

Leksawasdi (2004) investigated the subsequent biotransformation experiment on a two phase emulsion system using partially purified PDC extracted from *C. utilis* UNSW 709400 with 1.55 M benzaldehyde and 1.83 M pyruvate as substrates. The aqueous phase contained various type of buffers (2.5 M 3-[N-morpholino] propanesulfonic acid (MOPS), 20 mM MOPS, and 20 mM MOPS + 2.5 DPG). The experiment was carried out at 4°C with pH control at 7.0 (shown in Table 2.18). The results showed that the application of partially purified PDC extracted from *C. utilis* UNSW 709400 in 20 mM MOPS and 2.5 M DPG could produce the similar level of average PAC concentration (1.01 M in organic phase and 115 mM in aqueous phase) the standard errors were not given) to the system with a more expensive 2.5 M MOPS buffer.

Table 2.18 PAC production for a two phases emulsion system from partially purified PDC extracted of *C. utilis* UNSW 709400 with the aqueous phase contained various type of buffers

Researcher team	Buffer	Results
Leksawasdi (2004)	1. 2.5 M MOPS 2. 20 mM MOPS 3. 20 mM MOPS + 2.5 DPG	The application of the partially purified PDC extracted from <i>C. utilis</i> UNSW 709400 with 20 mM MOPS and 2.5 M DPG could produce the similar level of average PAC concentration (1.01 M in organic phase and 115 mM in aqueous phase) to the system with a more expensive 2.5 M MOPS buffer.

Rosche *et al.* (2005) performed the biotransformation study on a two phase emulsion system with 1.44 M benzaldehyde and 1.43 M pyruvate as substrates in 2.5 M MOPS buffer at 21°C using *C. utilis* UNSW 709400 PDC in the form of resting cells as summarised in Table 2.19. The results showed that the application of resting cells from *C. utilis* UNSW 709400 could produce the average PAC concentration level of 386 mM (standard error was not reported).

Table 2.19 PAC production for a two phases emulsion system from resting cells of *C. utilis* UNSW 709400

Researcher team	Type of PDC preparation	Results
Rosche <i>et al.</i> (2005)	resting cells	The application of the resting cells of <i>C. utilis</i> UNSW 709400 could produce the average PAC concentration level at 386 mM (standard error was not reported).

Gunawan (2006) investigated the two phase emulsion biotransformation system with 3.6 M benzaldehyde and 0.785 M pyruvate as substrates in a 20 mM MOPS buffer mixed with 2.5 M DPG at 20°C using pH control at 7.0. Two types of PDC preparation were employed as biocatalysts for PAC production, which were whole cells and partially purified PDC from *C. utilis* UNSW 709400 as shown in Table 2.20. The results showed that the application of whole cells from *C. utilis* UNSW 709400 could produce higher level of average PAC concentration than partially purified PDC.

Table 2.20 PAC production for a two phases emulsion system from whole cells and partially purified PDC of *C. utilis* UNSW 709400

Researcher team	Type of PDC preparation	Results
Gunawan (2006)	resting cells	The application of the whole cells of <i>C. utilis</i> UNSW 709400 could produce the highest average PAC concentration in both phases of 172 mM (standard error was not reported).

Satianegara (2006) investigated the two phase emulsion biotransformation system using whole cells of *C. utilis* UNSW 709400 with 1.7 M benzaldehyde and 1.4 M pyruvate as substrates in 2.5 M MOPS buffer at 21°C with/without pH control at 6.5 as shown in Table 2.21. The results showed that the application of whole cells from *C. utilis* UNSW 709400 with and without pH control could produce the similar level of average PAC concentration of 400 mM (standard error was not reported).

Table 2.21 PAC production for a two phases emulsion system from whole cells of *C. utilis* UNSW 709400 with/without pH control

Researcher team	Conditons	Results
Satianegara (2006)	<ol style="list-style-type: none"> 1. pH control 2. No pH control 	The application of the whole cells of <i>C. utilis</i> UNSW 709400 with and without pH control could produce the average PAC concentration in both phases at the similar level of 400 mM (standard error was not reported).