FIG. 1

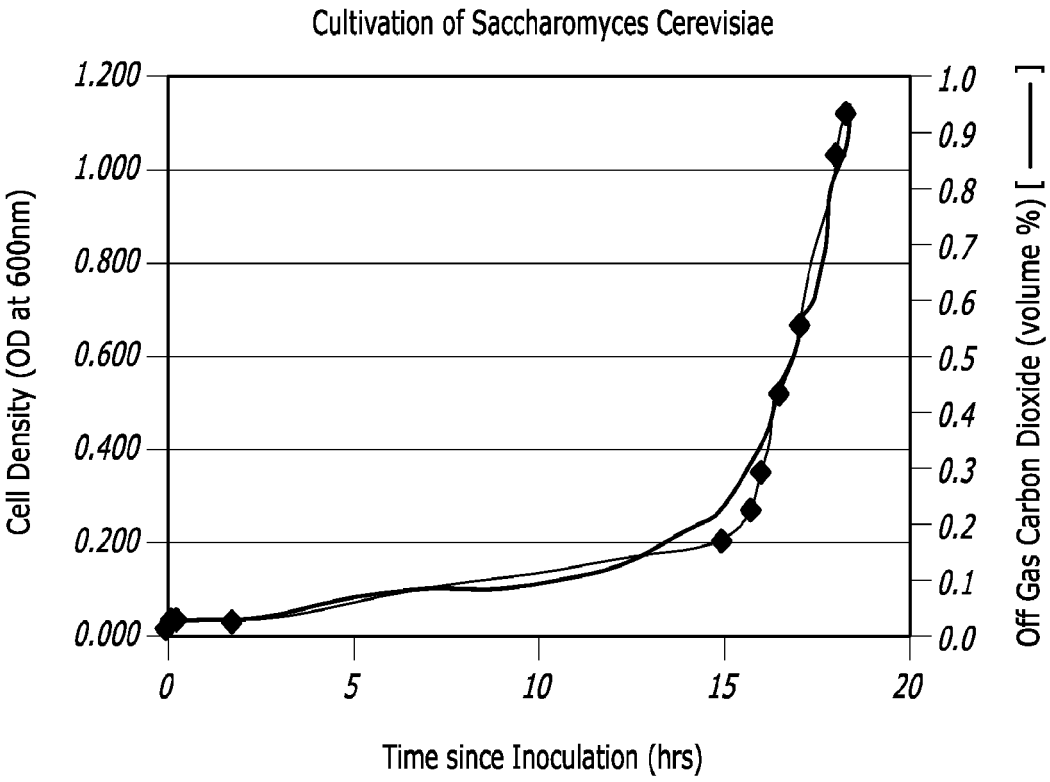

Cultivation of Saccharomyces Cerevisiae
Cell Density (OD at 600nm)
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Off Gas Carbon Dioxide (volume %) [——]
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
5
10
15
20
Time since Inoculation (hrs)

FIG. 2

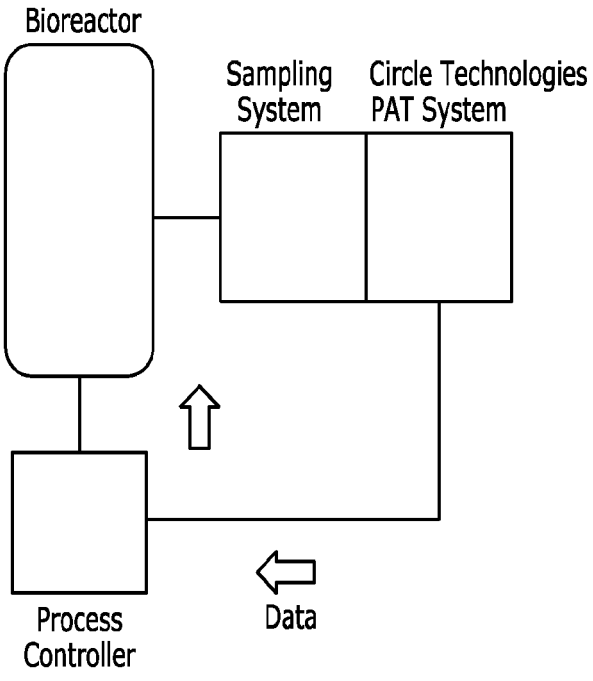

Bioreactor
Sampling System
Circle Technologies PAT System
Process Controller
Data

