

Determination of scale parameters in shaken bioreactors

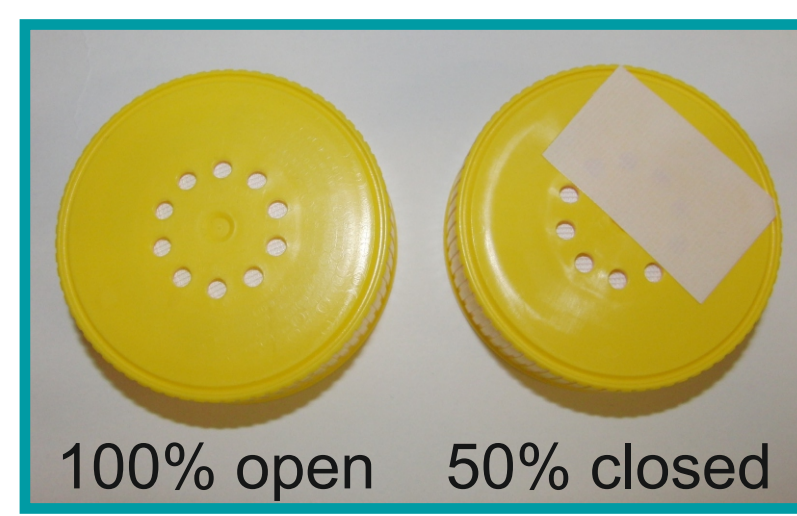
Orbital shaking technology has been widely used in biotechnology because it offers ease-of-use, increased flexibility and reduced costs. Recently, orbital shaken bioreactors of capacities from 1mL - 1000L have been employed for cultivation of mammalian cells and are expected to become attractive alternatives to conventional stirred-tank bioreactors. To carry out a scale up fundamental parameters such as the oxygen transfer rate (OTR) and aeration rate have to be known. Therefore commonly used disposable shaken bioreactors in sizes from 50mL to 2L were characterised.

Specific Aeration Rate (VVM)

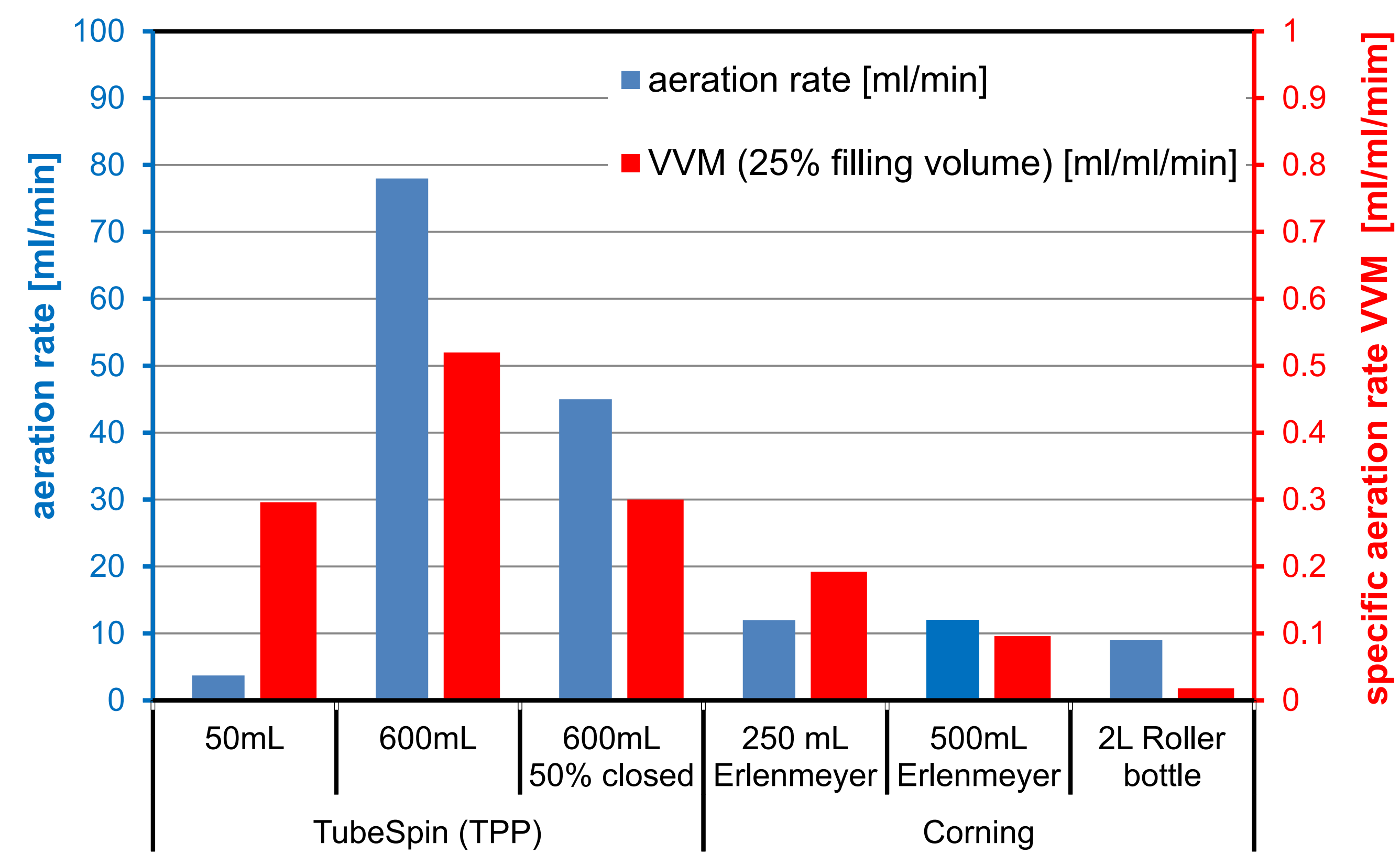
The specific aeration rate is an important scale up factor in the removal of volatile compounds like ethanol and CO₂. The aeration rate was determined by measuring the evaporation rate (Anderlei et al. 2002). The graph shows that the aeration rate varies depending on the type of shaken bioreactor. To keep a constant value within the shaken bioreactors the user has to adjust the liquid volume or, if using the Tubespin, close a certain number of cap holes with sticky tape (De Jesus et al., 2004).



