

## ***Interactive comment on “Biodegradation by bacteria in clouds: An underestimated sink for some organics in the atmospheric multiphase system” by Amina Khaled et al.***

### **Anonymous Referee #1**

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This work investigated biodegradation of bacteria in clouds with aqueous-phase modeling, demonstrating that biodegradation might be most efficient for volatile organic compounds with intermediate solubility. Most of current atmospheric models do not treat biodegradation by bacteria and this study suggests its potential importance for some cases. I found that the manuscript is well-written: motivation is clear, the methods are mostly described thoroughly, results and discussions are discussed well with many sensitivity studies, model analysis is comprehensive, and conclusions are justified. With that said, I am happy to support publication in ACP after the below comments are considered and implemented.

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- Throughout the manuscript I found terminology of VOC vs. NVOOC somewhat confusing. It seems that you categorize compounds based on solubility ( $K_H$ ) but not with vapor pressures (no vapor pressures are given for treated compounds). For organic aerosol research, VOC is often used for compounds mostly in the gas phase, while NVOOC for compounds mostly in the condensed phase. As you know, compounds which may exist both phases comparably are termed semi-volatile organic compounds (SVOC), so most compounds treated in this study appear better termed as SVOC. Some more clarifications with clear definition would help improve presentation quality.

- It was not clear to me how you treat phase transfer in your model. It is just simply stated that it is based on the resistance model (P3), but unclear how exactly you treat (Fuchs-Sutugin correction?) and what values you use for critical parameters such as gas diffusivity and mass accommodation coefficient.

- I wonder what is cell viability and how long bacteria would survive in cloud droplets. Would this be something should be discussed and considered in the model with some sensitivity studies? Cloud droplets contain oxidants (e.g., OH, H<sub>2</sub>O<sub>2</sub>, etc.), so I wonder if they experience oxidative stress and eventually degraded? In other words, would  $k_{\text{bact}}$  be time-dependent?

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