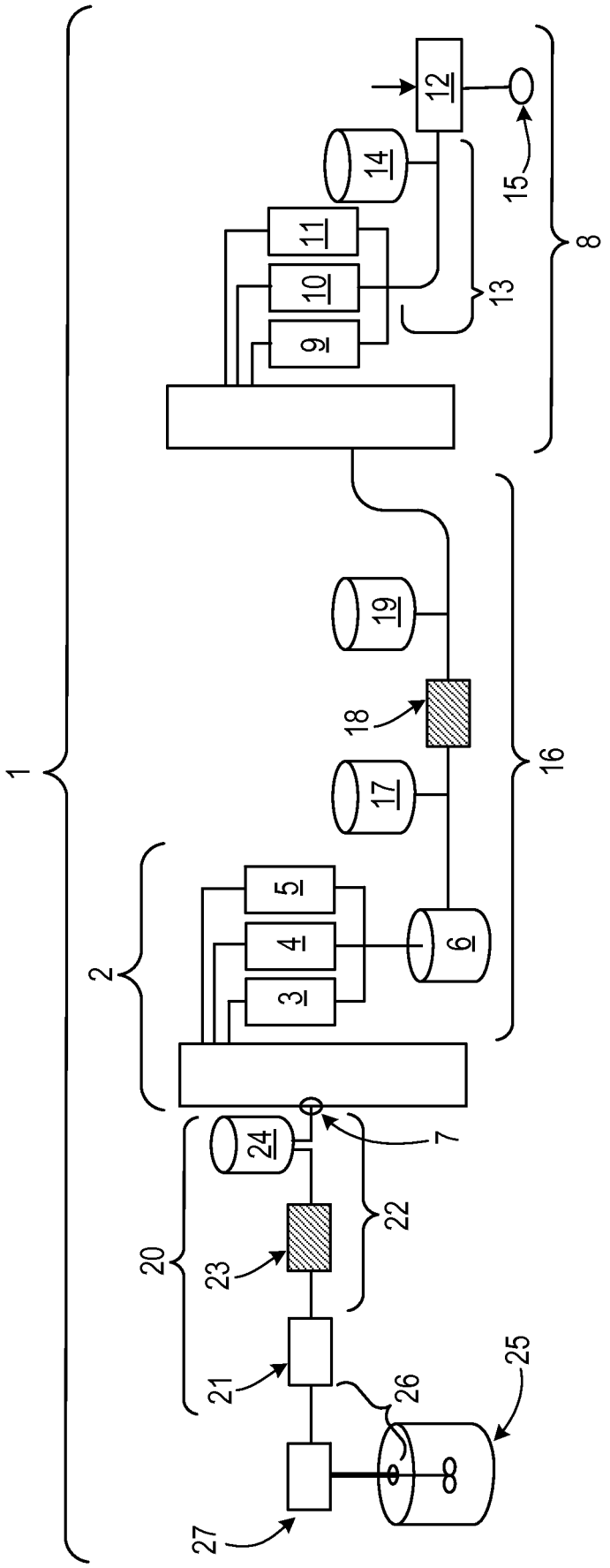


FIG. 1

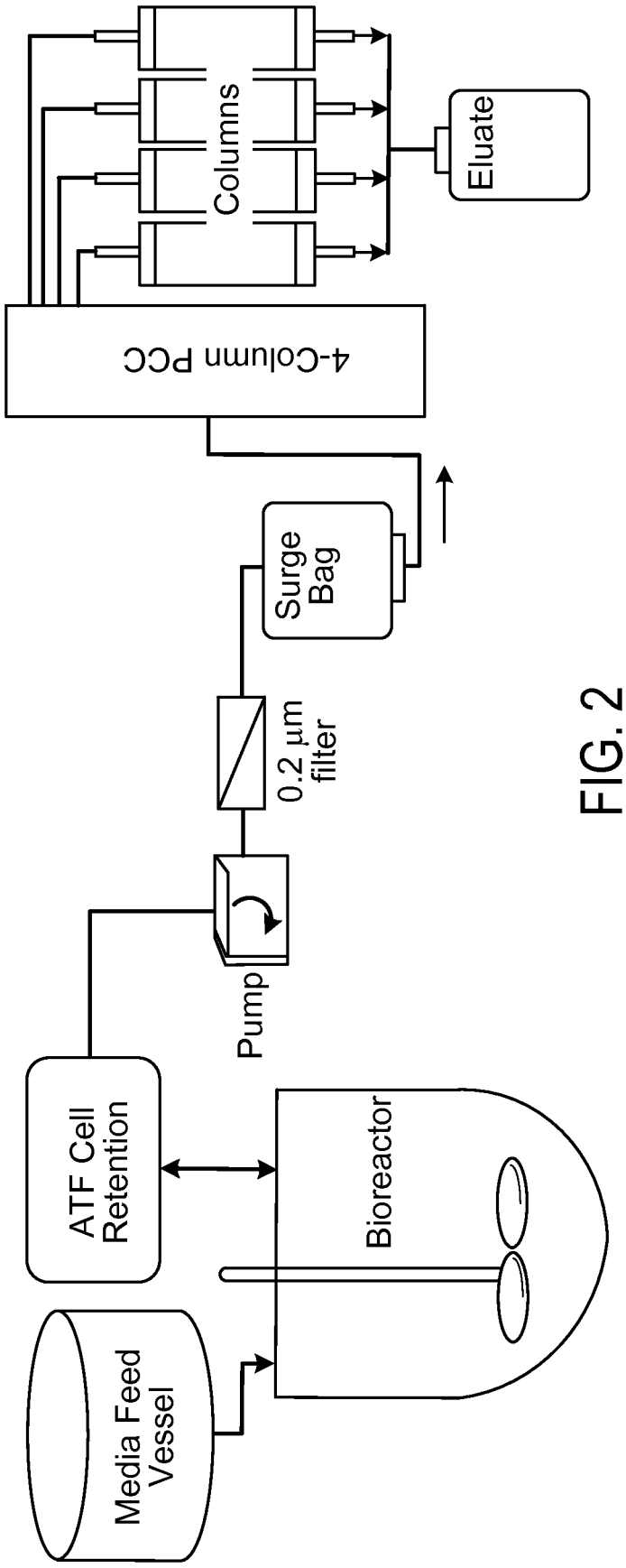

Columns
Eluate
4-Column PCC
Surge Bag
0.2 µm filter
Pump
ATF Cell Retention
Bioreactor
Media Feed Vessel

