NATIONAL WORKSHOP ON "NEW TRENDS IN BIOTECHNOLOGY: THEORY AND APPLICATIONS

ADSORPTION OF BASIC DYES ONTO LOW-COST ADSORBENTS: ANALYSIS OF THE EQUILIBRIUM STATE

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PROBLEM



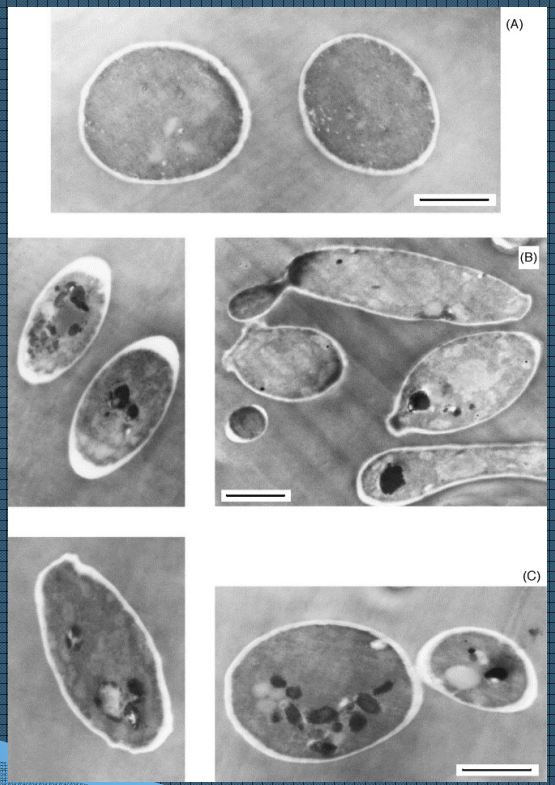
Color:

- Against the natural conception of pure water. It hides other types of pollution.
- Prevents the penetration of sunlight into deep layers of water – Photosynthesis.
- The biological risks have not been totally discarded (carcinogenic and toxic effects).

BIOREMEDIATION

Use of biological techniques to remove pollutants from air, soil and water.

