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Drinking Water
Engineering and Science
Discussions

Interactive comment on "Adsorption and Desorption studies of *Delonix regiapods* and leaves: Removal and recovery of Ni(II) and Cu(II) ions from aqueous solution" *by* Bolanle M. Babalola et al.

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Response to Interactive comments on "Adsorption and Desorption studies of Delonix regia pods and leaves: Removal and recovery of Ni(II) and Cu(II) ions from aqueous solution" by Bolanle M. Babalola et al.

The authors' responses to the Interactive comments (RC2) on Bolanle M. Babalola et al. are as follows:

Anonymous Referee #2 General comments: Comments from referee The approach is

interesting; however, the document has to be improved in the way of presenting the information/results, comparing with other literature and avoiding presenting the same data in both graph and tables. The graphs quality has to be improve. Author's response The manuscript has been improved in the way of comparing the results with other literature studies. The quality of the graphs has been improved.

Comments from referee It is recommended to compare with other adsorbents in terms of adsorption capacity (mg/g) and not percentage and including the initial concentrations. Author's response We have now compared the D. regia adsorption capacity with other agro-waste reported in the literature. A new table has been created in this regard (Table 3). However, we have chosen to use percentage as a measure of the efficiency based on the suggestion by reviewer #1.

Comments from referee The aim or need of the study is not well stated, the application is only for wastewater? Author's response The aim of the study is now well stated at the end of the introduction section.

Comments from referee The conclusions both, pods and leaves, are promising ones to remove the metals or only one of the plant parts? Author's response Both the pods and leaves could be used for the removal of Ni and Cu ions. However, the pods performed better in term of the amount of metal ions removed and regeneration of the biosorbent. These have been stated clearly in the manuscript as well as in the concluding section.

Comments from referee How should the material be applied, in batch or filters? Author's response We have conducted a batch experiment and our finding have showed that the agro-wastes are effective. We encourage other researchers to build on our studies by conducting the column/filter experiment. Comments from referee No study about economics was performed, so better not to mentions economic aspects. Author's response Since economic study was not performed, we have avoided the use of the term economics in the entire manuscript.

Specific comments: Comments from referee Line 13-14 mention that conditions such

as pH, contact time, metal ions concentration and the presence of sodium ions were studied, however in the abstract only the results of kinetics is presented, the results of the others conditions should be included. Author's response Abstract: the results of the other conditions have been included (now in line 17-19).

Comments from referee Line18-19: present the results of the isotherm data, at least the capacity in terms of mgMetal/gadsorbent and state is it is good or not in relation with others adsorbents in literature. Author's response The adsorption isotherm i.e the adsorption capacity of the pods and leaves of D. regia in terms of mgMetal/g adsorbent has been stated in the abstract.

Introduction: Comments from referee Include newer references as the newest one is from 2016. Author's response Newer references have been included

Comments from referee Some information about reports, monitoring or regulations of the metals in drinking and wastewater is needed, so, there will be an idea of which concentrations are of concern and should be used in the study to evaluate the adsorbents, that would justify why 100mgM/L was used in the study. Author's response The permissible limit of Cu(II) and Ni(II) in drinking water and wastewater has been included the manuscript (line 52 and 53; line 62 and 63).

Comments from referee Line 66-98 the removal capacity effectiveness of many adsorbents is reported, however almost no data of the capacity and initial concentrations of the metals is included, include the mg/g if that information is reported. That information gives an idea of why to go for natural adsorbents. Author's response Data on the capacity and initial concentration of metals have been included, the reported adsorption capacity reported in other studies in mg/g have been included.

Comments from referee Line 99 explain why is this research needed and why to choose this adsorbent, why to check the leaves and the pods? Author's response The reason why this research is needed and why we have chosen to use the pods and leaves of D. regia have now been detailed in the manuscript (line 106-118) Materials and methods:

Comments from referee Lines 111-112 were the leaves and pods dried? Author's response The leaves and pods were dried, this has been included in the manuscript (line 113)

Comments from referee Line 117 what were the concentrations used? Author's response The concentrations of metal ions used are now included (line 157).

Comments from referee Line 120-121 include the sodium and nitic acid concentrations tested. Author's response The sodium and nitic acid concentrations used are now mentioned in the manuscript (line 160).

Comments from referee Line 119 instead of referencing to paper include the procedures in detail including for example: type of water used, adsorbent dosage, metal concentrations, rpm, volume of solutions, time, etc. Besides it would be better to include subitems for each experiment starting from: kinetics, pH effect, isotherms, ionic strength effect and desortion experiment. Each one explained in detail. Author's response The procedures used in the adsorption experiment have been detailed in the manuscript (line 153 – 166).

Comments from referee Were the experiments performed at least in duplicate? Author's response The experiments were performed in triplicate, this was mentioned in the manuscript

Comments from referee Line 134 Equation 1 is not relevant, it is better to include after each subitem mentioned in the previous comment the corresponding equations for kinetics and isotherms. Better here than in the results and discussion section. Author's response All equations regarding kinetics and isotherm are now transferred to the materials and methods section. Moreover, Equation 1 is very important, and we have not deleted it.

Comments from referee Line 136 a specific subsection is needed for the analitycal procedure including equipment brand and model and the detection limit for both metals.

Author's response A new subsection on analytical procedure has been included (line 168-179).

