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Hydrology and Earth System Sciences
Discussions

Interactive comment on "HESS Opinions: Agricultural irrigation with effluent – Pharmaceutical residues that we should worried about" *by* Dror Avisar and Gefen Ronen-Eliraz

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Referee#1: (Q1-1) The topic of this manuscript has been discussed at all levels for more than 2 decades now and the amount of work that has been published on each and every point that is reported in this manuscript is overwhelming. However, A reader without previous knowledge could understand that the drug residue in wastewater is a problem mainly in Israel and that most of the work has been done by two groups (20 out of 47 references or 38 scientific peer-reviewed publications come from two group with the authors self-citing 14 of their his own publication).

(A1-1) Thank you for your comment. We definitely agree with the referee that some

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implications of this topic has been discussed for more than 2 decades and therefore rewrote some of the paragraphs that might gave the wrong impression that this problem is only in Israel. Anyhow, we did emphasize the idea that on the last years, with the progress of the analytics abilities and the growing consumption of pharmaceutical, this subject become much more acute and though much popular topics with relevant implication to promote to the research frontier, as arise from the article. In addition, we add some more relevant references to give a broader representation of the many research group dealing with this subject.

(Q1-2) The manuscript does not bring any new perspective and many arguments are not fully supported. For example drug residues are considered contaminant of soil, water and sludge however it is also stated that their concentration are very low and that no proven health implication was reported to date. There are logical gaps and jumps between hot spots with high contamination that can be dealt by AOPs and low level board contamination of soil and water that are not suitable for this type of treatment. Moreover, sometime the manuscript refer to drug and drug residues in other cases to pharmaceuticals and in other parts to organic micro-pollutants, which is much larger group. Finally the manuscript state that many of the pharmaceutical metabolites/transformation products are unknown and on the other hand calls for consideration of regulation these compounds.

(A1-2) The article is an opinion article and its target was to emphasize the complications related to this topic that pronounced by those arguments mentioned by the referee. For example although the concentration of the drugs residues is low, they do consider contaminants. Health implication showed by some research but not on all of the researches that have been done; One of the complications is that there are hundreds of metabolites that are unknown but it doesn't means they are not toxic though regulation must be consider with this limitation according to the writer opinion. Besides, thank you for these remarks because it seems that the point was not clear so we rewrite it to be clearer. We add a reference that showed contamination of soil, water

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and sludge, and reference that proven health complications to bridge on the gaps. In addition we broaden the section of treatment solution and add to the AOPs different kind of treatments dealing with the problem.

(Q1-3) Relevant literature is missing for example: Mensingh J., Thurston C. 2015 PPCPs: Preparing For An Uncertain Regulatory Future. Water on line https://www.wateronline.com/doc/ppcps-preparing-for-an-uncertain-regulatoryfuture-0001; Boxall et al. 2012 Pharmaceuticals and Personal Care Products in the Environment: What Are the Big Questions? Environ Health Perspect. Sep; 120(9): 1221–1229.; Ortiz de García, et al. 2013 Ranking of concern, based on environmental indexes, for pharmaceutical and personal care products: an application to the Spanish case. J Environ Manage. 129:384-97. doi: 10.1016/j.jenvman.2013.06.035. Epub 2013 Aug 28.; Lamastra L, Balderacchi M, Trevisan M. 2016 Inclusion of emerging organic ontaminants in groundwater monitoring plans. MethodsX. 2016 May 25;3:459-76. doi: 10.1016/j.mex.2016.05.008. eCollection 2016. EPA https://www.epa.gov/wqc/contaminants-emerging-concern-includingpharmaceuticals-and-personal-care-products; G. Eckstein, 2012Comment: Emerging EPA Regulation of Pharmaceuticals in the Environment, 42 Envtl. L. Rep. 11105.

(A1-3) Thank you very much for those relevant literature. We read it and broaden our references list.

(Q1-4) When one consider regulation a clear target and method must be suggested too. In this work no priority substance are suggested and it is noted twice in the text that to date the no toxicity at environmental levels was found. Moreover the detection methodology is very complex at best and often if one want to consider many metabolites the analytical methods are a subject for research and not routine analysis.