FIG. 2

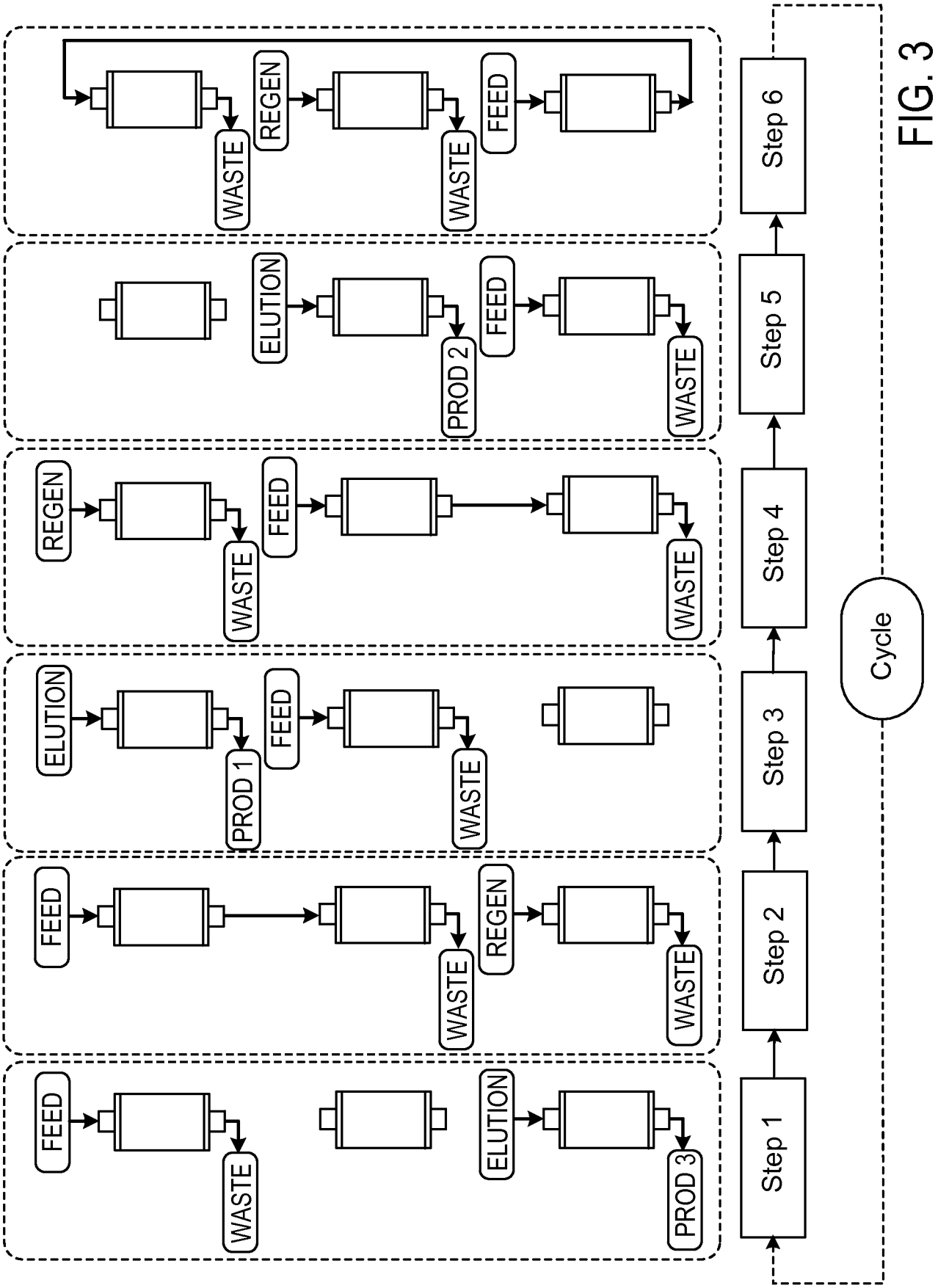

FEED
WASTE
REGEN
WASTE
FEED
WASTE
ELUTION
PROD 2
FEED
WASTE
REGEN
WASTE
FEED
WASTE
ELUTION
PROD 1
FEED
WASTE
FEED
WASTE
REGEN
WASTE
FEED
WASTE
ELUTION
PROD 3
Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Cycle

