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Comment

## ***Interactive comment on “Phosphorus sorption and buffering mechanisms in suspended sediments from the Yangtze Estuary and Hangzhou Bay, China” by M. Li et al.***

**Anonymous Referee #2**

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General comments: The manuscript focuses on sorption of phosphorus to suspended sediments in the Yangtze estuary in China, where the impact of sewage outfalls is large. Sorption experiments were performed and isotherms were fitted using known equations (Langmuir, Freundlich, Temkin) or an exponential expression. The authors show differences in the sorption behavior of the different sediments related to grain size and suggest the occurrence of precipitation of  $\text{CaHPO}_4$ . Incubations were also performed at lower phosphorus concentrations and different temperatures to understand the buffer capacity of the sediments. The zero equilibrium concentration and the linear adsorption coefficient increased with temperature suggesting a higher buffering capacity at higher temperatures. The experimental design seems adequate and pro-

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vides interesting information concerning phosphorus sorption to suspended sediments in the Yangtze estuary. I suggest some improvements in the figures and tables and a few questions about the text should be addressed. I recommend this manuscript for publication after minor revisions.

Specific comments:

Abstract. I find the first sentence confusing. What/Which are the mechanisms of the buffering effect? And the adsorption isotherms are not controls on the phosphorus behavior (but they are indeed useful to estimate phosphate concentrations in aquatic environments). I suggest a rephrasing of this sentence.

Section 2.1 Sampling. The title refers to suspended sediments but in the experiments bottom sediments were used. Some explanation on the assumptions made and on the extrapolation of the results from bottom sediments to suspended sediments would be helpful. Information on the natural suspended sediment concentrations typical for this area and how that relates to the particle concentrations used in the experiments would be helpful.

Table 1. I believe the DIP concentrations refer to the water column and not porewater. That could be stated more clearly. Information on the porewater phosphate concentrations would be helpful since that's the concentration at which the sediments were equilibrated after deposition.

Section 2.2 Isothermal adsorption isotherms. Why were the sediments ground? I see no advantage in that and it will potentially bias the results by increasing the surface area available for sorption. 24h of incubation might be a short period to achieve equilibrium based on previous literature (van Raaphorst and Kloosterhuis 1994, Leote et al. 2012). Was this checked?

Section 3.1 Adsorption isotherm models. Lines 5, 7, 10, 21 and 24. The use of P adsorption density is more adequate than P adsorption capacity. Line 18-Ion product

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calculation. I have the impression that the concentration given (12 mg l<sup>-1</sup>) refers to phosphate concentration. However, it is divided by the molecular weight of phosphorus. Shouldn't the molecular weight of HPO<sub>4</sub> (96 g mol<sup>-1</sup>) be used instead?

Section 3.2 Buffering effects. Line 22-The nomenclature for the equilibrium phosphate, PS-EPC<sub>0</sub>, induces in error because it seems to be PS minus EPC<sub>0</sub>. This becomes particularly confusing in the equation (line 25). I suggest replacing it by NAP (native adsorbed phosphorus) or another equivalent expression. It would be interesting to have some information about the sediment porewater concentrations of phosphorus, since the adsorbed fraction was lastly equilibrated in the bottom and not in suspension and at a different particle concentration.

Section 3.3 Influence of temperature on sediment buffer capacity to phosphorus. Line 11- "The rate of both adsorption and desorption will increase with temperature." This statement cannot be inferred by the increasing K with increasing temperature and no kinetic data is provided. Therefore, references should be provided.

Technical corrections:

Page 17521 – Line 9. Maintains instead of maintain.

Page 17522 – Line 14. I suggest replacing three sediments by sediment triplicates or three sediment samples.

Page 17523 – Line 5. Was instead of were

Page 17523 – Line 21. "... except using very low initial P concentrations..." sounds odd. I suggest using something like: 'with the difference that very low P concentrations were used'

Page 17527 – Line 11. Adsorb instead of absorb

Table 2. For clarity, I suggest moving the columns of r and S from the Temkin equation to the right so that they are in line with the ones obtained for the other equations. A

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description of what  $n$  and  $K$  from the Freundlich equation, and  $R$ ,  $T$ ,  $\beta$ ,  $Q_0$  and  $C_0$  from the Temkin equation, are should be provided in the end of the table, similarly to the parameters from the Langmuir equation

Figure 1. Changjiang estuary in the map should be replaced by Yangtze estuary since this might be confusing for many readers

Figure 2. The indication of plots a and b should be in capital letters to make it more clear. The data points in plot B should follow the same symbols as in plot A, i.e. triangles and circles for samples B and F, instead of squares and triangles. In the legend adsorption capacity should be replaced by adsorption density.

Figure 3. What do the lines represent in the plot? Which equations were used for the fit?

Figure 4. The indication of plots a, b and c should be in capital letters for higher clarity.

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**BGD**

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