Botany-06
Investigation of Antimicrobial Property of Ervatamia Coronaria Flowers

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Since time immemorial plant extracts have been used for healing purposes which emphasizes upon the preventive and curative measures of medicine. This project investigates the antimicrobial properties of flowers of Ervatamia coronaria. Methanol and aqueous extract of the flowers of Ervatamia coronaria were made and tested for antimicrobial activity against Staphylococcus aureus and Escherichia coli. Agar well diffusion was employed as the test method.

Experiments:
1. Aqueous extract and methanol extract of Ervatamia coroaria flowers were made
2. Study of the susceptibility of Staphylococcus aureus to Aqueous & Methanol extract of Ervatamia coronaria flowers.
3. Study of the susceptibility of Escherichia coli to Aqueous & Methanol extract of Ervatamia coronaria flowers.
4. Comparison study with the effect of Chloremphenicol, on Staphylococcus aureus and Escherichia coli.

Observation:: The well in which the methanol extract was added showed an inhibitory zone of diameter (15 mm) against Staphylococcus aureus and Escherichia coli, while aqueous extract showed no zone against each of the bacteria. Sample A also did not show any hollow zone. Chloremphenicol, an antibiotic to Staphylococcus aureus and Escherichia coli were kept as a positive control also did not show hollow zone.

Results:

1. Methanol extract of Ervatamia coronaria inhibited Staphylococcus aureus as well as Escherichia coli.
2. Aqueous extract and Sample A did not inhibit Staphylococcus aureus and Escherichia coli.

Conclusion: Methanol extract of Ervatamia coronaria has a significant antimicrobial activity against pathogenic strains of Staphylococcus aureus and Escherichia

Botany-07

Investigations on Growth Stimulating Activity of Datura Stramonium and Embelia Ribes in Crop Plants

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The project puts forth an innovative way to increase the growth and yield of crops. Numerous synthetic and organic chemicals and fertilizers are being used for this purpose, however their indiscriminate use pose threat to our environment. Hence, in search for a safe and eco-friendly alternative, it was decided to test the efficacy of plant extracts in terms of their growth promoting activity.

The preliminary experiments hinted about the growth stimulating action of the extracts prepared from Dhatura seeds (Datura stramonium), a weed, and Wawding seeds (Embelia ribes) - a medicinal plants. These plant materials are easily available and economically feasible. Initial study was performed to test the efficacy of these extracts on 14 different crops belonging to various groups viz., oilseeds, cereals, pulses and vegetables. The extract was prepared by soaking the plant seeds in 10 volumes of water (w/v) at room temperature for 48 hours. The filtrate was used for the study.
Seeds of crop plants were sown in propagators. Extract was added on day 1 only, with different concentrations. Subsequently the seedlings were watered.

The effect of extracts was studied in terms of seed germination, root length, shoot length, root-shoot ratio, and vigor index. It was found that extracts had a positive effect on germination and growth of crops, particularly at lower concentrations. In addition to this it was observed that the use of extract decreased the need of subsequent irrigation with water.

Chem-02
Approach for Carbonaceous Nano Material Synthesis from Soil Sources and its Application.

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The project aims at extraction of carbonaceous nano material through simple technique from terrestrial sources, their physiochemical characterization and exploring their potential as an enzyme immobilization matrix. Current research reveals, microbial quality up gradation of soil is dependent on carbon nano material formation and clustering. Soil humus and also Shilajit, a natural substance, exuding naturally from mountain rock pores, were considered for clustered resource for carbon nano-materials. These biogenic nano-carbons can perhaps be utilized as safer and useful nano systems.

Simple solution and extraction procedures were adopted for low temperature carbon nanomaterial extraction from shilajit and humus . The natural anostructures were therefore retained which can provide less toxic interactions in ecosystems. The product was evaluated for its shape and size through Photon Correlation Spectroscopy AFM, SEM and TEM imaging and chemical characterizations were done in Energy Dispersive x-ray Spectroscopy and powder XRD analysis. Shilajit derived nano carbon was further used as an immobilization matrix for different enzymes, Urease and Bromelain. The enzymes were successfully immobilized with almost no depreciation of activity even after prolonged exposure to ambient temperature conditions, indicating possible applications of new soil derived carbon nanomaterial in biochemical researches, biosensors and different other fields. Additionally there lies a significant possibility that such nanomaterials will be less toxic and ecofriendly and cost-effective.