FIG. 3

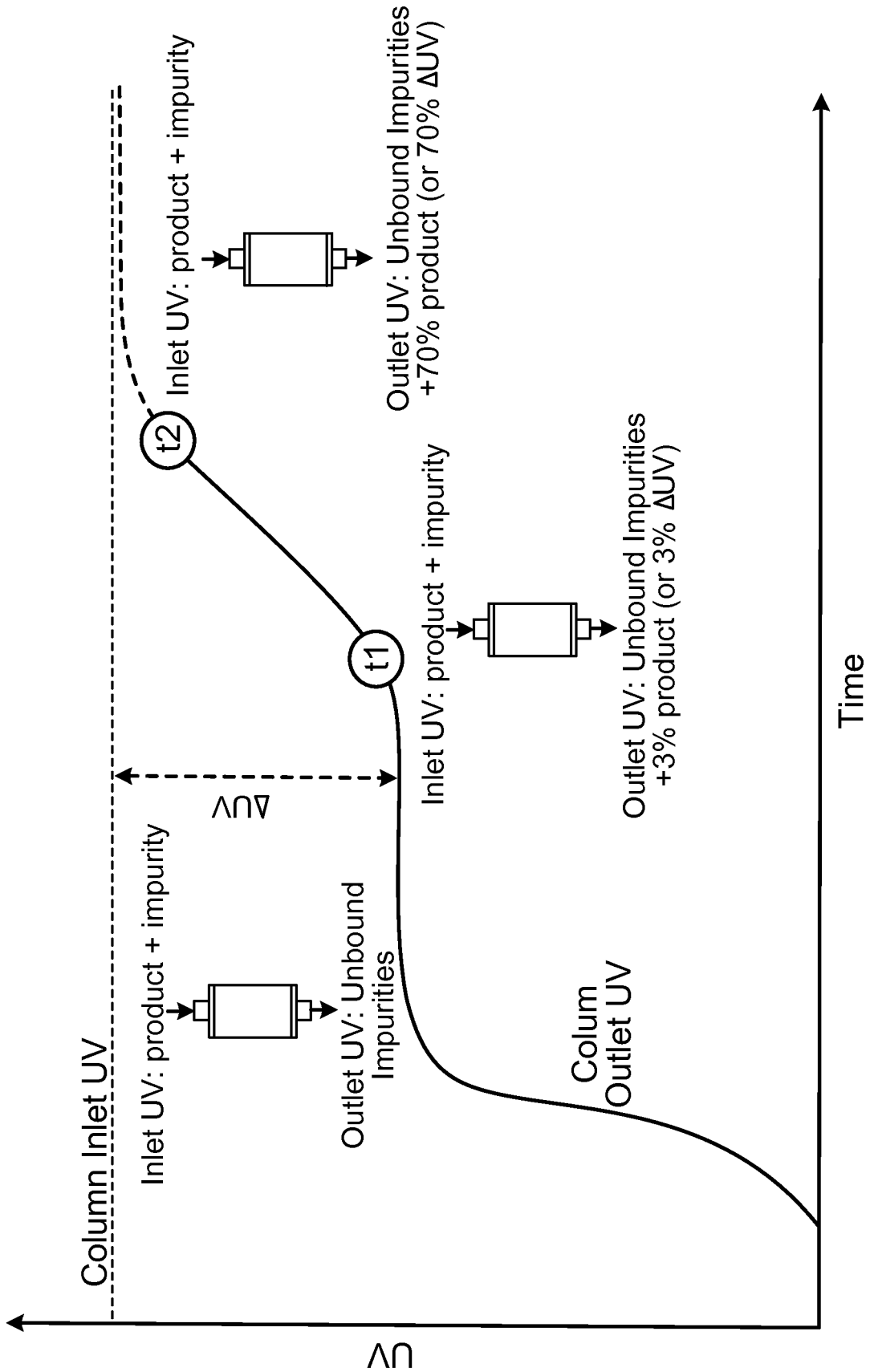

UV
Time
Column Inlet UV
Colum Outlet UV
Inlet UV: product + impurity
Outlet UV: Unbound Impurities
ΔUV
t1
Inlet UV: product + impurity
Outlet UV: Unbound Impurities +3% product (or 3% ΔUV)
