



VOLUMETRIC OXYGEN TRANSFER COEFFICIENT'S COMPARISON BETWEEN DIDACTIC AND COMMERCIAL BIOREACTORS

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Introduction. A bioreactor is a container that provides desirable conditions for biochemical reactions, these equipments are used in many biotechnological operations and its use is essential. Bioreactors are expensive due to measurement and control needs of the operating conditions¹. In aerobic processes, oxygen is a key substrate due to its low solubility in medium even water and it has to be supplied continuously^{2 3}. Oxygen transfer rate has to be known in order to predict the best behavior and performance¹.

The aim of this work is to compare the volumetric oxygen transfer coefficient (k_La) between commercial and bioreactors constructed by students of UP-Puebla

Methods. Three bioreactors were built by students of UP-Puebla (didactic reactors) with a glass container of 1 l. The commercial bioreactor and the three didactic were provided of aeration, agitation and temperature. Indirect Dynamic method of oxygen desorption was used in order to determine the k_La ³, oxygen dissolved in distilled water was measured at 20 °C with an electrode Metler-Toledo M300. Desorption was provoked by supply of nitrogen³. Two aeration and two agitation conditions were used 1.33 and 2.66 vvm, 600 and 800 rpm, respectively.

Results. The behavior of desorption and absorption oxygen are shown in Figure 1 (oxygen dissolved concentration (%) vs. time) for the three bioreactor with the different conditions. Typical behavior was observed.

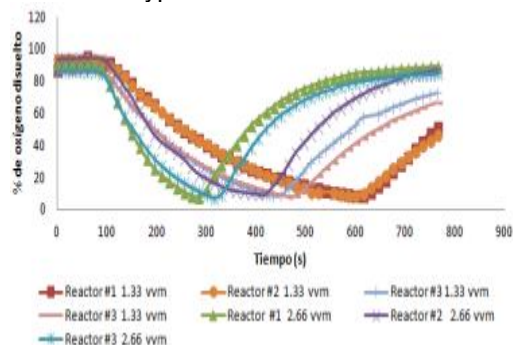


Figure 1 Desorption and absorption behavior of the bioreactors at different conditions.

Table 1. k_La (h^{-1}) Values in the bioreactors at different conditions

Reactor	1.3 vvm		2.6 vvm	
	600	800	600	800
Commercial	20.19	25.02	-	-
Didactic 1	17.70	20.09	43.13	42.43
Didactic 2	17.60	19.03	27.45	34.07
Didactic 3	24.18	22.52	37.78	42.21

Statistical testing ANOVA one way was applied using MATLAB, k_La values were compared at different conditions. Table 2. P-value 0.2145 indicates that hypothesis null has to be rejected, and hypothesis alternative will be accepted, so didactic and commercial reactors develop the same performance and there's no difference between reactors when the same conditions are used.

Table 2. ANOVA one way results in MATLAB software

Source	SS	df	MS	F	Prob>F
Columns	3.425e-006	3	1.14167e-006	2.34	0.2145
Error	1.95e-006	4	4.875e-007		
Total	5.375e-006	7			

Conclusions. Commercial bioreactors are expensive and the student hardly ever handle them, so this work shows that didactic built bioreactors have similar volumetric oxygen transfer coefficient (k_La) of commercial bioreactor. There aren't k_La affectations between different reactors ($P > 0.005$). So, students can use the didactic bioreactors to carry out fermentations and understand the hydrodynamic behavior, with the same performance that a commercial reactor.

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