Fig. 3

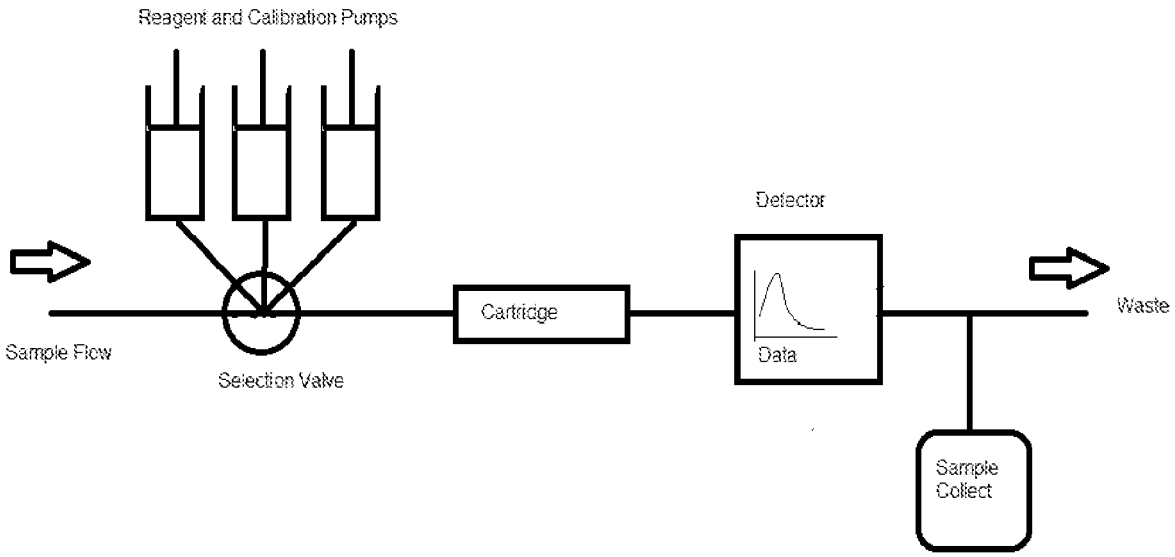

Reagent and Calibration Pumps
Detector
Cartridge
Waste
Sample Flow
Selection Valve
Data
Sample
Collect

