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ORIGINAL LITERARY WORK DECLARATION

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Registration/Matric No: SGH130011
Name of Degree: MASTER OF TECHNOLOGY (ENVIRONMENTAL MANAGEMENT)
Adsorption Studies of Methylene Blue using Selected agro-wastes as Low Cost Adsorbents

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ABSTRACT

Today, there are a lot of dyes available commercially. Effluent discharge from textile industries to neighbouring water bodies is currently causing significant health problem. Synthetic dyes used in textile industries, if not treated prior to its disposal can enter our water systems and cause pollution. The study was performed using different agro-wastes namely kenaf (FH 990), banana stem, and sugarcane bagasse to produce low cost industrial adsorbents. Adsorption method was applied in removing methylene blue (MB) dye from aqueous solution. The aims of this study are to investigate the adsorption capacity under optimal parameters and compare the cost effectiveness together with the calorific value of adsorbents before and after the treatment. The characteristics of wastewater effluent was examined and the characteristics of adsorbents were determined by using FTIR, FESEM and BET analysis. The experiments were conducted in single adsorbate system by batch technique to determine the optimum condition for higher adsorbency. The determination of optimum conditions was carried out in different pH (2 - 10), agitation time (5- 300 minutes), initial concentration (10 – 70 mg/L) and temperature (20 - 100 ºC). The adsorption isotherms of Langmuir and Freundlich were employed to examine the equilibrium adsorption data. Thermodynamic parameters such as ΔH°, ΔS° and ΔG° were also calculated. The optimal adsorption was achieved by banana stem with the adsorption capacity of 68.47 mg/L and maximum removal percentage of 97.82 % for initial methylene blue concentration of 70 mg/L. The adsorption of methylene blue can be well describes by Freundlich isotherm and the adsorption process was found to be exothermic and spontaneous for all the adsorbents. Thus, all results indicated that the selected agro-wastes could be employed as an effective new low cost adsorbent for the removal of textile dyes from aqueous solutions.
ABSTRAK

Kini, terdapat banyak pewarna yang boleh didapati secara komersial. Pembuangan efluen dari industri tekstil ke dalam sistem pengairan telah menyebabkan masalah kesihatan yang ketara. Pewarna sintetik yang digunakan dalam industri tekstil boleh menyebabkan pencemaran jika tidak dirawat sebelum dilepaskan ke dalam sistem air. Kajian ini dilakukan dengan menggunakan sisa pertanian terpilih iaitu kenaf (FH 990), batang pisang dan hampas tebu untuk menghasilkan penjerap perindustrian kos rendah. Kaedah penjerapan telah digunakan untuk menyingkirkan pewarna metilena biru (MB) daripada larutan cecair. Tujuan kajian ini adalah untuk mengkaji kapasiti penjerapan di bawah parameter optimum dan membandingkan keberkesanan kos bersama dengan nilai kalori adsorben sebelum dan selepas rawatan. Ciri-ciri air sisa efluen telah dikaji dan ciri-ciri penjerap ditentukan dengan menggunakan analisis FTIR, FESEM dan BET. Kajian ini telah dijalankan dengan menggunakan sistem penjerapan berkala untuk menentukan keadaan yang optimum untuk penyerapan yang lebih tinggi. Rawatan ini termasuk penentuan keadaan optimum pada pH yang berbeza (2 - 10), masa pergolakan (5-300 minit), kepekatan awal (10 - 70 mg / L) dan suhu (20 - 100 ºC). Sesuhu penjerapan Langmuir dan Freundlich telah digunakan untuk mengkaji data penjerapan pada keseimbangan. Parameter termodinamik seperti ΔH°, ΔS dan ΔG° juga telah dikira. Penjerapan optimum telah diperolehi dengan menggunakan batang pokok pisang dengan kapasiti penjerapan 68.47 mg/L dan kadar penjerapan maksimum 97.82% bagi kepekatan metilena biru sebanyak 70 mg/L. Penjerapan metilena biru dapat diterangkan dengan isoterma Freundlich di mana penjerapan didapati adalah proses eksotermik dan spontan untuk semua bahan penjerap. Keputusan menunjukkan bahawa sisa pertanian boleh digunakan sebagai bahan penjerap baru yang berkesan untuk penyingkiran pewarna tekstil dari larutan cecair dengan kos yang rendah.
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<tr>
<td>mL</td>
<td>Millilitre</td>
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<tr>
<td>cm⁻¹</td>
<td>Unit used for wavenumber</td>
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<tr>
<td>%</td>
<td>Percentage</td>
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<tr>
<td>mg/L</td>
<td>Milligram per litre</td>
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<tr>
<td>L/mg</td>
<td>Litre per milligram</td>
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<td>J K⁻¹ mol⁻¹</td>
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<td>ΔG°</td>
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<td>ΔS°</td>
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<td>µm</td>
<td>Micrometre</td>
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<tr>
<td>KJ/mol</td>
<td>Kilojoule per mole</td>
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<tr>
<td>K</td>
<td>Kelvin</td>
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<td>°C</td>
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<td>g</td>
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<td>L</td>
<td>Litre</td>
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<td>mm</td>
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<td>Gram per litre</td>
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<td>mg/g</td>
<td>Milligram per gram</td>
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<td>R²</td>
<td>Linear correlation</td>
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<td>mV</td>
<td>Megavolt</td>
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<td>Symbol</td>
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<tr>
<td>m³/mol</td>
<td>Metre square per mole</td>
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<td>cm</td>
<td>Centimetre</td>
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<tr>
<td>atm</td>
<td>Atmospheric pressure</td>
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<td>FAU</td>
<td>Formazin Attenuation Unit</td>
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<td>cm³</td>
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<td>MIDA</td>
<td>Malaysia Industrial Development Authority</td>
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<td>Matrade</td>
<td>Malaysia External Trade Development Corporation</td>
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<td>NaOH</td>
<td>Sodium hydroxide</td>
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<td>H₂O₂</td>
<td>Hydrogen peroxide</td>
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<td>AOX</td>
<td>Adsorbable organic halides</td>
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<td>IUPAC</td>
<td>International Union of Pure and Applied Chemistry</td>
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<td>MB</td>
<td>Methylene Blue</td>
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<tr>
<td>LMB</td>
<td>Leukomethylene blue</td>
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<td>COD</td>
<td>Chemical oxygen demand</td>
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<td>Acronym</td>
<td>Description</td>
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<td>BOD</td>
<td>Biological oxygen demand</td>
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<tr>
<td>RO</td>
<td>Reverse osmosis</td>
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<td>DO</td>
<td>Dissolved oxygen</td>
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<td>rpm</td>
<td>Rate per minute</td>
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<tr>
<td>FTIR</td>
<td>Fourier transform infrared spectroscopy</td>
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<td>UV-VIS</td>
<td>Visible and Ultraviolet Spectroscopy</td>
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<td>TDS</td>
<td>Total dissolved solids</td>
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<td>TSS</td>
<td>Total suspended solids</td>
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