t2
Inlet UV: product + impurity
Outlet UV: Unbound Impurities +70% product (or 70% ΔUV)

FIG. 4

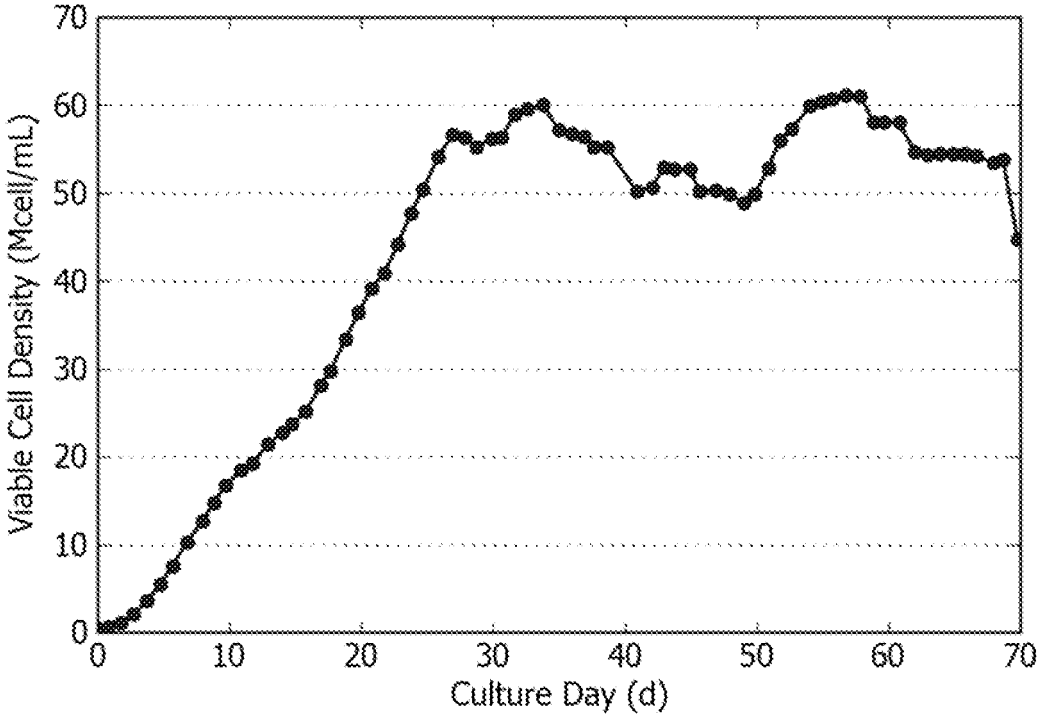

Viable Cell Density (Mcell/mL)
0
10
20
30
40
50
60
70
0
10
20
30
40
50
60
70
Culture Day (d)