ISF1-X, KUHNER, CH

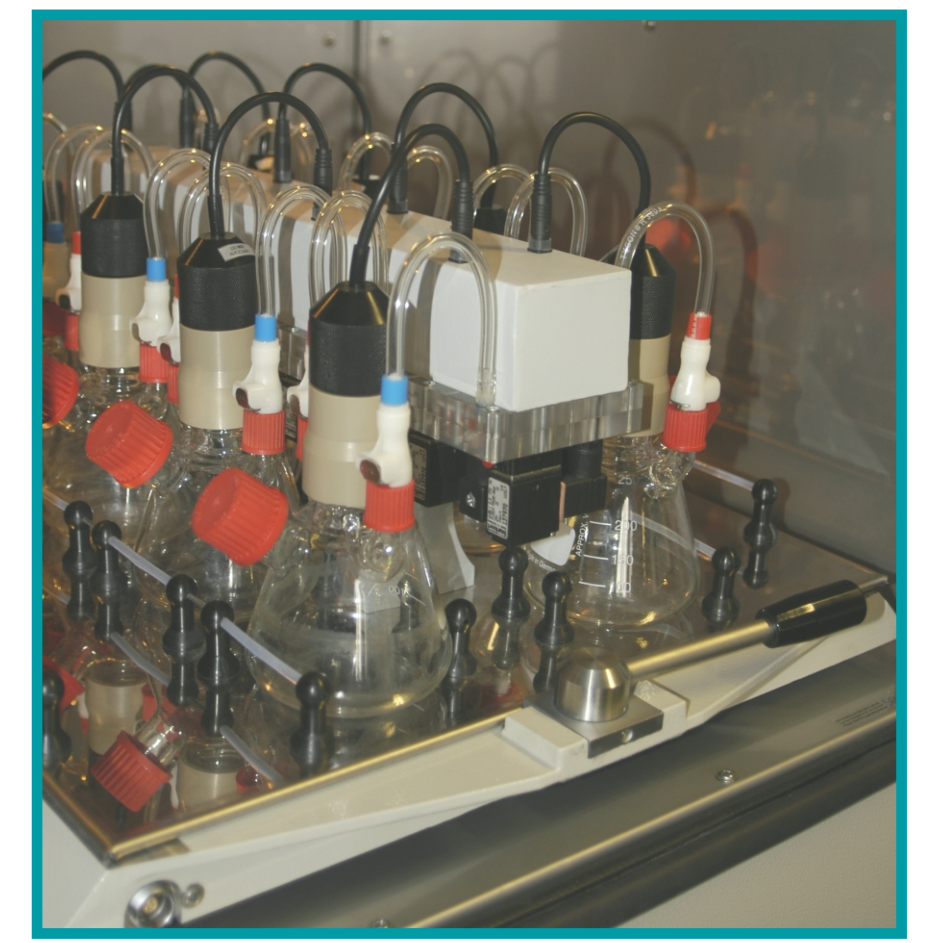