Fig. 4

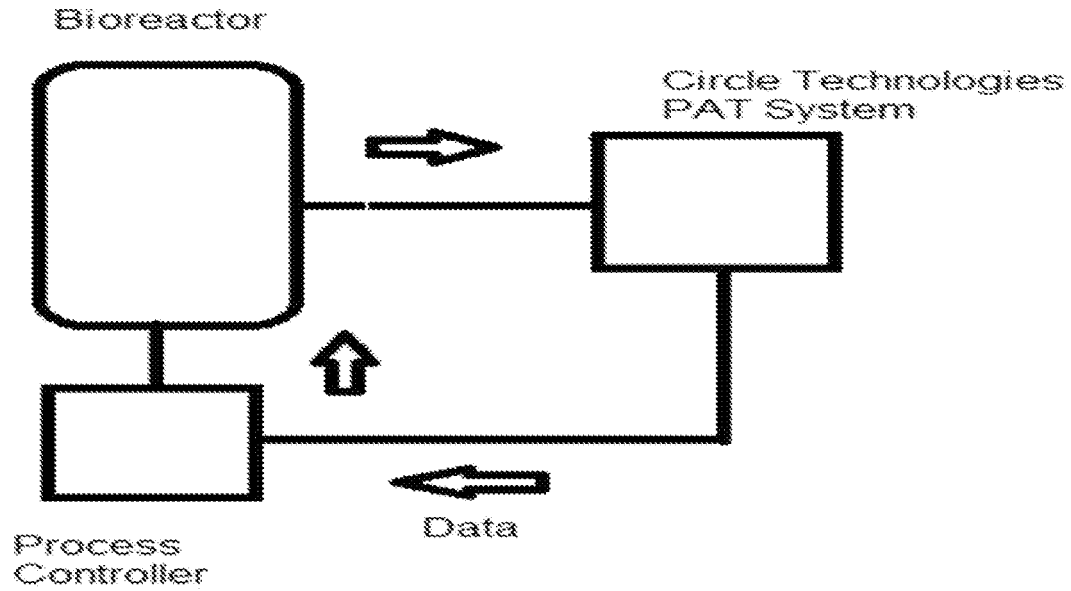

Bioreactor
Circle Technologies
PAT System
Data
Process
Controller

Fig. 5

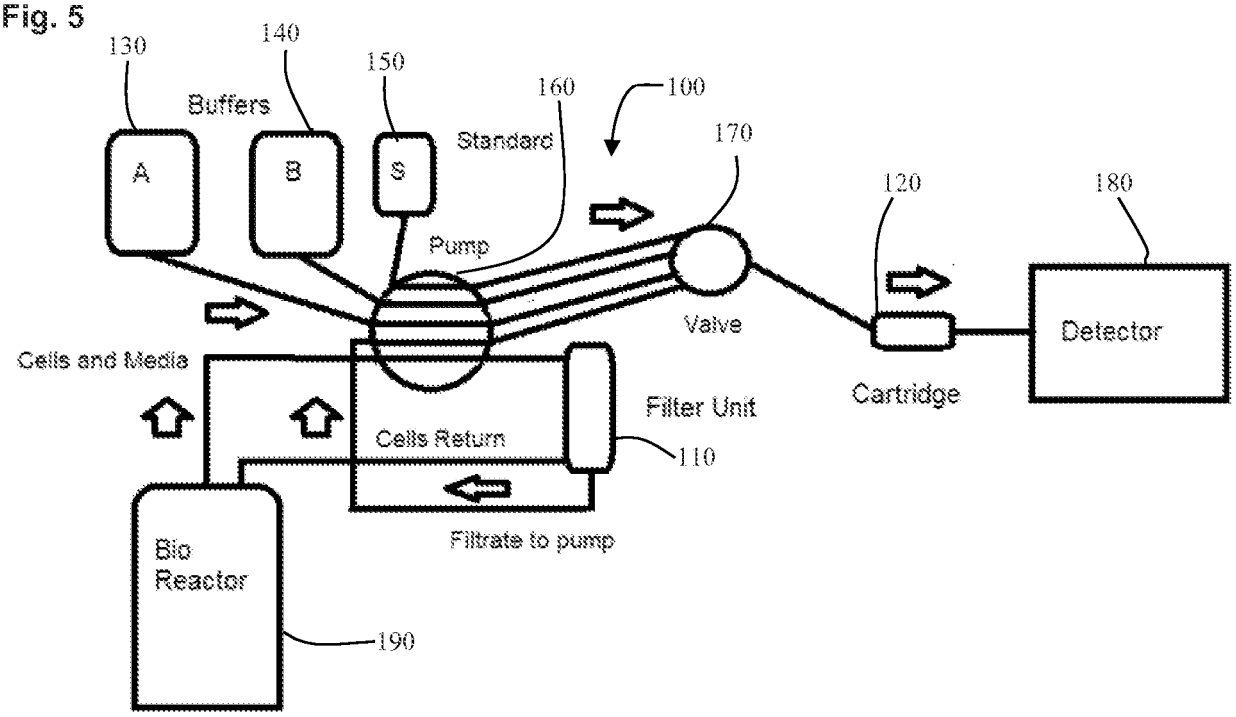

130
140
150
160
100
170
120
180
Buffers
A
B
S
Standard
Pump
Valve
Detector
Cartridge
Cells and Media
Filter Unit
Cells Return
110
Filtrate to pump
Bio Reactor
190

Fig 6.