(A1-4) Thank you for your remark. We accept that the call for consideration of regulation is still not prepared and we should have written it differently: not as suggestion for regulation but in order to clear the point of this article - raise awareness. In order

to emphasize the complexity and the difficulties arise with this topic, connected with the complex methodology that goes with the water recycling (for detection and for removal), and the immediate need of recycling wastewater, it is important to be aware of the damages that might come with this as stated from the title.

Specific comments:

(Q1-5) Page 1 lines 26-27 - This is related mostly to biological contamination and waterborne diseases which are not really the subject of this work. This makes this statement a bit misleading. Page 3 fig 2 The amount of water resource will grow between 2010 and 2040 by _1400 Mcm/year and the reuse by only _500? Also is this original data/figure or should be credited to Bar-Eli, 2017 or someone else?

(A1-5) It is correct that this sentence is mostly related to biological contamination and waterborne diseases, and they are not the subject of this work, but it is part of the introduction which leads to the point that recycling water is not in a question but a present need and a fact. Therefore, solution, such as eliminate wastewater recycling, is unthinkable, although it fold in an unknown threat. It is correct that the water resources will grow by 1400Mcm/year and the effluent only by 500Mcm/year. The main water resource which grown so much is desalinated water. Anyway, the figure removed since we rewrite the paragraph and it was not relevant anymore.

(Q1-6) Page 5 lines 19-20 what were the measured ADP3 concentrations in that experiment?

(A1-6) ADP3 was given as example of degradation product of AMX. The sentence on line 19-20 is refer to AMX again as example of known pharmaceutical that degrade spontaneously in the aqueous environment to different metabolites (one of them is ADP3), that not all of them are known but some of them stable and toxic. In the context of this example it didn't seems interesting to discuss the actual concentration.

(Q1-7) Page 8 lines 4-5 This is very important point and should be discussed in de-

tails maybe even as a separated section. Please provide proofs for toxic effects and contamination of soil and water resources.

(A1-7) Thank you for this remark. It is important and we broaden the discussion on this important point in the text and added relevant references (Page 6, lines 5-20).

(Q1-8) Page 8 lines 8-10 This is a problematic statement - the drug residues identity is often known based on section 2 and concentrations of known active compounds are very low at ug/L or below with no proof that they cause health problem. Does these facts justify legislation that require very expensive and labor intensive analysis?

(A1-8) The drug residues identity in the wastewater or effluent is not always known. If it wrongly misunderstood on section 2 it is rewritten on section 2 clearer now. It stated in the article that although the concentration is very low, it might be dangerous. Thank to your referee, we understand that it might misunderstand though we rewrote the whole paragraph, and add relevant references. These facts are scary although the concentrations are very low, since accumulation of different discrete concentrations, might ended with significant concentrations, so as presented in the text, it is unthinkable to ignore the problem and leave it out of legislation.

(Q1-9) Page 8 section 4 In this section there is a mixture of point sources or hot spots like hospitals or manufacturing facilities with concentration effluents which are very different from contamination of groundwater, soils or municipal/domestic wastewater or even agricultural wastewater that were mentioned earlier.

(A1-9) Paragraph 4 deals with the possible solutions for pharmaceutical residues removal. Some of the solutions fold in the point sources treatment, which makes it easier to deal with. Those point source, like municipal wastewater or hospital waster, both contribute to the contamination of groundwater, though I am not sure what did the reviewer meant with this remark.

(Q1-10) Page 9 lines 7-8 You need to prove that the OMP residuals harmful and which

specific elements are the problematic not the other way around.

(A1-10) Thank you for the comment. We rewrite the sentence and add reference that showed the harmful impacts on the environment. In the specific lines mention above, it is part of the authors opinion to give a summary of how we think about neglecting the problem, even though, the specific target is sometimes unknown.

(Q1-11) Throughout the text: authors use OMP, drugs and pharmaceuticals referring to the same group of materials – please unify the terms. Check sub and super scripts.

(A1-11) Thank you for the comment. In this article we focus on pharmaceutical residues, which derivate from OMPs or/and from drugs, and so change it along the article to be uniform.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2018-411/hess-2018-411-AC1-supplement.pdf

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