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Drinking Water
Engineering and Science
Discussions

Interactive comment on "Natural manganese deposits as catalyst for decomposing hydrogen peroxide" *by* A. H. Knol et al.

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Authors reply to comment of Mr. Pierre Le-Clech

Dear Mr. Le-Clech, Thank you for your comment on and suggestions for the manuscript. The authors agree that the manuscript will benefit from your comment and considerations. Hereafter we respond to your individual comment.

Abstract Avoid approximate expressions such as "more and more" Line 10: "were the same" than what?

P1, line 1: "more and more implement" is replaced by "(are intending to) implement".

P1, line 10: "were the same" is replaced by "were found equal".

Introduction: More reference needed to support the various claims (especially in the first few sentences) P2, line 24: Reference "(Houtman, 2010)" is added.

P2, line 25: Reference "(Wuijts et al., 2013)" is added

P10, The next reference is added: Wuijts, S., van der Grinten, E., Meijers, E., Bak-Eijsberg, C.I., Zwolsman, J.J.G, Impact of climate change on surface water as a resource for drinking water: From problem areas to measures, Dutch Ministry of Infrastructure and Environment, 2013.

Symbols need proper identification (p3, line 22)

P3, line 22: "$\Sigma\mu$Ñş [kG]" is replaced by "ΔH [kJmol-1]".

P3, line 23: "kG "is replaced by "kJmol-1".

Avoid terms like "apparently" (p4, line 3)

P4, line 3: "Apparently the reaction rate is increased as this alternative route has a lower activation energy than without the catalyst (Masel, 2001)"is replaced by "According to (Masel, 2001) the reaction rate is increased as this alternative route has a lower activation energy than without the catalyst".

More details information/background is needed to better (quicker) understand the nature/origin of the natural manganese deposits

P4, line 10: "However, it was known that dissolved manganese in surface and groundwater deposits as manganese oxide compounds on grains in sand filters" is replaced by: "However, it was known that dissolved manganese present in surface and groundwater forms, together with deposits from iron and calcium, manganese oxide deposits on the grains in the sand filters. These compounds cause an increase of the grain size with a lower purification performance as a result. In practice, the grains needs to be replaced after a certain lifetime, by fresh sand. Especially ground water may contain a high content of manganese, which may be makes the replaced grains suitable for

decomposing hydrogen peroxide."

Methods: It is not completely clear if the MCFgw have been practically used before their application in this study. If so, more details about their state need to be provided. Practically, how easy it would be to supply such similar materials on demand? "the first backwashing" is mentioned, but not information is given on that: why? How?

P5, line 11: "Three different catalysts were used: GAC and two types of manganese coated filter material" is replaced by: "Three different catalysts were investigated: fresh GAC and two types of used manganese coated filter material. The filter materials were collected from full-scale filters at drinking water treatment plants."

P5, line 15: "The first material was manganese coated filter material from a groundwater treatment plant (MCFgw), replaced at the end of the filter life time" is replaced by: "The first material was manganese coated filter material from a groundwater treatment plant (MCFgw). This filter material is regularly replaced as a result of the rapid growth of the grains." A sample is taken at the end of the filter life time of 7 years".

P5, line 18: "The MCFsw was collected from the double layer sand filters" is replaced by: "The MCFsw was collected from a double layer sand filter, with a filter life time of 31 years" .

P5, line 20: "During the first backwashing of MCFgw, a part of the coating was separated from the grains. This coating (MC) was also used as catalyst." is replaced by: "In order to clean the grains after filling the reactor, MCFgw was backwashed with water before the first tests. During backwashing, a part of the coating was separated from the grains and formed a top layer. This top layer of fine coating was removed from the reactor and also used as catalyst (MC)."

Results The authors could improve the readability of this section. E.g. Try to limit expression like "in one way or another", or obvious statement such as "slope of the lines is the value of r"

I am not sure all the proposed figures are needed. For example, Fig 7 does not directly target the decomposition phenomenon,and touch more on the practical operability of the system (another topic)..

P7, line 28: "The slope of the lines is the value of r." is removed.

P8, line 24: "Presumably, the adsorption of hydrogen peroxide on the catalyst was inadequate due to the increased expansion, see Fig. 7, which resulted in less catalyst surface in the same reactor height." is replaced by: "Presumably, the adsorption of hydrogen peroxide on the catalyst was inadequate due to the increased expansion of up to 170%, which resulted in less catalyst surface in the same reactor height."

P9, line 1: "In one way or another pelleting MC till a diameter of about 2mm would make higher flow velocities possible, and with that a smaller reactor footprint." Is replaced by: "Pelleting MC till a diameter of about 2mm would make higher flow velocities possible, and with that a smaller reactor footprint."

P19: Figure 7 is removed.

It would have been interesting to describe more in details the mechanisms/reasons behind those trends

The trends in Figure 5 were used to compare the rate of decomposition between the different catalysts. The results were earlier presented in Chapter 3 in graphs 1 till 4 and Table 2, where the reasons and mechanisms were discussed.

The small discrepancies due to upflow rates is also not probably significant enough to deserve a graph

Figure 6 shows that the particles of MC were too small to achieve a high up flow velocity, despite the high density of MC, necessary to limit the reactor footprint. Therefore the authors advise to pellet the MC, when applying for peroxide quenching. Up flow operation of a catalyst has the advantage that the hydraulic resistance cannot be increased by oxygen bubbles and suspended solids. This mode of operation makes a backwash

facility superfluous, and is therefore of interest for (water supplier) companies.

On behalf of the authors,

Antonie Knol

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