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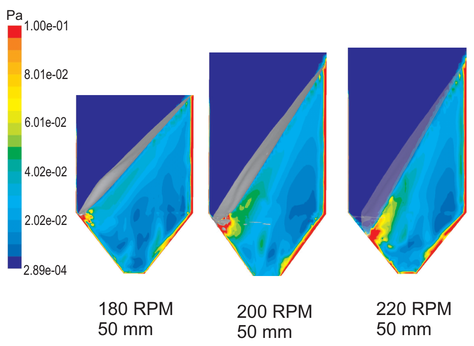
# Shaken bioreactors in the field of cell cultivation

Orbital shaking technology has been widely used in the biotechnological field because of easy-of-use, increased flexibility and reduced costs. Recently, orbital shaken bioreactors of scales from mL - 1000L have been employed for cultivation of mammalian cells and are expected to become attractive alternatives to conventional stirred-tank bioreactors. To meet the need of developing a mature bioreactor system, extensive investigations, including simulations using Computational Fluid Dynamics (CFD), are underway to better understand the special engineering properties resulted from orbital shaking.


## Good Scalability:

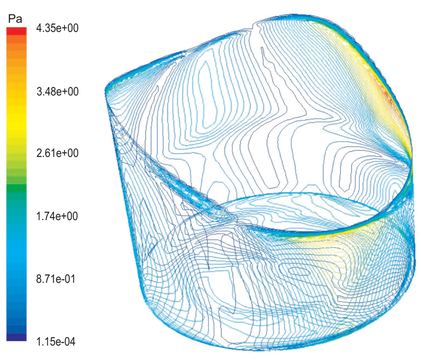
+ same hydrodynamic
+ surface aeration
+ calculable
+ no foam
+ no bubbles

**20mL**

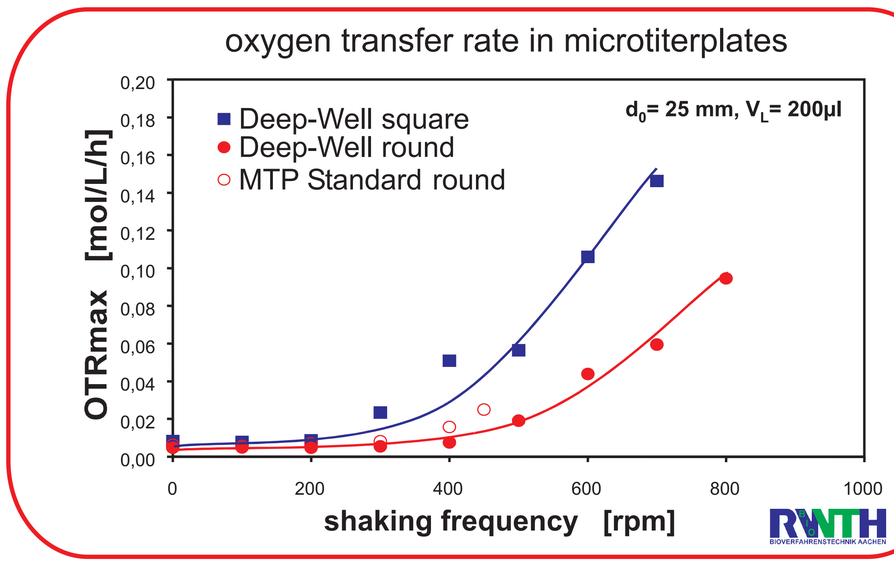



Shear stress is two logs below cell damage

**12L**

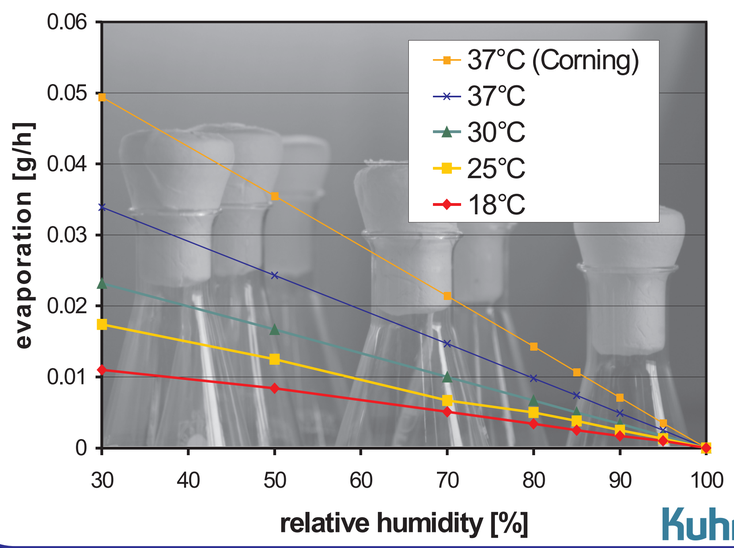



30-L cylinder, working volume 12L, shaking speed 80 rpm

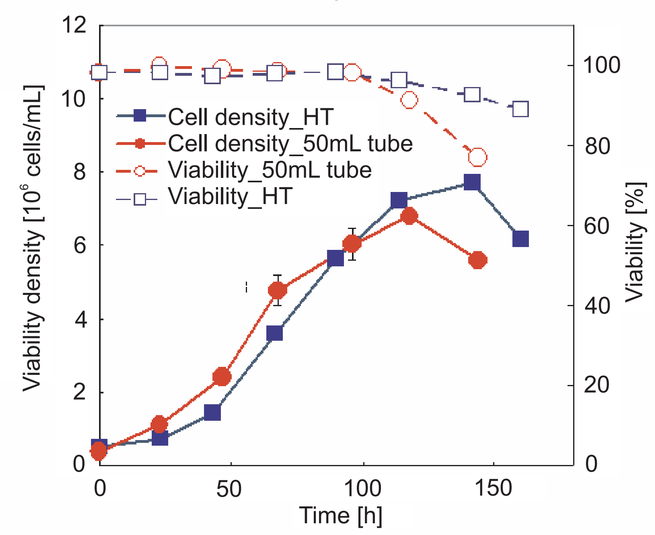



| parameter | small scale | large scale | optimisation |
|---|---|---|---|
| shear stress | low | low | none |
| evaporation | high | low | humidified environment |
| aeration | high | middle | oxygen enriched air<br>helical track |

Evaporation: 250mL narrow necked shake flask




Comparison: 50mL tube and 55L cylindrical vessel with helical track

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