- Bioaccumulation: Living organism
- Biosorption: Dead biomass







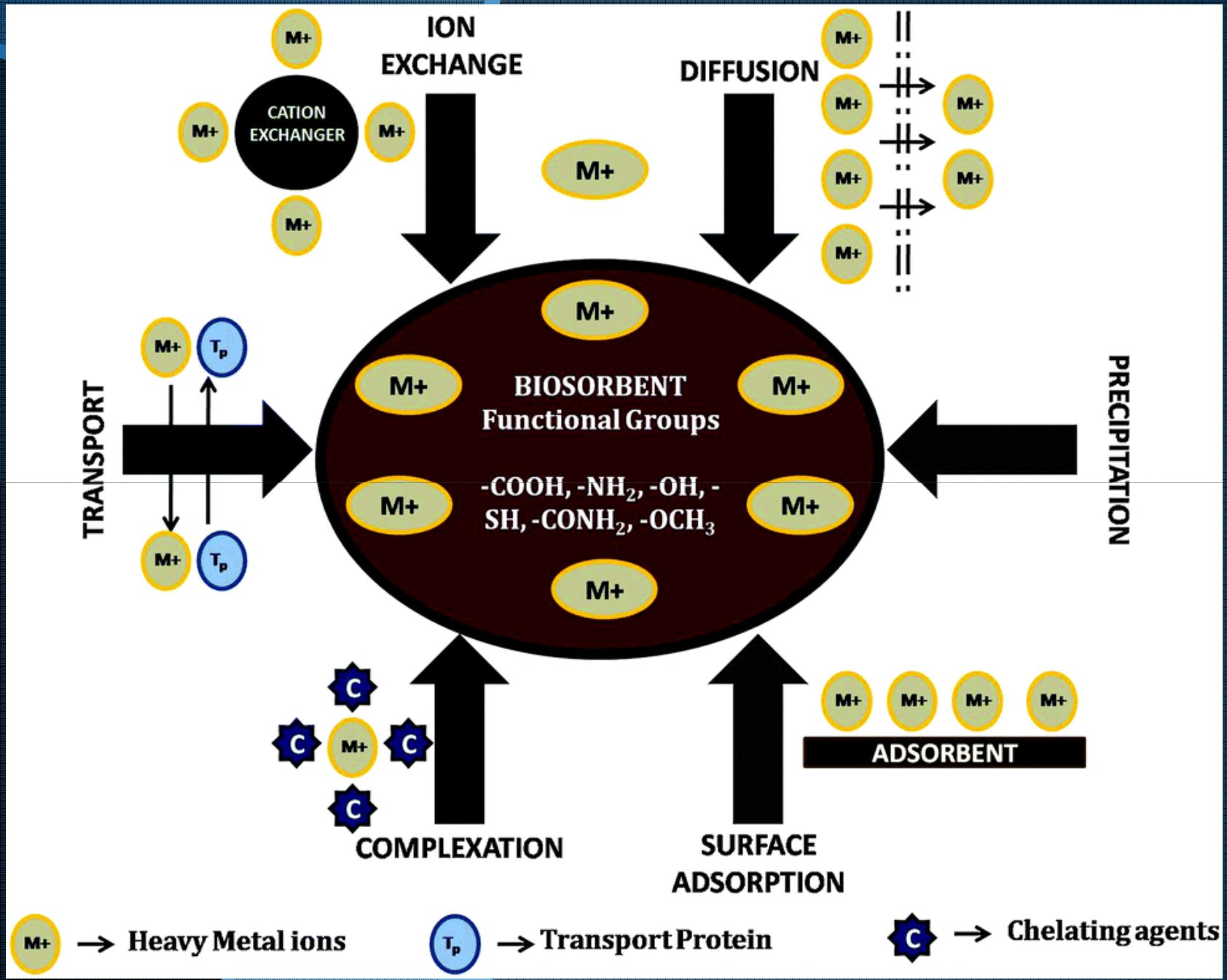
BIOSORPTION

- Use of non-living biomasses to passively remove pollutants
- Driven by physico-chemical processes
- Algae, crustacean shells, eggshell, nutshell, fruit peels, fruit seeds, TEALEAVES.
- Fast kinetics (saturation time).
- Potential recyclability of waste

MECHANISM

Complex structure, mainly formed by polysaccharides have many ways for pollutants to be taken up:

- Metabolism dependent.
- Non-metabolism dependent.


ION EXCHANGE
CATION EXCHANGER
DIFFUSION
BIOSORBENT
Functional Groups
-COOH, -NH2, -OH, -SH, -CONH2, -OCH3
TRANSPORT
PRECIPITATION
COMPLEXATION
SURFACE ADSORPTION
ADSORBENT
M+ → Heavy Metal ions
Tp → Transport Protein
C → Chelating agents

ADVANTAGES

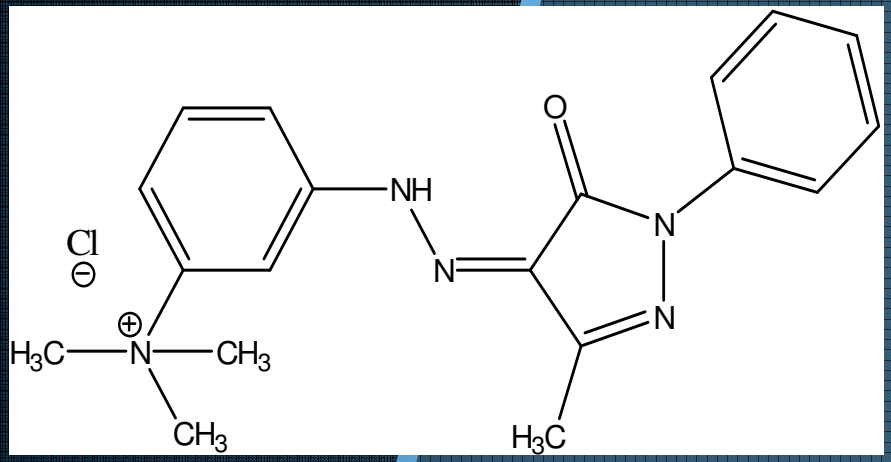
- Competitive performance.
- Pollutant selectivity.
- Cost effectiveness.
- Pollutant recovery.
- No sludge generation.