FIG. 5A

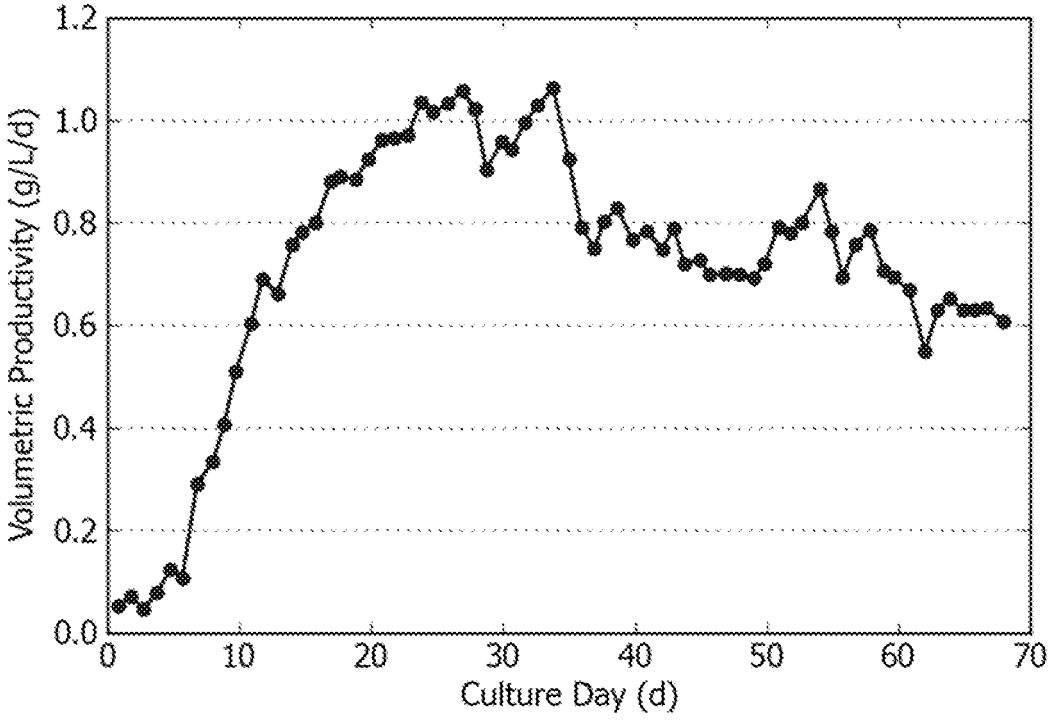

Volumetric Productivity (g/L/d)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
10
20
30
40
50
60
70
Culture Day (d)