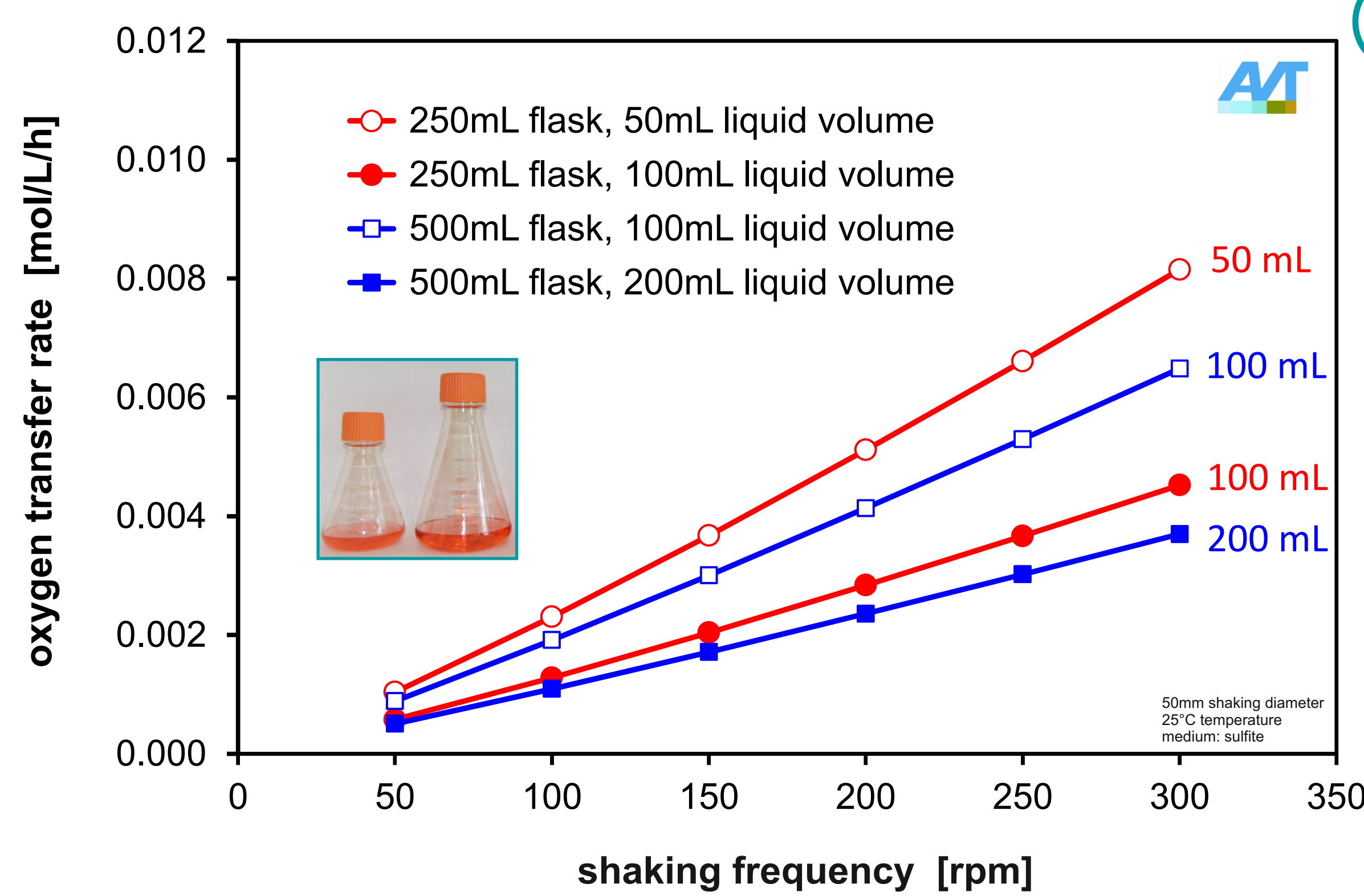