USES OF BIOSORPTION

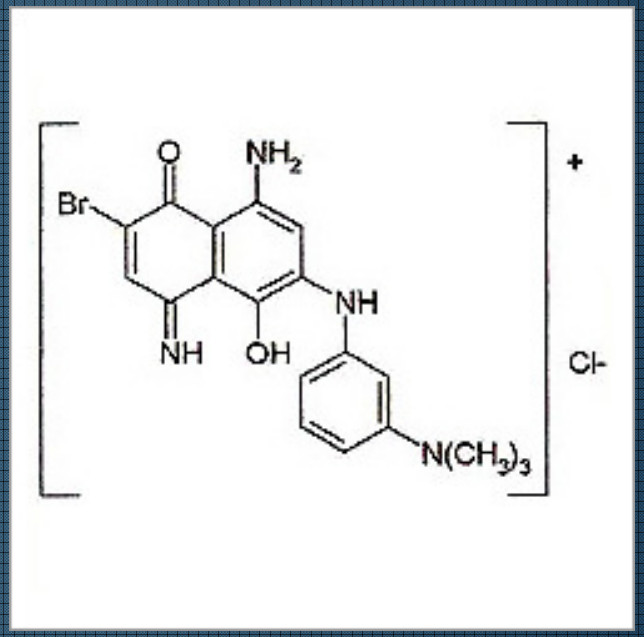
- Eco-friendly filtering technique.
- Alternative for using man-made resins (x10 more expensive).
- Potentially used for air and water.

TARGET POLLUTANTS

“ Basic Blue 99: Naphthoquinoneimine, cationic dye. Amino and hydroxyl groups present.



Basic Yellow (BY57)



Basic Blue 99 (BB99)