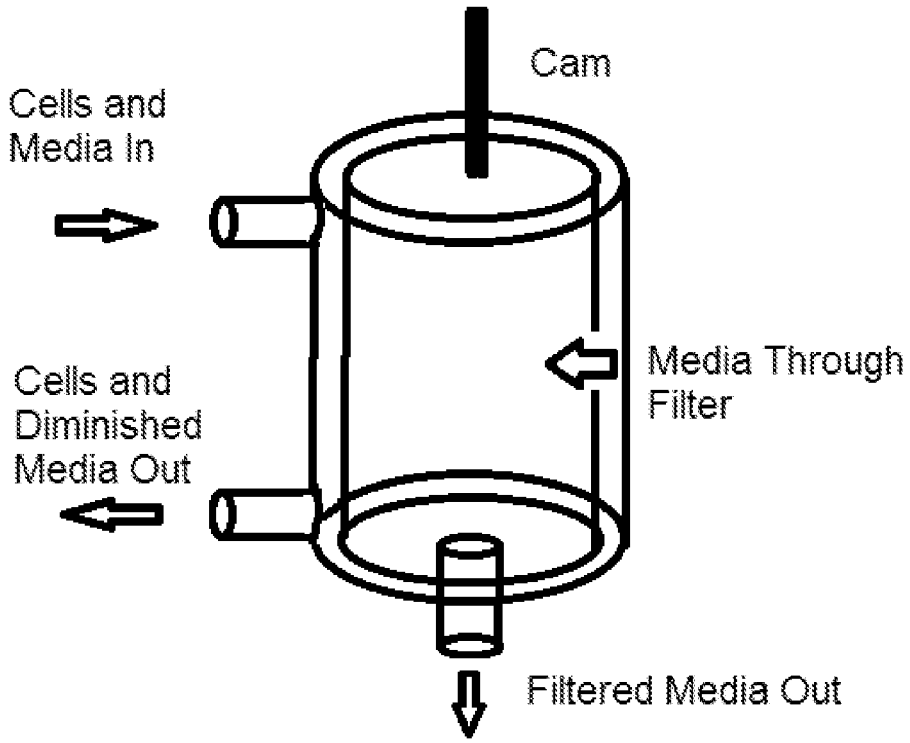

Cam
Cells and Media In
Media Through Filter
Cells and Diminished Media Out
Filtered Media Out

FIG. 7

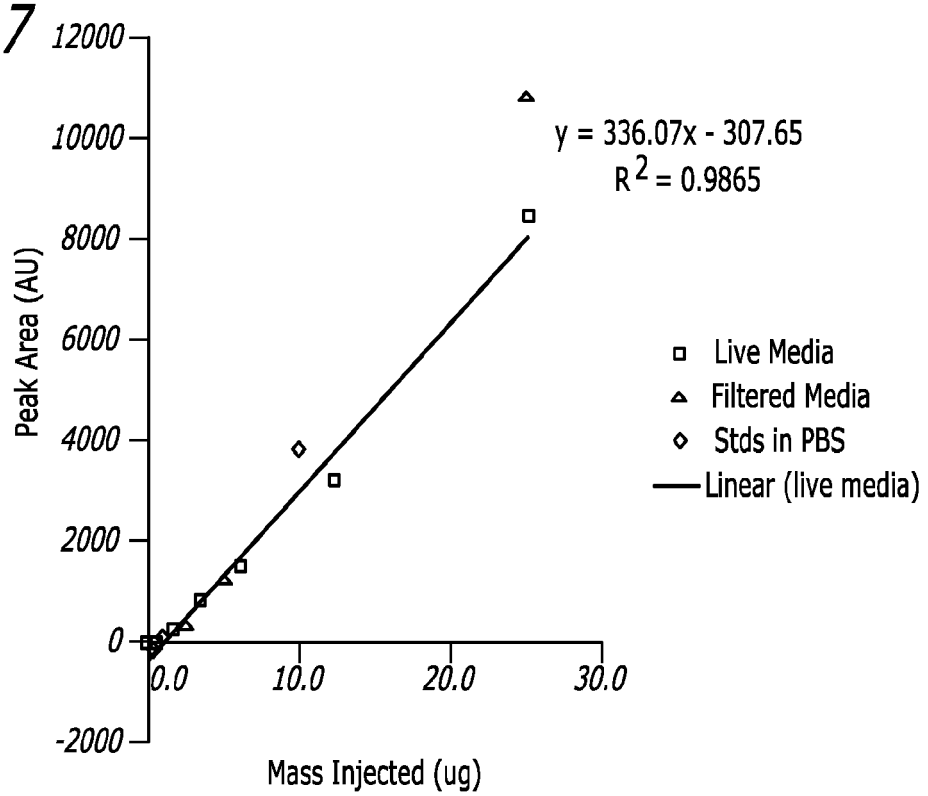

12000
10000
8000
6000
4000
2000
0
-2000
Peak Area (AU)
0.0
10.0
20.0
30.0
Mass Injected (ug)
y = 336.07x - 307.65
R 2 = 0.9865
Live Media
Filtered Media
Stds in PBS
Linear (live media)

