Microcalorimetric investigation of lambda prophage induction using mitomycin C

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Bacteriophages are viruses infecting bacteria. They can be virulent and lyse bacteria directly after infection or they can be temperate and integrate their DNA into the bacterial chromosome (so called prophage) and survive. These prophages undergo a symbiotic strong relationship. They are passed to the next generations of cells but can presumably be activated to cause phage propagation and cell burst by several chemicals and UV light in lab cultures but also in the environment. Therefore, prophages could be called molecular time bombs [1] on one hand side. On the other hand side, evidences are piling up, that's the coevolution of prophages and their hosts have led to positive effects for the host, e.g. by horizontal phage mediated gene transfer. Real time monitoring devices are needed to clarify the role of prophages in pure cultures and microbial communities.

Calorimetry was proven to provide real-time insights into the activation of prophage propagation [2]. The applied fermentation calorimetry that allows a combination of mass and energy balances provides a coherent picture of the infection process. Unfortunately, fermentation calorimetry is too laborious and too complicate to allow a fast screening of different chemicals as potential detonators of the molecular time bomb. Chip calorimetry is well suited for monitoring metabolic reactions on phage infections however it does not allow combining mass and energy balances [3]. For these reasons, we try here for the first time to develop isothermal microcalorimetry and isothermal titration calorimetry as monitoring tools for activation of silent viral infections. We want to explore, how much information is at least necessary to characterize the calorimetric curve in terms of the infection process. For that purpose, the infection processes were thermokinetically modelled.

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