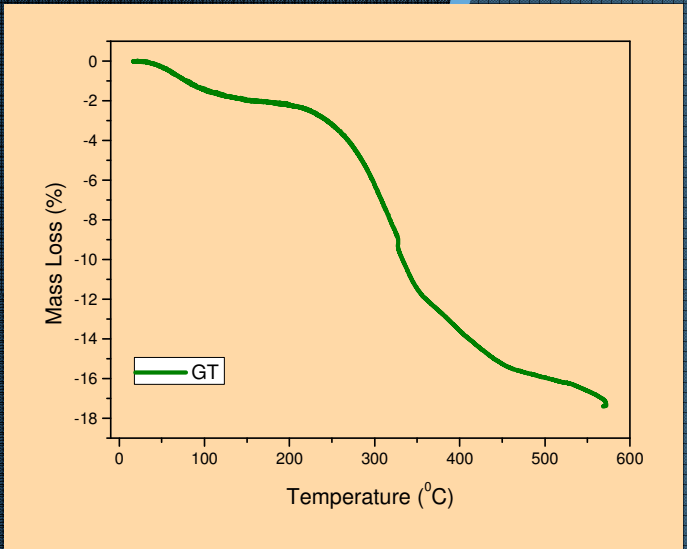
OUR ADSORBENTS

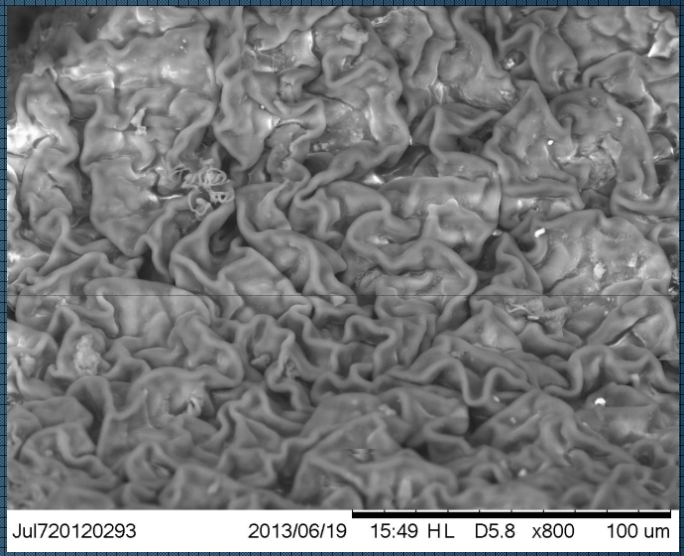
- Why? High content of functional organic groups such as alcohol (fiber and carbohydrates), carboxylic acids and amines (structural polysaccharides).

- Widespread use of green tea as a hot/cold drink. Massive collection from green tea industries (i.e. Arizona and other bottled tea-based drinks).

RESULTS

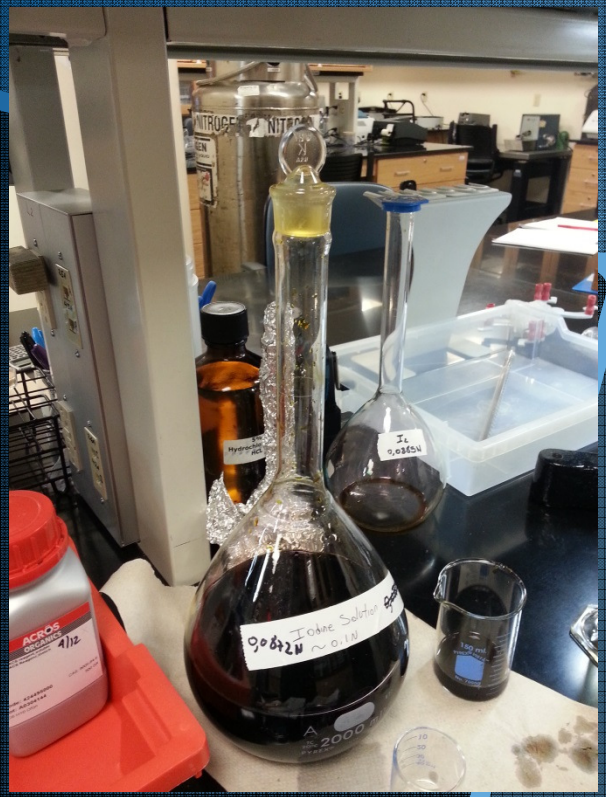
Characterization of the Adsorbents by TGA, SEM, FTIR, SURFACE AND POROSITY

