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Modeling biodegradability of dissolved organic matter using a beta-distribution

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We followed a long-term (up to 500 d) microbial degradation of DOC from lake water. The dynamics of biodegradation was described by first order kinetics and a Bayesian decay model. The simplest first-order decay model had a constant decomposition rate for whole pool of DOC. The second first-order model included three pools: two decomposing pools of DOC (labile and semilabile) and a non-decomposing refractory pool of DOC. The Bayesian model assumed that the biodegradability of DOC was distributed according to a beta-distribution. The first-order model with one DOC-pool described the observed biodegradation dynamics poorly. The three-pool model had good fit to the data, but defined 75% of DOC into non-degradable pool. The beta-distribution model fitted to the data as well as the second first-order model. In beta-distribution model all DOC is potentially biodegradable, which allows the extrapolation of decomposition beyond the time of bioassay. In a closer examination, the three pool model seems to be a special case of the more general beta-distribution model. The beta-distribution model presented in this study has an excellent fit for description of long-term biodegradation allowing extrapolations of biodegradation beyond the observed times of bioassays and thus improves our understanding about the biodegradability of recalcitrant organic matter.