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Drinking Water Engineering and Science Discussions

Interactive comment on "Removal of Dyes from Simulated Wastewater using Low Cost Activated Carbon Derived from Date Pits" *by* Salam A. Mohammed et al.

Anonymous Referee #2

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The authors study the transformation of date pits into activated carbon by two different methods and investigate their application as adsorbent to remove four dyes from wastewater. This approach produces a high profitable recycled material and is one of the most merging, ecological and low cost R&D techniques explored by scientific community.

In the introduction section, the authors should to highlight their motivation; on the basis of literature; to use: i) both methods: thermal treatment in a microwave device or in a furnace (give examples of specific surface area values from literature...etc), ii) in chemical activation before thermal treatment, the choice of sulphuric acid as an

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impregnant agent (to precise its role, and to expect its benefits compared to others chemical agents such as H3PO4, ZnCl2, KOH,...etc).

The experimental section ought to be more detailed and clarified by presenting a scheme where authors should indicate every step of preparation of the eight AC samples and precise differences between chemical-physical and physical-chemical treatments.

The results as presented in the paper aren't adequately discussed. Authors should make an unambiguous comparison between all AC samples with clear interpretations by i) exploring SEM images, ii) adding N2 adsorption isotherm of each AC (if it is possible) in order to find out the total pore volume, the specific surface area using BET method, and pore size distribution (micropores, mesopores), or to expect the values of these parameters on the basis of literature results (if it is not possible), iii) making adsorption experiments using different initial concentrations of dyes to find out the adsorption isotherm of each dye and to fit it by usual models (BET, Freundlich,. . .etc). These would be helpful to conclude about interactions between each dye and adsorbent.

Comments on the manuscript:

- The authors (Ath) should mention in the abstract and introduction that the precursor (date pits) was impregnated firstly by sulphuric acid before pyrolysis in furnace or microwave oven.

- In the experimental procedure, (Ath) should precise the concentration of sulphuric acid, the quantity of date pits impregnated by acid, the ratio of impregnation (weight of acid/weight of pre-treated date pits) and comment the choice of the temperature 400°C for pyrolysis in furnace, precise the power of the microwave oven.

Line 66-67:". . .different proportions, (Ath) should avoid repetition of the unit % - Different concentrations of dyes were prepared by authors as explained in experimental

paragraph. Authors have to precise that those solutions served to establish the calibration curve for NIR measurements and only the concentration 100mg/L of each dye was used in adsorption experiments.

Lines 75 & 76: (Ath) should replace “burnt” by “pyrolyzed”.

Line 77: the statement is not clear: After cooling, the two portions were grinded and sieved into a uniform size. The particle size was between (250-425μm) and the second one was between (425-600μm) Correction: After cooling, each portion was grinded and sieved into two size distributions. The particle size of the first distribution was between (250-425μm) and for the second one was between (425-600μm).

- (Ath) should add a statement where they attribute the names for each sample: for example FAC1 and FAC2 for activated carbon (AC) particles prepared by pyrolysis in furnace and having size range 250-425μm, and 425-600μm respectively.MAC1 and MAC2 : for AC pyrolyzed in microwave oven and having size distribution as for FAC1 and FAC2 respectively. . .

Line 82: A series of three fixed beds adsorption column: four dyes have been tested: MB, MO, CR, and EY, and until this line, it is clear that (Ath) prepared 4 samples of AC, however, eight samples are tested in the section of results. -In adsorption experiments: the weight of each AC sample used as fixed bed for adsorption should be specified.

Lines 92-93: (Ath) should explain and precise if they use a peak at a unique wavenumber for adsorption kinetic monitoring or all obtained absorbance peaks in the range 4000 -10000 cm-1

Line 97-98: the statement is not clear; explain the physical and chemical modifications that have been made to improve the porosity and the morphology of AC.

Line 103: caption of Figure1: did (Ath) mean SEM micrographs of A) MAC1, B) FAC1, C) FAC2? If yes, make the necessary corrections. If not, (Ath) should add precisions in the experimental paragraph (preparation of activated carbon) about difference between

physical-chemical modifications and chemical-physical modifications.

Line 109: (Ath) should describe the size distribution of pores obtained according to SEM images for comparison (only macropores are observed by this technique) to make evidence that number of pores, and their size were varied based on the thermal treatment, it is recommended to authors to measure N2 adsorption isotherms of their samples for making a precise assessment (pore volume and pore size distributions: micropores, mesopores).

Line 113-117: Authors should add a Figure presenting some NIR absorbance spectra (for illustration) (for example: at the beginning of adsorption, after 100s, and at the end of adsorption for MAC1 and FAC1).

Lines 125, 126: in equation (1): correct the formula of

% removal = {([dye]initial – [dye]final)/[dye]initial}$\times$100

(Ath) should replace “Predicted concentration” by “concentrations of dyes deduced from NIR absorbance measurements was plotted against time until reaching the adsorption equilibrium for FAC1, MAC1,...as depicted in figures 2 and 3”. Omit “pore size” in the statement.

Line 128: The time needed ...was varied from...: omit “was varied” and substitute it by: “was different”

Line 131: the interval (250-425μm) is the range of AC particle size not the range of pore size since Authors didn’t present any results about pore size distributions of AC samples. There is an ambiguity in results, as mentioned in experimental paragraph by authors, fours AC samples were prepared by chemical activation followed by heat treatment in furnace or in microwave oven, then the two samples were divided into two parts according to the range of their size after grinding and sieving. However, in figure 2 and 3 and in table 1, authors report results about eight samples.

Line 132: ..at pore size (250-425μm) : omit “pore size”

Line 133 -137: Other usual key parameter to use for comparison is the adsorption capacity of each AC sample (grams of adsorbed dyes/grams of AC). The initial rate of adsorption (to calculate from the first two measured concentrations of dye during adsorption test) could be also useful.

Line 135: “Overall, the highest dye removal was found in smaller pore size AC”: (Ath) should omit this statement, because it is not true. There is no clear correlation between size of AC particles (not pore size) which refers to the external accessible surface and the % removal of dyes. % removal or adsorption capacity (which is related to the internal surface accessibility of AC) depend on the pore size distribution, total pore volume (micropores and mesopores), specific surface area SBET, physical (physic-sorption) and/or chemical (chemi-sorption) interactions between adsorbent and dye, size and shape of dye molecules. . .etc and all these parameters aren’t measured for instance in this paper.

Line 212 to 214: For EY removal, the explanation of the result is generic. (Ath) should give more specific interpretations (on the basis of functional groups of MB molecules, EY, and those expected to have at AC surface samples according to the previous works in the literature).

Table 1 must be cited in the text.

Figures 2 and table1: there is a discrepancy in % removal indicated in table 1 and the results of figure 2.a: in figure 2.a, the % removal of MCP and FCP are the highest and are close, but in Table 1 (column a) The highest value calculated from figure2.a corresponds to FPCe, moreover, %removal of FCPc and MCPd are different. (Ath) should check again their results for more consistency.

Figures 2 and 3: It is more convenient to plot (Concentration of adsorbed dye versus time) where: Concentration of adsorbed dye = Initial concentration – measured concentration in the solution) (mg/L)

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Line 219: (Ath) should omit “two different porosities” and substitute it by “two different size particles”, -The conclusion is generic; (Ath) should give more details of the obtained results.

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