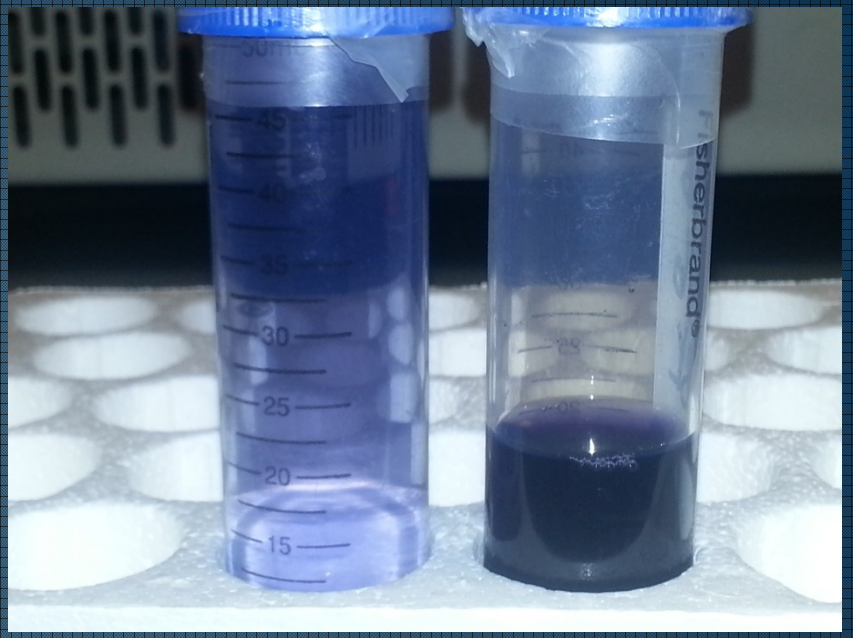


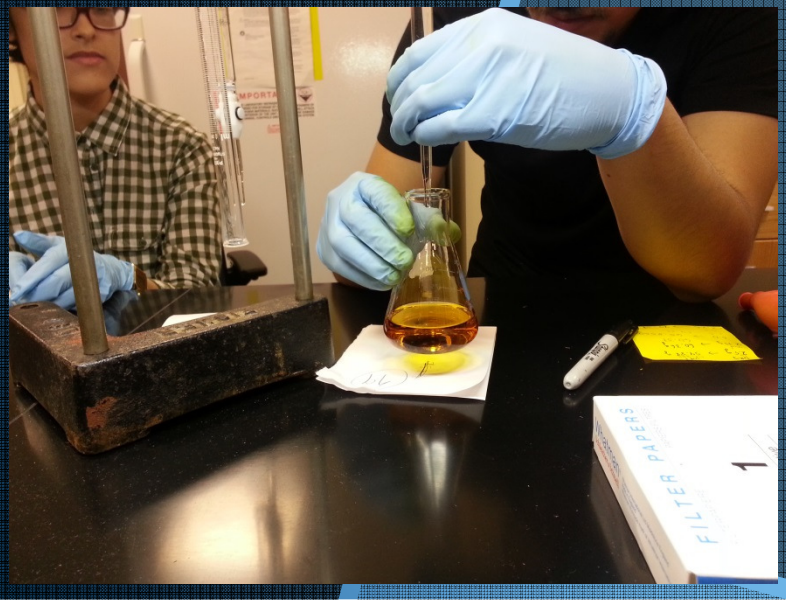


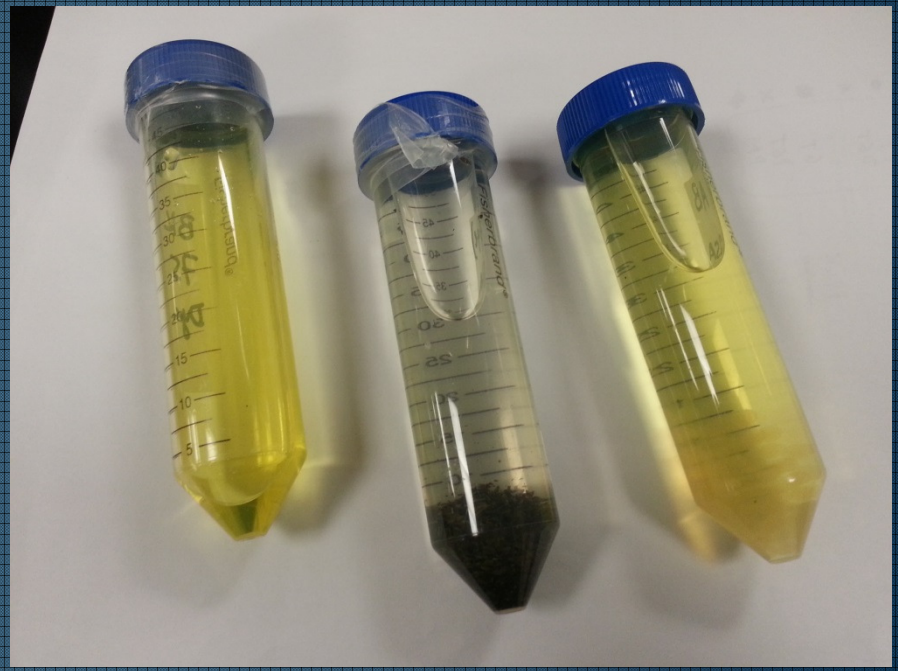
FTIR ANALYSIS	*cm^{-1}*
O-H STRETCH	3436
N-H BENDING	1636
C=O STRETCH	1656
C-O STRETCH	1111
C=O STRETCH	1720

