLANT MATERIALS:

Characters	*Cycas circinalis L.*	*Lablab purpureus L.*	*Spathiphyllum wallisi*
ROOT			
Root type	Tap root and corolloid root	Tap root with many laterals and adventitious roots	Fibrous with root rots
Root external characters	Root hairs and root caps are present	Root hairs present	Root hairs are present
Root colour	Green	Pinkish White	White
STEM			
Stem type	Woody, unbranched	Semi erect, slightly woody	They are acaulescent (appearing to have no stem).
Stem external characters	Stem is covered with alternate whorls of leaf bases of foliage leaves and scale leaves	Bushy, perennial herb, shows tendency to climb	Stem is absent
Stem color	Brown	Brown	-Nil-
LEAF			
Leaf size	Leaves are dimorphic- 1.foliage leaves – 1-3m long 2. Scale leaves - 10-15cm long	Large, alternate, trifoliate	>6 inches
Leaf shape	Leaflets are lanceolate	Leaflets are ovate	Leaves are elliptical,lanceolate, oblong, ovate
Leaf texture	Glabrous	Pubescent, hairy on the undersides	Glossy, glabrous
Leaf margin	Dentate margin, Rachis is present	Entire	Prominent mid rib is present
Leaf venation	Reticulate venation	Reticulate venation	Parallel venation
Petiole	Petiole has two rows of spines	Petiolate, long and slender	Petiolate, short petiole is present
Taste	Bitter	Bitter	Bitter
Leaf toxicity	Toxic	Non-toxic	Toxic
FLOWER			
Pedicel	-Nil-	Present	Present
Caylx	-Nil-	2 sepals connate purple to pink	Reduced or absent
Corolla	-Nil-	2-4, papillonaceous corolla	Reduced, White spadix flowers
FRUIT			
Fruit type	Berry like	Pods	Berry
Fruit size	3-5cm	4-15cm	1 – 1.3 cm
Fruit shape	Cone like	Oblong	Spherical
Fruit external	Non hairy	Hairy	Non hairy
SEEDS			
Seed colour	Green-brownish	White, Brown, Black	White

Fluorescent studies of powdered drugs:
The characteristic color behavior of dried and powdered drugs and powdered dissolved in Organic solvents like petroleum ether, chloroform, alcohol, water, acetone ethyl acetate, Conc. HCl and H_2SO_4 (5%) i.e., leaf of *Cycas circinalis, Dolichus lablab* bean peel and leaf of *Spathipyllum wallisii* was observed under the visible and ultra violet (UV 365nm) light. The color reactions of these drugs solutions thus emitted fluorescence light are tabulated in Table no:

4.6 Fluorescent studies of Cycas circinalis L. powder:

SL NO.	Treatment	Visible	UV 365 nm
1.	Powder	Dark green	Pink
2.	Ethanol	Green	Light pink
3.	Acetone	Green	Pink
4.	Conc. HCl	Dark brown	Black

Fluorescent studies of Dolichus labab L. powder:

SL NO.	Treatment	Visible	UV 365 nm
1.	Powder	Light green	Pink
2.	Ethanol	Light Green	Light pink
3.	Acetone	Green	Pink
4.	Conc. HCl	Dark brown	Black

Fluorescent studies of Spathiphyllum wallisii L. powder :

SLNO.	Treatment	Visible	UV 365 nm
1.	powder	Dark green	Pink
2.	Ethanol	Dark green	Pink
3.	Acetone	Green	Light Pink
4.	Conc. HCl	Darkbrown	Black

SUMMARY & CONCLUSION:

The low cost activated carbon from the plant materials used is found to have applicable capacity to adsorbed Methylene blue. The Methylene blue removal was found to occur through the process of adsorption which is basically a surface phenomenon. The activated carbon required a contact time of about 120-150 minutes for the optimum adsorption of Methylene blue. The adsorption rocess was found to depend on the particle size, the carbon dosage, the pH of the solution and temperature of the absorbate.

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