This project proves that carbonaceous nano-material can be extracted at low cost from our eco system only and these nano materials are possibly devoid of any eco-toxicity, thus, can be put to diverse application.

Maths-02
An Improved Tool for 'N'- Secting an Angle

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A simpler and much improved mechanism to divide an angle into any number of equal parts has been developed by me, rectifying the flaws of my previous year's "Compass to n-sect an Angle". This instrument consists of a disc and an adjustable rod is attached perpendicularly to the centre of the disc. The other end of the rod is fixed to a needle (supported by stands) with the help of a ball-and-socket joint and the mechanism is made such that the rod can move in all directions pivoted at a point. The disc is inclined to the vertical at a certain angle. When it is rotated on its axis, the centre of the disc also traverses a circular path, with the point of attachment of the rod as the centre.

The needle and a certain point on the disc touch the plane of the paper. Let the distance between these two points be'd'. Assuming that the disc purely rolls, the angle rotated by the disc and that by the rod are respectively in the ratio of the radius of the disc and the distance'd'. Thus an angle can be divided in any ratio.

Physics-06
A Study on the Reflection of Electromagnetic Waves from Two Reflection Type Diffraction Gratings

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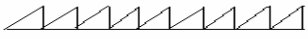
A STUDY ON THE REFLECTION OF ELECTROMAGNETIC WAVES FROM TWO REFLECTION TYPE DIFFRACTION GRATINGS

Diffraction gratings are useful in infrared spectroscopy and can also be useful in the microwave bands, for astrophysical research. Gratings of special designs would be necessary for the purpose.

This project is a theoretical study of the properties of two special designs of reflection gratings , regarding their screen intensity distribution pattern (IDP). The anticipation is that the gratings would be useful as dispersing element in the far infrared and microwave bands.



Grating 2

For grating 1:

$$I = I_o \left(\frac{\sin^2 \frac{ka\sin\theta}{2}}{\sin^2 \theta}\right)\left(\frac{\sin^2 kNa\sin\theta}{\sin^2 ka\sin\theta}\right)\left(\cos^2 \frac{k[\{(1+\cos\theta)d + a\sin\theta\}]}{2}\right)$$

I is the intensity, I_o is a constant, *k* is the wave propagation constant, θ is the diffracted angle, N is the number of grating elements.

The derived intensity expressions tell us that IDP depends not on the absolute values of a, d and wavelength of the incident radiation λ but on their ratios. We use two ratios

λ /a = λ' and λ/d = λ''

with a =d and N = 5,10,15,20; I vs. λ' vs. θ , plots were obtained.

a = d = 1 was used.

$-10^\circ \leq \theta \leq 10^\circ$, considering the mathematical approximations made in the derivations.

Intense side bands were obtained for λ' = 0.01 to 0.1 (N = 10,15) and λ' = 0.01 to 0.07 (N = 5).

For grating 2 :

$$I = I_o\left(\frac{\sin^2 \frac{ka\sin\theta}{2}}{\sin^2 \theta}\right)\left(\frac{\sin^2 \frac{kd(1+\cos\theta)}{2}}{(1+\cos\theta)^2}\right)\left(\frac{\sin^2 \frac{kNa\sin\theta}{2}}{\sin^2 \frac{ka\sin\theta}{2}}\right)$$

This design did not secure good results.

A method has been designed that allows simultaneous variation of a,d, λ,N and corresponding variation of the nature of the IDP can be observed.

Ratios d/a = m_1 and λ/a = m_2 are introduced.

a = 1 is used.

A special transformation function converts each ordered pair ($m_1(1), m_1(2)$) into one single unique numerical entity (V) , (restrictions imposed).

V = $m_2 + 4m_1 - 1$

An index E represents the nature of the IDP concerning the side bands for $-10^\circ \leq \theta \leq 10^\circ$ in a qualitative sense with a number.

A FORTRAN program creates a data file of the corresponding E, V, m_1, m_2 , N.

E vs. V vs. N plots and V vs. m_1 vs m_2 plots will give us the (d/a , λ/a , N) sets for grating 1

which give good results.

Resolvability, dispersion, free spectral range, missing orders are topics of further study. The program for grating 1 has to executed. Practical experimentation also has to be done with for grating 1.