Surface Area (m^2/g)	2,735.00
Micropore Volume (cm^3/g)	0.692
Total Pore Volume (cm^3/g)	1.106


ACROS
organics
4/12


sherbrand
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45
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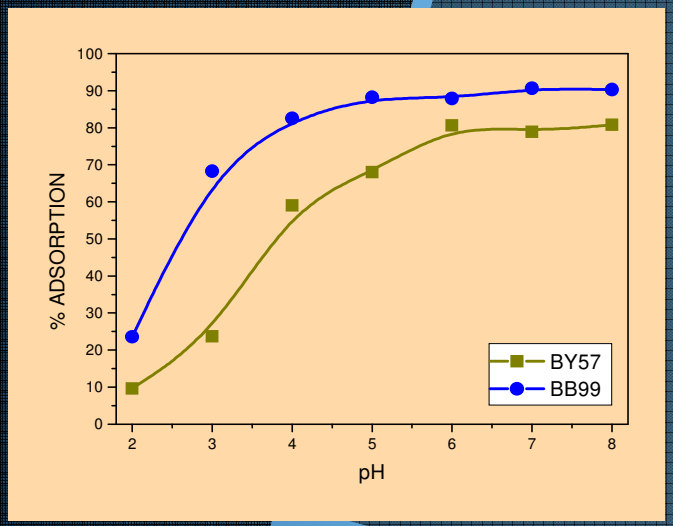

FILTER PAPERS


sherbrand

Results

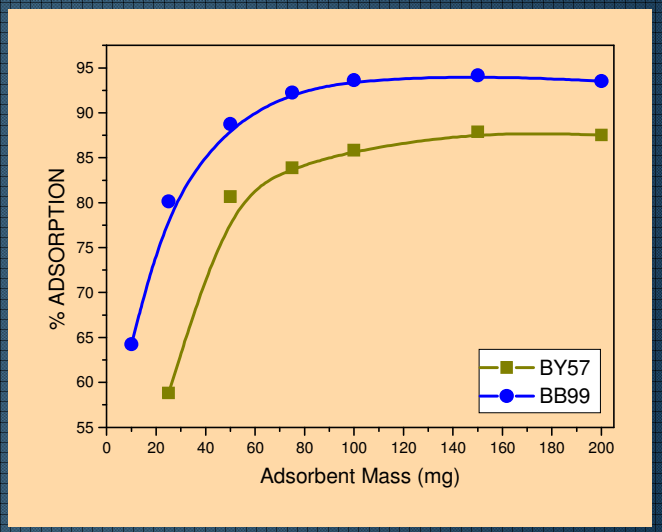
pH Effect

- Ionization of adsorbent's surface and dye
- Higher pH promotes higher adsorption.