FIG. 5B

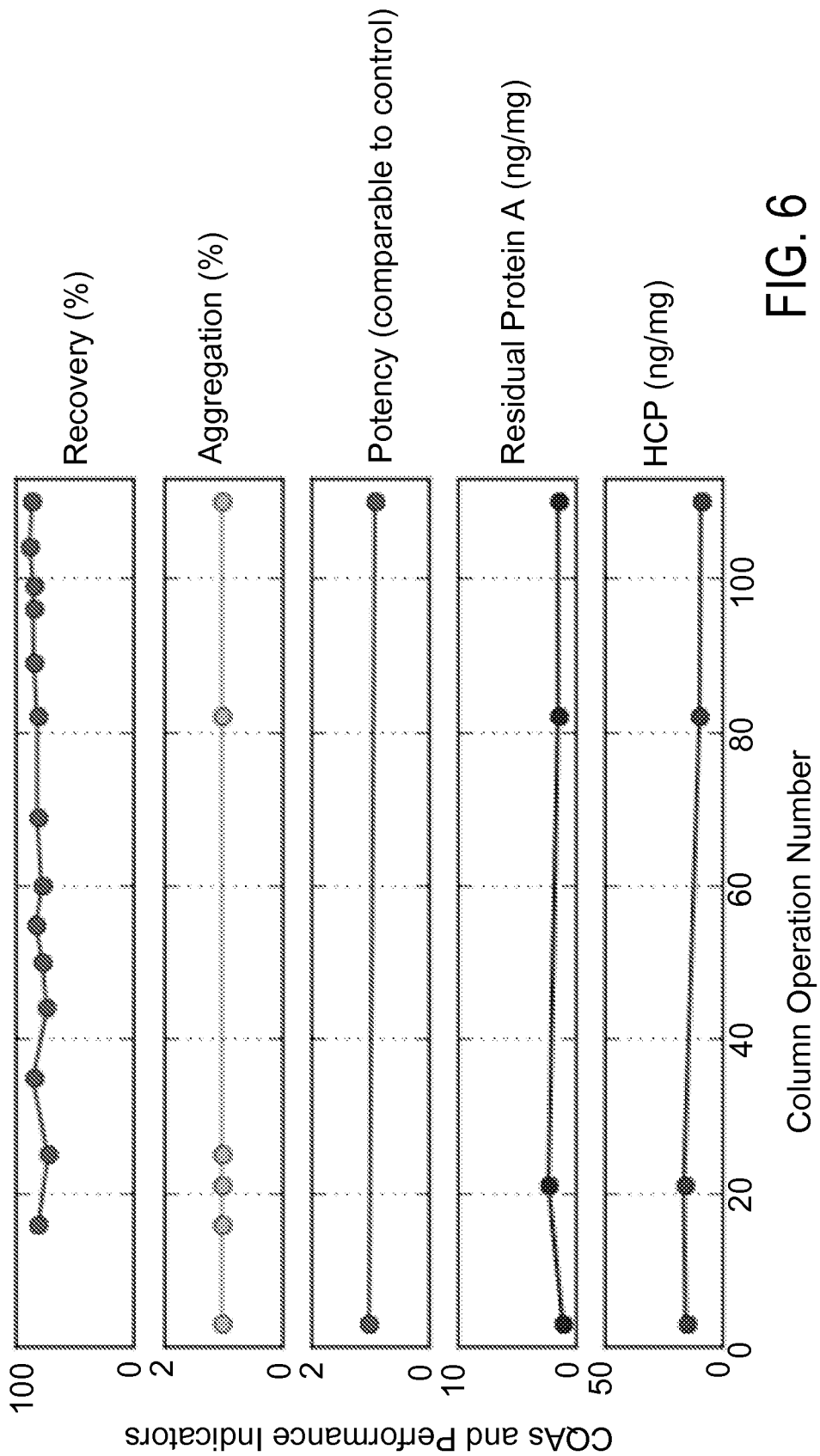

Recovery (%)
Aggregation (%)
Potency (comparable to control)
Residual Protein A (ng/mg)
HCP (ng/mg)
100
0
2
0
2
0
10
0
50
0
0
20
40
60
80
100
Column Operation Number
CQAs and Performance Indicators