Results and discussion: Comments from referee Lines 156-158 The diffractogram first shows that both materials are amorphous, that could be related to high surface area and potential adsorption. Besides, include in Figure 3 the diffractogram of cellulose so, that it can be directed compare, specially thinking that in natural products not only cellulose is present, what about lignin for example? DRX is not enough to characterize a natural products, other techniques like IR, MNR, etc is needed. What is found in literature for natural adsorbents of this type? Which moiety are responsible for the adsorption? Line 157 mention amino group, but in figure 2 no nitrogen was detected. Author's response The diffractogram have been replotted and all phases present have been identified based on the ICSD Nos. 03-0289, 20-0231 and 26-1077 and discussed.

Comments from referee Line 164-165 start with the kinetic study. Author's response We have chosen to report the research in the order in which the experiments were conducted i.e. pH was optimized, followed by contact time, etc.

Comments from referee Line 165 it is important to mention that in general pods performed better than leaves for both metals in the whole pH range, why? Author's response We have now mentioned that the pods performed better than leaves for both metals (line 416 -418), and also in the concluding section.

Comments from referee Line 176: include adsorbent dose. Author's response Adsorbent dosage has been included in the experimental conditions mentioned in all of the adsorption plots.

Comments from referee Line 183: what can be the precipitate? What literature says? Author's response The nature of the precipitates has been included (line 277).

Comments from referee Line 200 the equipment and time evaluated goes in the materials and methods section. Line 201 it is evident that pods are better than leaves, make

a comment. Author's response The equipment and time evaluated have been moved to the materials and methods section. Comments have been made on the fact that the pods are better than leaves (line 309 -310).

Comments from referee Line 207 include adsorbent dose. Author's response Adsorption dosage has been included in the experimental conditions mentioned in the plot

Comments from referee Line 205 -228 the information in Fig. 5b and Table 1 is basically the same, let the Table 1 in the document. Author's response The authors have chosen to retain the kinetic and isotherm plots, unless the editor insist that the plots should be removed.

Comments from referee Line 210-213 then adsorption was mainly in 30 min, how is that compare to the literature? Faster, slower? Author's response The exceptionality of 30 min contact time for D. regia biomass in comparison to other agro-waste has been detailed in the manuscript (line 312-320).

Comments from referee Line 218 how Hansen et al. (2010) supports your results on kinetics? Author's response How Hansen et al. (2010) supports the results on kinetics have been included.

Comments from referee Line 223: put the equation in materials an methods Author's response All equations have been transferred to the materials and methods.

Comments from referee Line 228: compares the Qe and k values obtained for the pods and the leaves among them and the literature. Author's response The Qe and k values obtained for the pods and the leaves in the literature has been included (line 337-340).

Comments from referee Line 230 this is confusing is that the same experiment for the isotherms? Then, the title item should refers to the isotherms experiments. Author's response The data obtained on the effect of initial adsorbate concentration was used to model the isotherm. The title now reflects isotherms experiments (line 342).

Comments from referee Line 241 regarding with Fig. 6b and Fig 6c those are the

linearized isotherms and the same information is on Table 2. Recommend to plot Qe vs Ce instead of those figures. Author's response The authors have chosen to retain the kinetic and isotherm plots, unless the editor insist that the plots should be removed.

Repeated word "correlation" has been deleted.

Comments from referee Line 296-300 the data suggest that the pods are better than the leaves, it can be seen from the graphs in Figs. 5a and 6a, from the data. Besides, 1/n and Kf are lower and higher respectively for the pods for both metals confirming that the pods perform better and adsorption is more favorable on them at the concentrations studied. Author's response The fact that 1/n and Kf are lower and higher respectively for the pods for both metals confirming that the pods perform better, have been included in the manuscript (line 416 -418). Also reinstated in the manuscript is that Figs. 5a and 6a showed that the pods is better than the leaves.

Comments from referee Line 300-304 higher R2 only confirms which data fit better to the model not which one is a better or a favorable adsorption. Author's response The wrong notion of a higher R2 associated to a favorable adsorption has been corrected.

Comments from referee Line 305 the adsorbent dose experiment is to determine the isotherm. Author's response The adsorbent dose experiment can not be used to determine the isotherm, but the initial adsorbate concentration experiment.

Comments from referee Line 316 better to use normal scale, not logarithmic so the effect is easier to see. Author's response Normal scale has been used to plot Fig 7b.

Comments from referee Line 331 was that experiment as all made by duplicate? Author's response All experiments were conducted in triplicate.

Comments from referee The results with 0.05M HNO3? Are confusing, how is that the Ni and Cu pods % is substantially lower and with ultra pure water and higher concentration is practically the same in both cases? How to explain that? Author's response Section 3.3 has been re-discussed.

Comments from referee Line 352-352 what can be concluded from the isotherm data? Are those good or not for the removal of the metals, are them better than others? Line 354/355 what to conclude from the kinetic, is it fast or lower than others? Author's response The isotherm discussion is detailed in section 3.2.3., a brief statement of the isotherm study is required in the concluding section and this is what has been done.

Comments from referee Line 355/356 see comment on line 331, confusing data. Author's response The desorption study has been revisited and re-discussed.

Comments from referee Line 357-359 no economical study was done, so can't conclude that. Besides only two metals were evaluated and using ultrapure water, so can't conclude is application in natural conditions and besides, can't conclude about others environmental contaminants Author's response We have avoided the use of the term "economics"

The authors appreciate the editors and reviewers of this manuscript, the comments and suggestions received have greatly improve the quality of the manuscript.

Thank you.

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