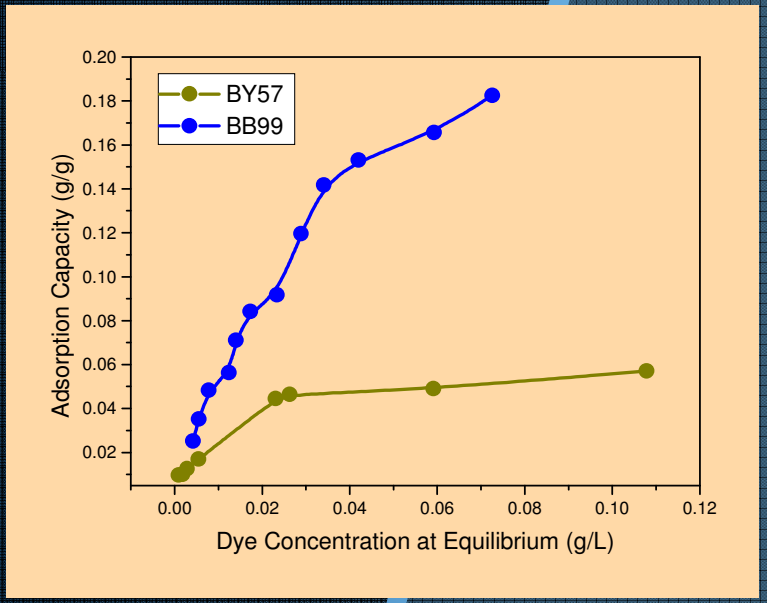
Mass Effect

- Minimize amount of adsorbent.
- Higher adsorption promotes formation of aggregates.



RESULTS

"Isotherms were modeled by Langmuir and Freundlich theories.

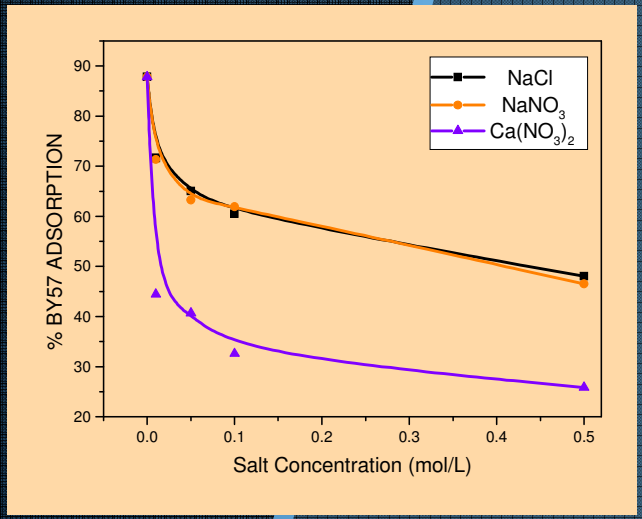


ISOTHERM MODEL	BY57	BB99
Langmuir		
q_{max} (g/g)	0.06	0.27
b (L/g)	63.29	25.82
R^2	0.979	0.988
Freundlich		
k_F (L/g)	0.23	1.27
n	1.829	1.448
R^2	0.984	0.978

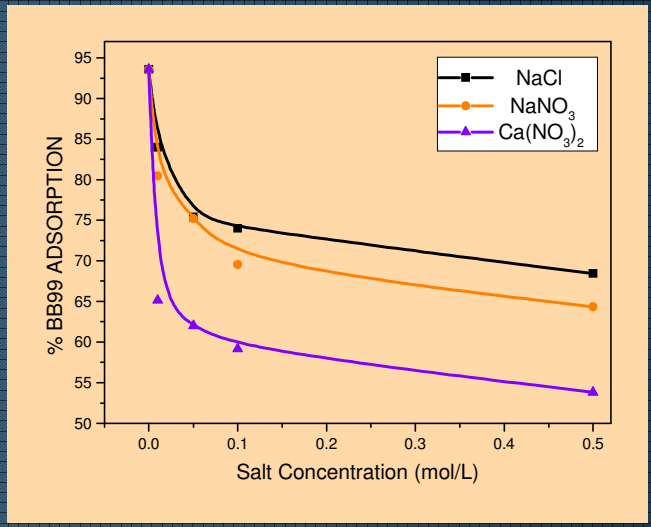
RESULTS

Salinity Effect:

- Decreases adsorption due to competition for the adsorption sites.
- Higher the charge, the stronger the effect.