Engg-13 (Team)
Climbing Chair

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Structure:
A normal chair is taken and the seating is cut into 2 equal parts in the anterior end (referred to as S1 and S2) and joined at the posterior end. Behind the backrest, 2 cylindrical rods(R1 and R2) are placed held to the backrest by loops. The bottom part of these 2 rods have a rectangular base. Similarly 2 more cylindrical rods(R3 and R4) are placed below the 2 parts of the seating. They are fixed to the divided part of the seating with the help of loops and are free to move away from the undivided part. The ends of these 2 rods protruding at the posterior end have rectangular bases too. They are aligned in such a way that the bases of R1 and R2 rest on the bases of R3 and R4 respectively. The divided part of the seating is free to move up and down with the help of hinges which is fixed between the divided and the undivided part of the seating.

Functioning:
The chair is kept in the slanting position. When R1 is pushed down, R3 goes up. Since R3 is fixed only to the divided part of the seating that part of the seating goes up. When the chair is slightly pushed forward, the front leg of the lifted side of the chair rests on the upper step. This action is repeated for R2 also. As this action is repeated the next time, the back legs of the chair also spontaneously get lifted and rest on the upper step resulting in climbing action.

We have understood its mechanism through construction of a dummy model of the chair. We came across many practical problems which are now being rectified

Engg-14 (Team)
Design of a Low Cost Single-Shot Hypodermic Syringe

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Our project is aimed at preventing re-use of disposable syringes (especially in poor countries). We propose a cheaper model of the hypodermic syringes which stops acting after the first use.

The front of the piston of the syringe is provided with a projection of appropriate length, covered by a cap-like socket in which the projection can slide. The inner wall of the socket has a ring shaped projection near its bottom which allows the passage of the piston head to pass only once in the backward direction. The inner diameter of the nozzle of the barrel is slightly more than that of the piston cap. The nozzle's inner wall contains projections at two places along its length.

When the piston is pulled back the medication is drawn in. Due to the presence of the projected obstructions in the shaft of the nozzle and also in the shaft of the piston socket, the (piston socket) system gets more elongated than before. Now, as the piston is pushed forward for the final injection, the top of the piston socket system gets stuck in a clasp-like projection present near the top of the nozzle shaft and is unable to be pulled back without breaking the syringe. Our model proposes that the needle is not detachable but fixed with the syringe.

Env Sc-13 (Team)
Eco Friendly Particle Board Made From Agricultural Waste Using Natural Binder Derived from Spoiled Garlic

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This project aims at deriving the natural binder from spoiled garlic and using that natural binder to make particle board from agricultural waste. The maximum life span of garlic is about 6 to 8 months. So every year lot of spoiled garlic is found in marketing yards and from farmers. And every year the agricultural waste which is remained on the farm after harvesting the crops, is burnt by the farmers. So it spreads air pollution. The main advantage of our process is that synthetic binder was not used during the whole process like urea formaldehyde and phenol formaldehyde. Secondly we have tried to utilize the agricultural waste by making particle board from it. And the binder which we have used in making the particle board from agricultural waste is also made from spoiled garlic.
Process-1 (making natural binder from spoiled garlic): We collected 250 g spoiled garlic bulb and put it into the pressure cooker. After that one litre water was added to it. It was heated on a stove till the volume of water does not become half. Then this boiled mixture was crushed in a kitchen mixture. After that again 500 ml water was added to it and was heated in the pressure cooker till the volume of water doesn't become half. Then that mixture was constricted with the help of cotton cloth to collect the extract in the liquid form. We got nearly 500 ml extract in liquid form. After that we boiled it in an open vessel till it becomes thick paste. Then we got nearly 80 g binder.

Process-2 (making sheet from agricultural waste using natural binder): We collected agricultural waste like cotton straws, wheat husk, groundnut husk, castor straws, etc. and dried it in open sunlight. Then we crushed and pulverized it to convert it into powder form. After that we took 80 g agricultural waste powder and mixed uniformly the 20 g of binder made from spoiled garlic with it. Then we fed this mixture into the mould and gave appropriate pressure and heat on both the side simultaneously with the help of vulcanizing press. Then we took the sheet out of the mould and kept it for self cooling.

Uses: We can utilize agricultural waste for making particle boards. We can also utilize the natural binder in place of Urea formaldehyde, Phenol formaldehyde etc. to make any type of particleboard. Such particle boards can be used in furniture applications.