FIG. 6

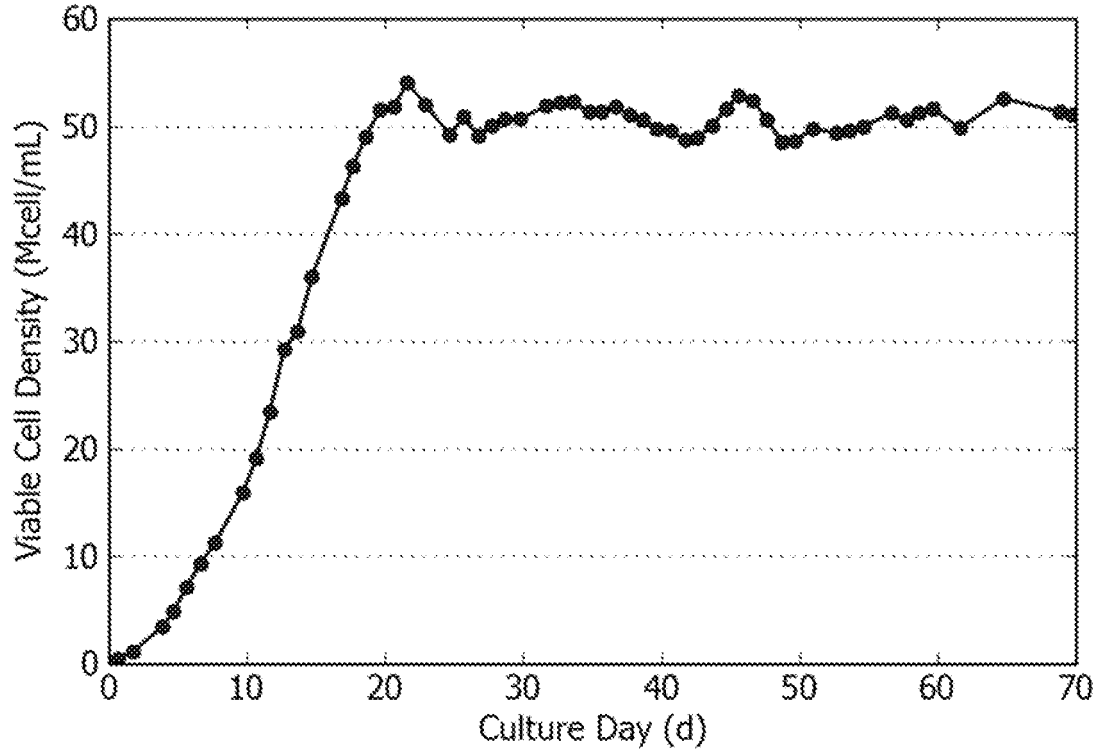

Viable Cell Density (Mcell/mL)
0
10
20
30
40
50
60
0
10
20
30
40
50
60
70
Culture Day (d)

FIG. 7A

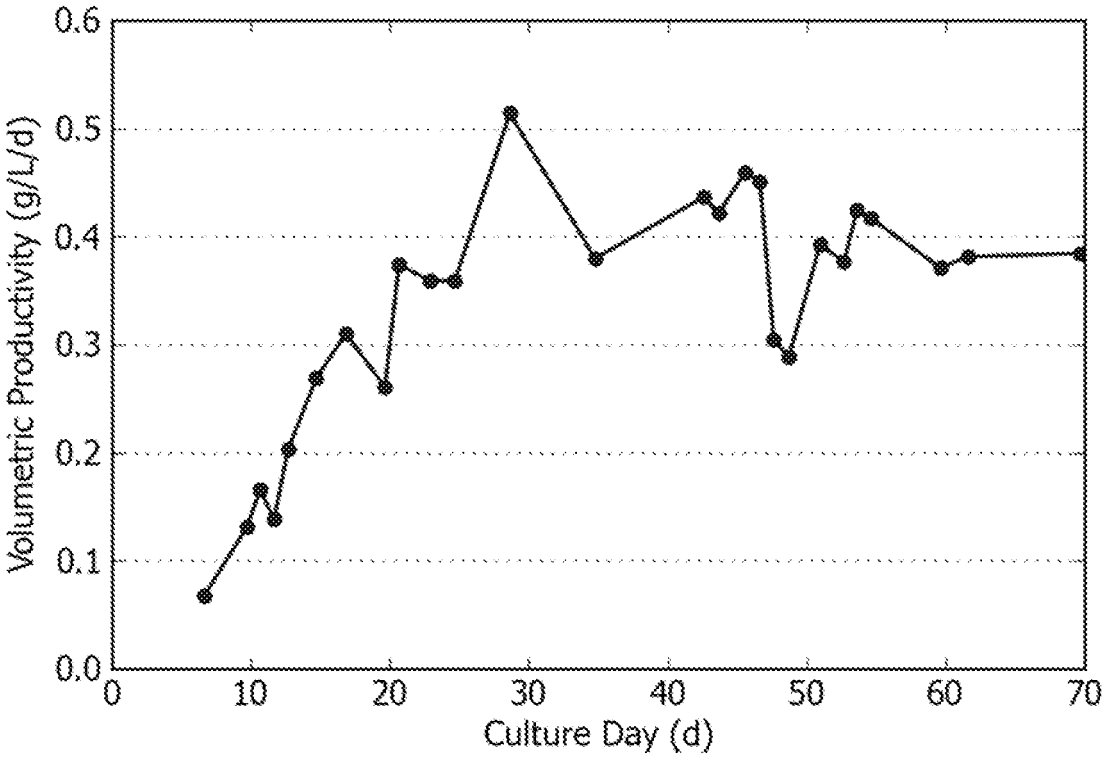

Volumetric Productivity (g/L/d)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
10
20
30
40
50
60
70
Culture Day (d)