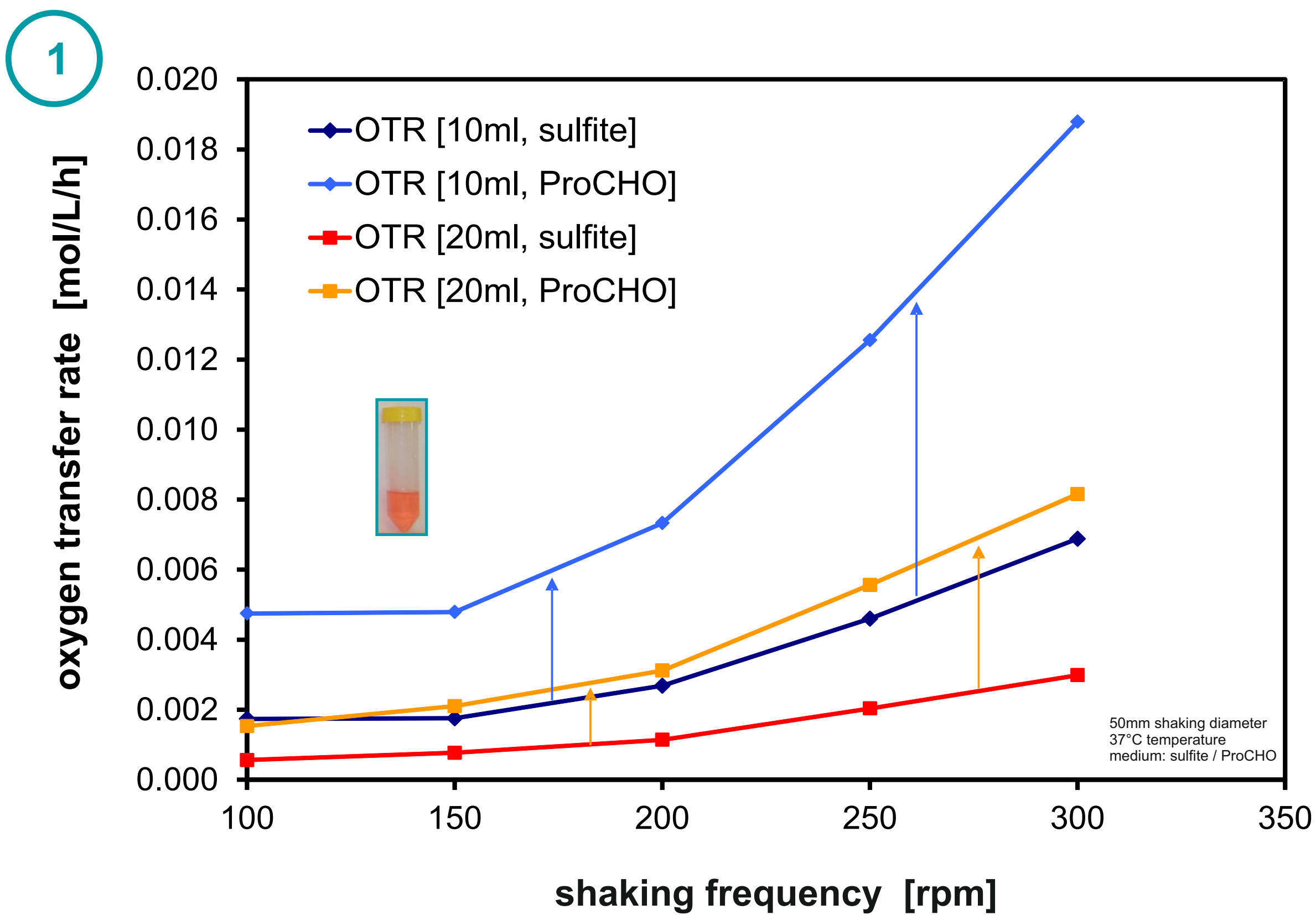