FIG. 8

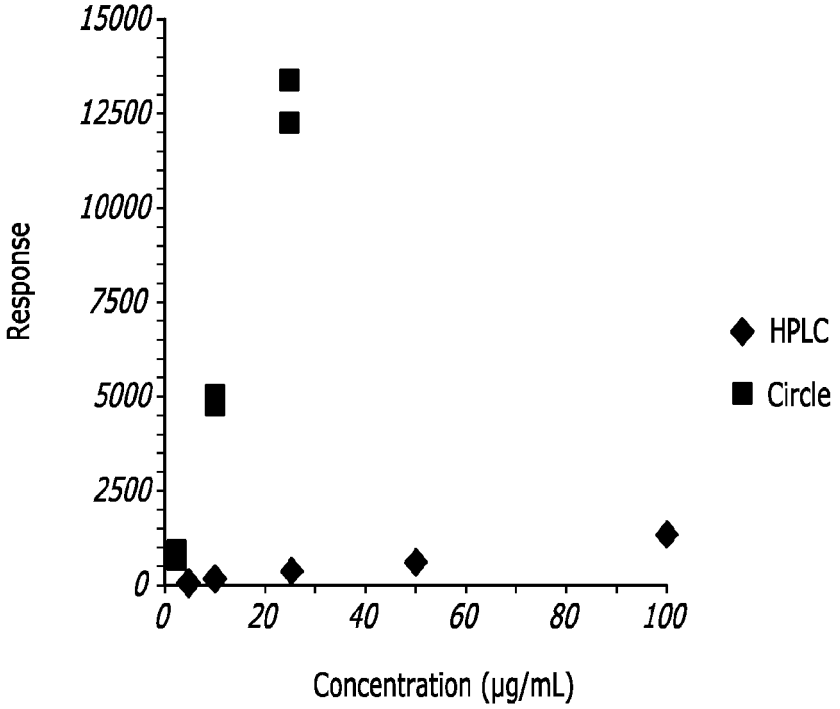
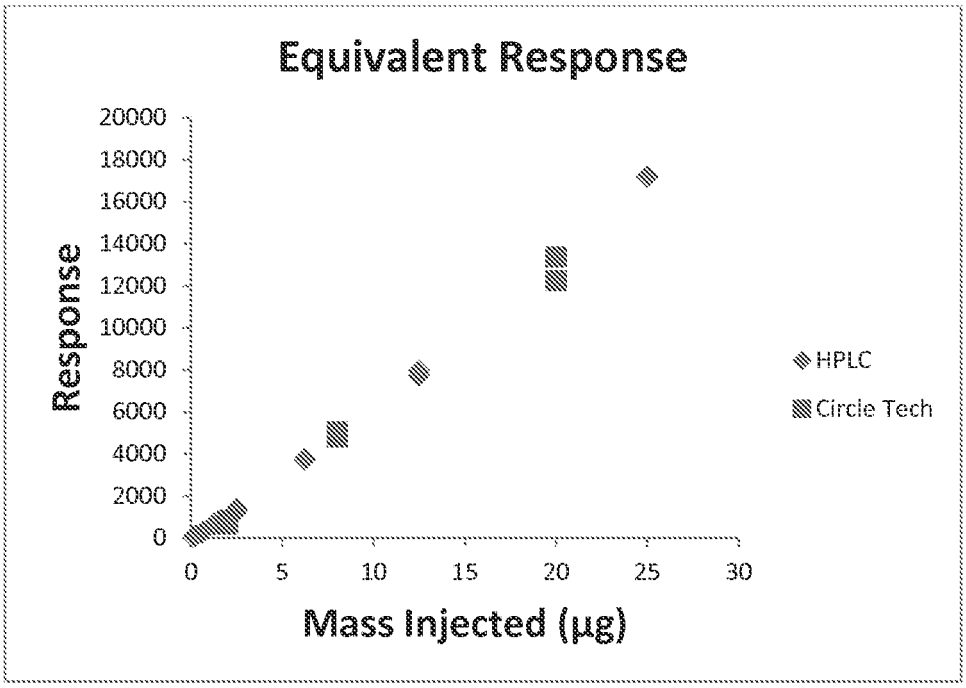

15000
12500
10000
7500
5000
2500
0
Response
0
20
40
60
80
100
Concentration (µg/mL)
HPLC
Circle

Fig. 9


Equivalent Response
Response
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
5
10
15
20
25
30
Mass Injected (µg)
HPLC
Circle Tech