

Table 1
Highest cell densities by various propagation techniques of *E. coli*

Propagation technique	Basic medium	C source	Yield; g dcw/l	Reference
<i>Fed batch</i>				
1. Exponential growth	Semi-defined Medium yeast Extract	Glucose	54	Shiloach and Bauer, 1975
2. Carbon source defended linear growth	Defined Minimal medium	Solid glucose	134	Neidhardt et al., 1974; Matsui et al., 1989
	Defined Minimal medium	Glucose	104	Riesenbergs et al., 1990
	Defined Minimal medium	Citric acid	148	Korz et al., 1995
	Defined Minimal medium	Glycerol	128	
	Protein hydrolyzate and yeast extract	Glycerol	84	Macaloney et al., 1996
3. Slow linear growth to keep acetate concentration close to zero	Defined minimal medium	Low glucose Glycerol	145	Horn et al., 1996
<i>Dialysis</i>				
1. Membrane dialysis reactor	Against complete growth medium	Glycerol	174	Märkl et al., 1993
2. "Nutrient-split" feeding	Against basal medium Against buffer salt solution	Glycerol Separate glycerol feeding	190 150	Nakano et al., 1997 Ogbonna and Märkl, 1993

Horn U, Strittmatter W, Krebber A, Knupfer U, Kujau M, Wenderoth R, et al. High volumetric yields of functional dimeric miniantibodies in *Escherichia coli*, using an optimized expression vector and high-cell-density fermentation under non-limited growth conditions. *Appl Microbiol Biotechnol* 1996;46:524–32.

Korz DJ, Rinas U, Hellmuth K, Sanders EA, Deckwer WD. Simple fed-batch technique for high cell density cultivation of *Escherichia coli*. *J Biotechnol* 1995;39:59–65.

Macaloney G, Draper I, Preston J, Anderson KB, Rollins MJ, Thompson BG, et al. At-line control and fault analysis in an industrial high cell density *Escherichia coli* fermentation, using NIR spectroscopy. *Trans Inst Chem Eng* 1996;74:212–20.

Märkl H, Zenneck C, Dubach ACH, Ogbonna JC. Cultivation of *Escherichia coli* to high cell densities in a dialysis reactor. *Appl Microbiol Biotechnol* 1993;39:48–52.

Matsui T, Yokota H, Sato S, Mukataka S, Takahashi J. Pressurized culture of *Escherichia coli* for a high concentration. *Agric Biol Chem* 1989;53:2115–20.

Nakano K, Rischke M, Sato S, Märkl H. Influence of acetic acid on the growth of *Escherichia coli* K12 during high-cell-density cultivation in a dialysis reactor. *Appl Microbiol Biotechnol* 1997;48:597–601.

Neidhardt FC, Bloch PL, Smith DF. Culture medium for enterobacteria. *J Bacteriol* 1974;119:736–47.

Ogbonna JC, Märkl H. Nutrient split feeding strategy for dialysis cultivation of *Escherichia coli*. *Biotechnol Bioeng* 1993;41:1092–100.

Riesenbergs D, Menzel K, Schulz V, Schumann K, Veith G, Zuber G, et al. High cell density fermentation of recombinant *Escherichia coli* expressing human interferon alpha-1. *Appl Microbiol Biotechnol* 1990; 34:77–82.

Shiloach J, Bauer S. High yield growth of *E. coli* at different temperatures in a bench scale fermentor. *Biotechnol Bioeng* 1975;17:227–39.