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Drinking Water Engineering and Science Discussions

Interactive comment on "Application of optical tomography in the study of discolouration in drinking water distribution systems" *by* P. van Thienen et al.

P. van Thienen et al.

peter.vanthienen@kwrwater.nl

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First, the authors would like to thank anonymous referee 2 for his/her review of and comments on the paper.

Our responses to the specific comments:

- P42, line 22-26: For fig 2b-e, it is mentioned that most light reaching the sensors follows the most direct route through the pipe and then four mechanisms are listed. Does the most direct route include these four mechanisms or only one of these? Please clarify.

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The most direct route includes all four. We have replaced the word 'respective' by 'subsequent' to clarify that the beam path is characterized by these four processes from LED to sensor:

"The other cases (Fig.2b-e), however, show that most light reaching the sensors follows the most direct route through the pipe, i.e. by subsequent refraction at the air-perspex, perspex-water, opposite water-perspex, and opposite perspex-air transitions, which is generally close to the imaginary line connecting LED and sensor."

- P48, line 25: the authors briefly discuss wet tests performed with the tomography device. However, these results are not very detailed. The authors should either remove this paragraph or present these results in a more detailed way. In fact, the latter would strengthen the manuscript.

We have expanded this section a little to better describe what was done, but admit that the description is still not very specific. If the referee and editor feel this somewhat expanded description is insufficient, we will remove it from the paper.

"In addition to these dry tests, wet tests have been performed with the tomography device fitted to a vertical piece of perspex pipe filled with water. Small amounts of coffee granules were dropped in the water by hand in different patterns, forming a sinking column of coffee particle suspension when dropped in a single location or a wider cloud when dropped over a larger area. Working in this way, it was difficult to control the exact location and shape of the particle clouds sinking through the beam field of the measurement device. However, the resulting tomograms were consistently in agreement with the visually observed location of the particle columns and clouds."

- P49, line 20: At the beginning of section 4.2, it is mentioned that several practical issues were come across and resolved during the test phase. The authors then mention that optical properties of particles are important: : : (line 20-23). However, it is not clear from the actual text how this issue was resolved. Or is this only an observation?

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The issue was resolved by the choice of testing material. We have added a phrase to stress this: "For this reason, a test material was selected which is dull and dark."

- P52, line 1: I would like the authors to discuss more about the impact of not considering light scattering and reflection by particles in the current model

We have included a discussion of the effects of the shortcomings of the applied optical model, including the effects of not considering scattering and reflection by particles:

"This would alleviate the following limitations of the current optical model: 1) In the current model, when particles which do significantly scatter and/or reflect light are studied, more light from a single source reaches all light sensors in varying amounts, depending on the particle distribution. The method tries to explain this in terms of the applied model, i.e. a smaller amount of light being blocked by particles on the modeled beam paths, meaning fewer particles in these paths. 2) When high particle concentrations are used, particles start to be in each other's shadows, more so on longer beam paths than on shorter paths. This results in a smaller amount of light intensity reduction for long beams (through the centre of the domain) per particle than for shorter beams (along the wall). As the optical model assumes equal light blocking for each particle regardless of the concentration, a uniform actual particle concentration throughout the domain would result in a tomogram with a somewhat higher light absorption coefficient along the walls than in the center. "

- Section 5 Conclusions: This section needs to be expanded to actually reflect the conclusions of the paper

Our original conclusion was that we have a promising method. We have added more specific conclusions:

"A method for studying particle processes in situ has been presented and tested. The following can be concluded:

- The mathematical framework presented here is suitable for obtaining meaningful

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images from light measurements.

- The technical implementation is capable of resolving semi-transparent objects in a test setting."

Interactive comment on Drink. Water Eng. Sci. Discuss., 4, 39, 2011.