TubeSpin 600, TPP, CH

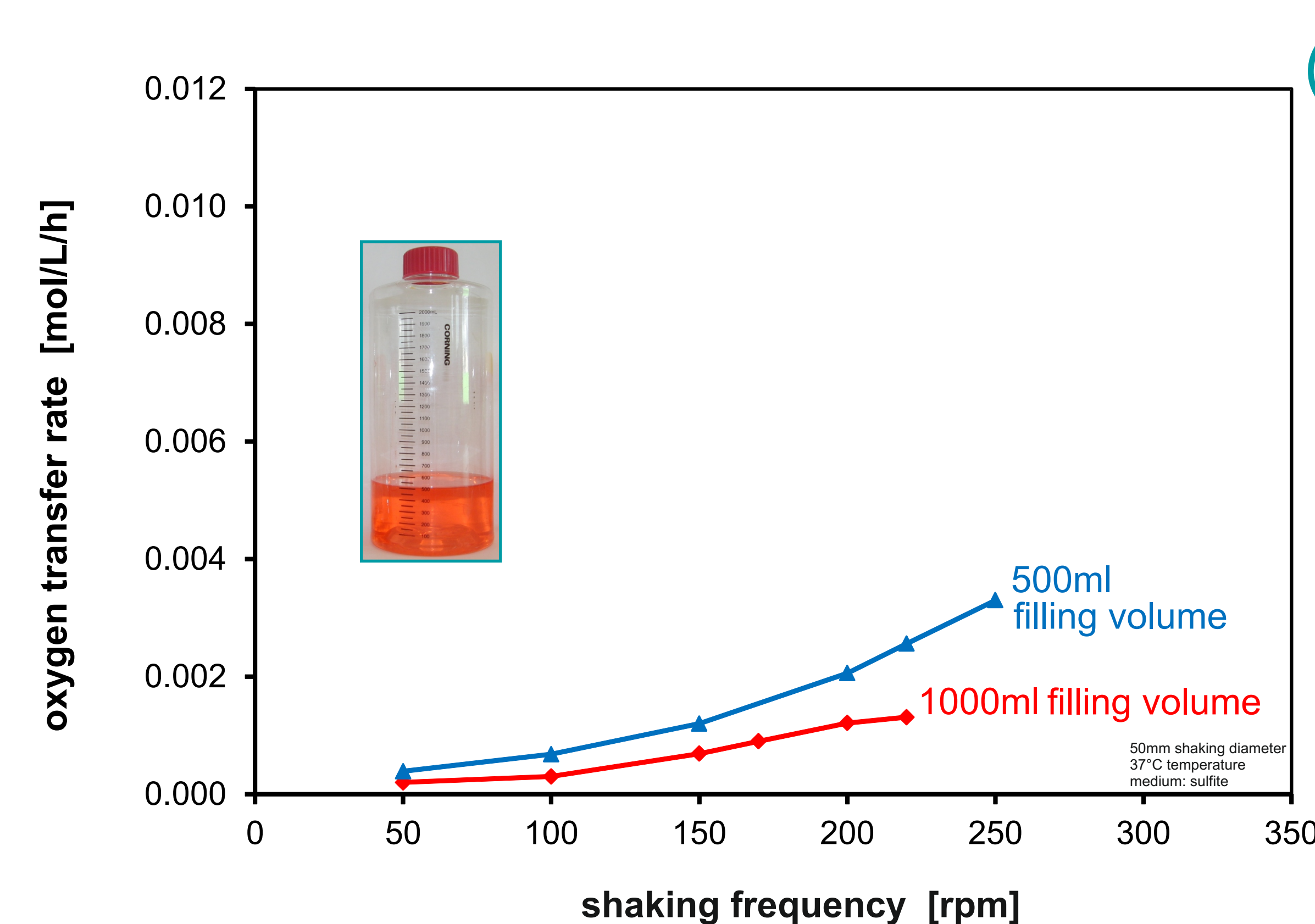
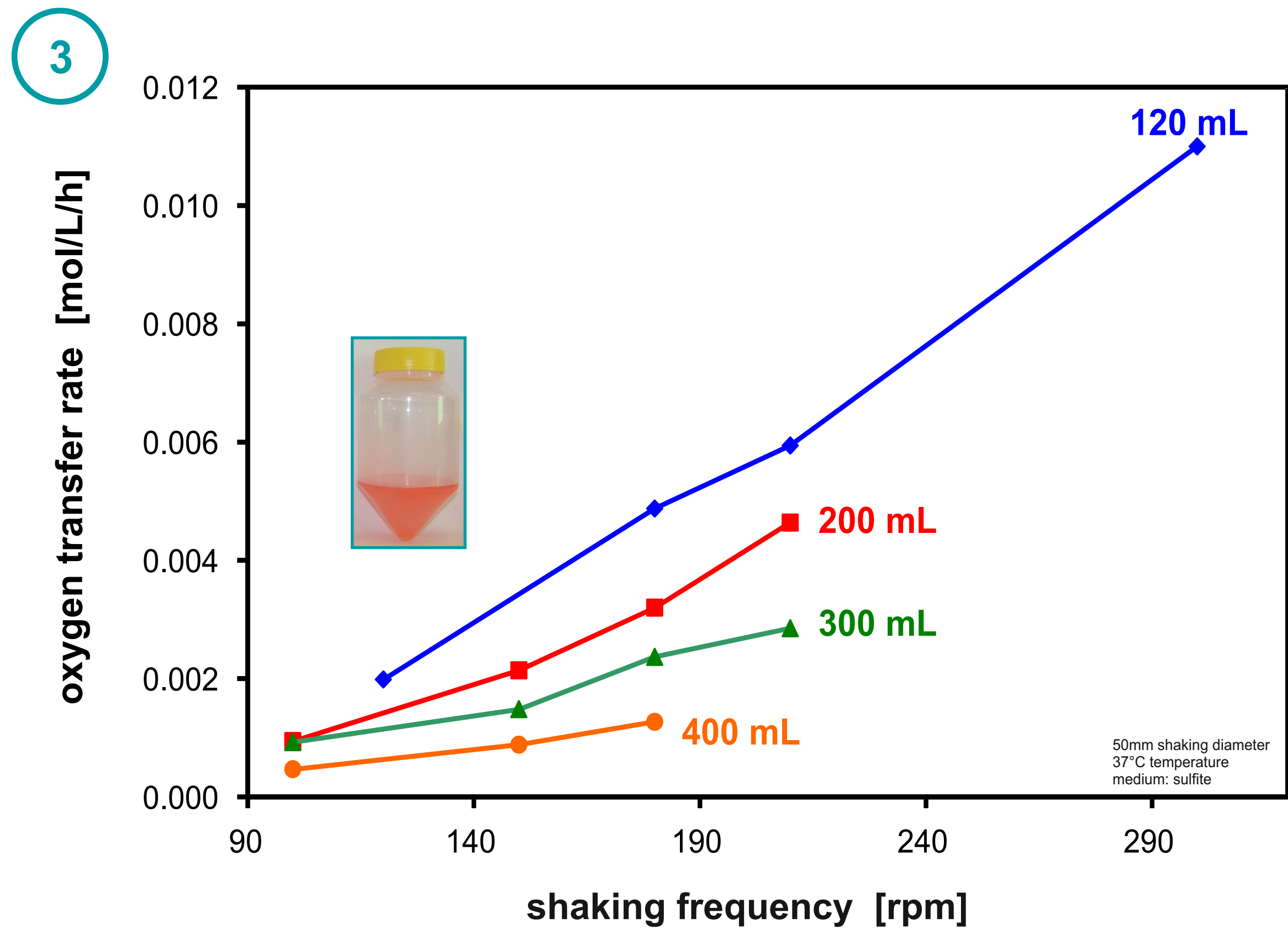


Oxygen Transfer Rate (OTR)

The OTR is one of the most important scale up factors. In order to standardize the results of the different shaken bioreactors a sulfite system (1M) was applied. To transfer the results to real cultivation medium (eg. ProCHO medium, figure 1) a correlation factor of 2.7 was determined. All measurements were carried out with the online measuring tool RAMOS (Maier et al., 2004). The OTR depends on the type of shaken bioreactor, shaking diameter, shaking speed and filling volume. In practice the user can adjust the shaking speed, shaking diameter and the liquid volume to achieve comparable OTRs in shaken bioreactors.



RAMOS, KUHNER, CH



adapted (RAMOS) and standard TubeSpin

Literature:
 New method to determine the mass transfer resistance of sterile closures for shaken bioreactors T. Anderlei; C. Mrotzek; S. Bartsch; G. Amoabediny; C. P. Peter; J. Buechs, Biotechnology and Bioengineering; 2007
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