BY57

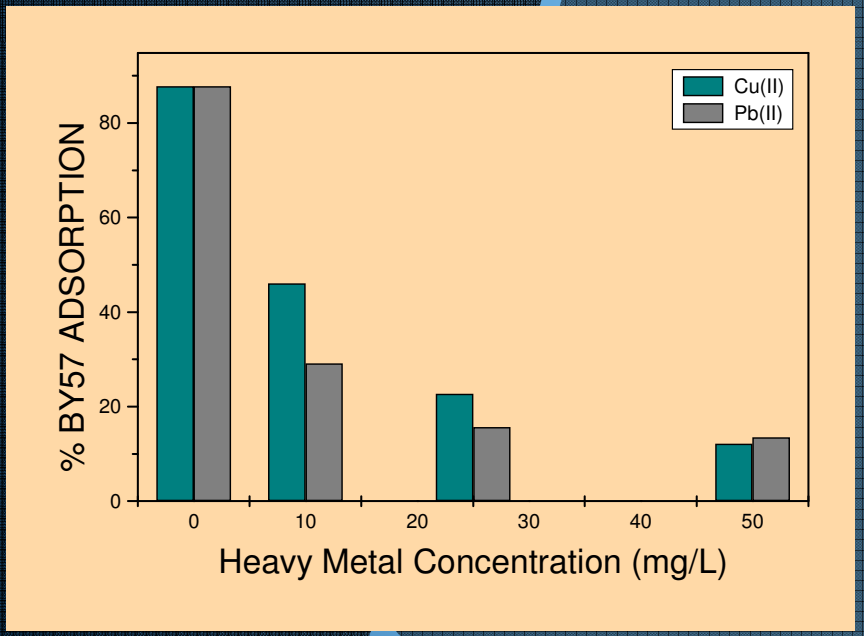


BB99

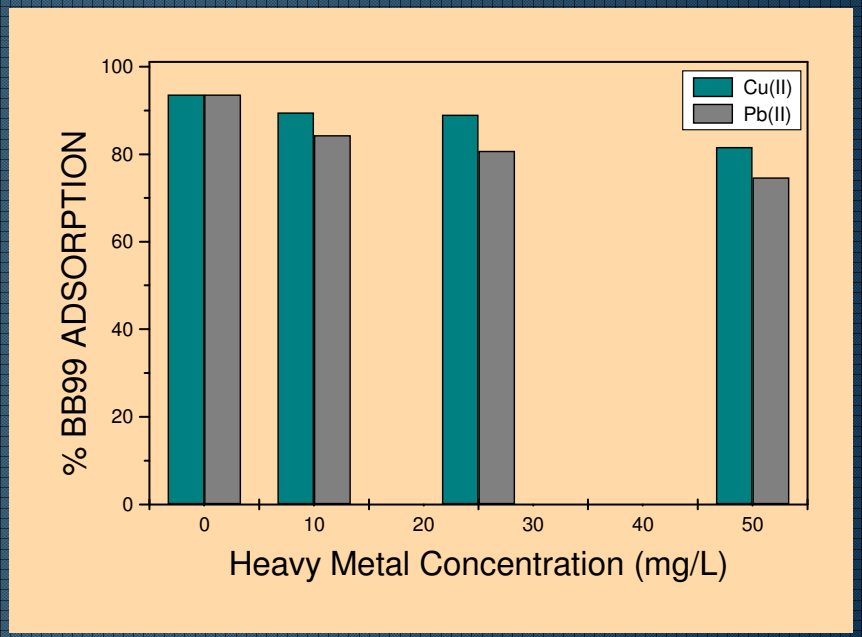
RESULTS

Presence of Heavy Metals

- Large and positively charge ions.
- Present in residual waters.



BY57



BB99

CONCLUSIONS

- Green Tealeaves have proven to be promising adsorbents for model dyes BY57 and BB99.
- TGA, FTIR, surface/porosity and SEM studies report advantages of GT as an alternative adsorbent.
- Langmuir and Freundlich isotherms modeled the adsorption indicating a q_{max} of 0.06 and 0.27g/g for BY57 and BB99, respectively.
- Salinity and heavy metals have a negative effect on the adsorption of both dyes, due to competition for adsorption sites.

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