FIG. 7B

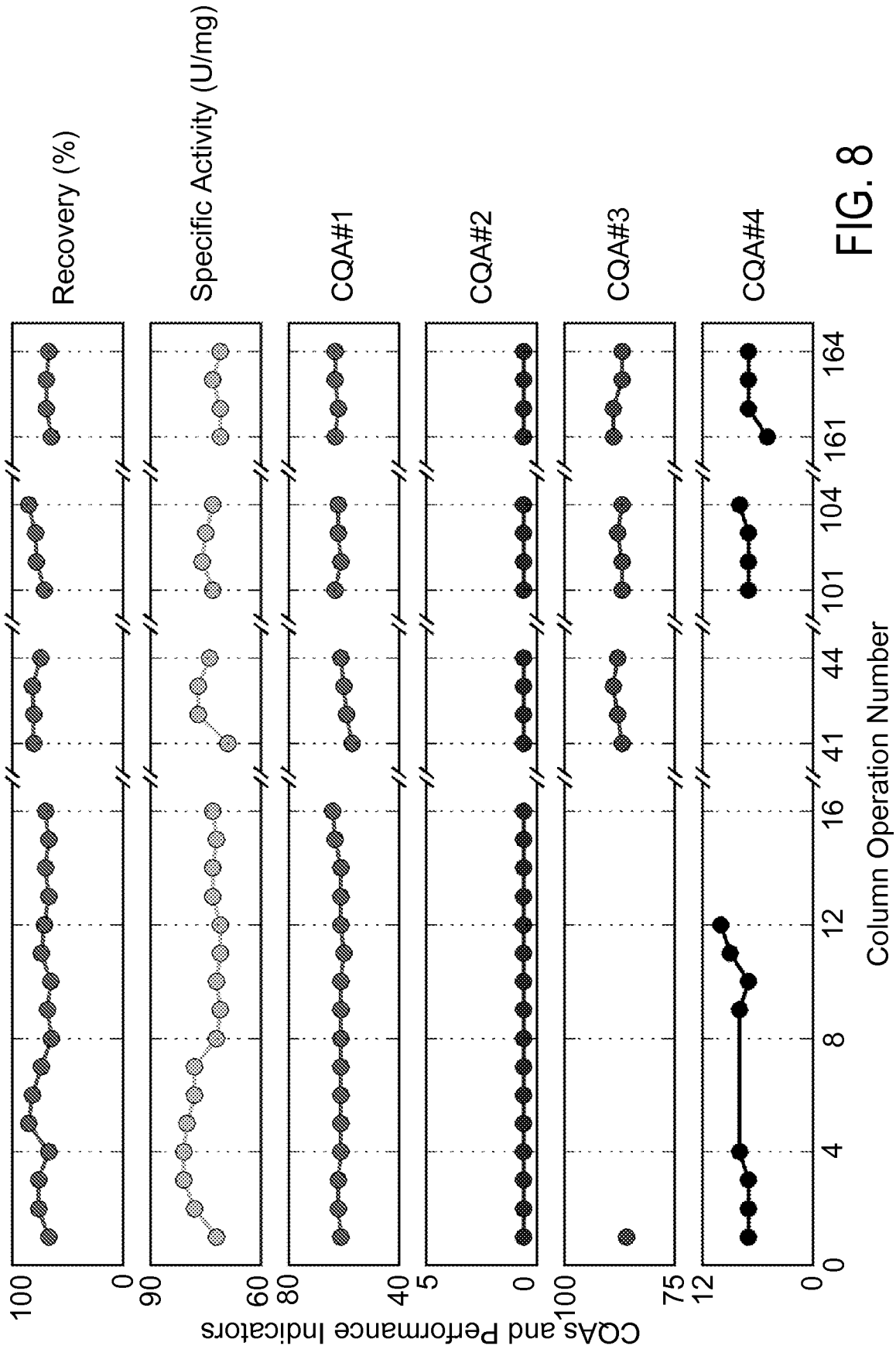

Recovery (%)
Specific Activity (U/mg)
CQA#1
CQA#2
CQA#3
CQA#4
CQAs and Performance Indicators
Column Operation Number
100
0
90
60
80
40
5
0
100
75
12
0
0
4
8
12
16
41
44
101
104
161
164

FIG. 8

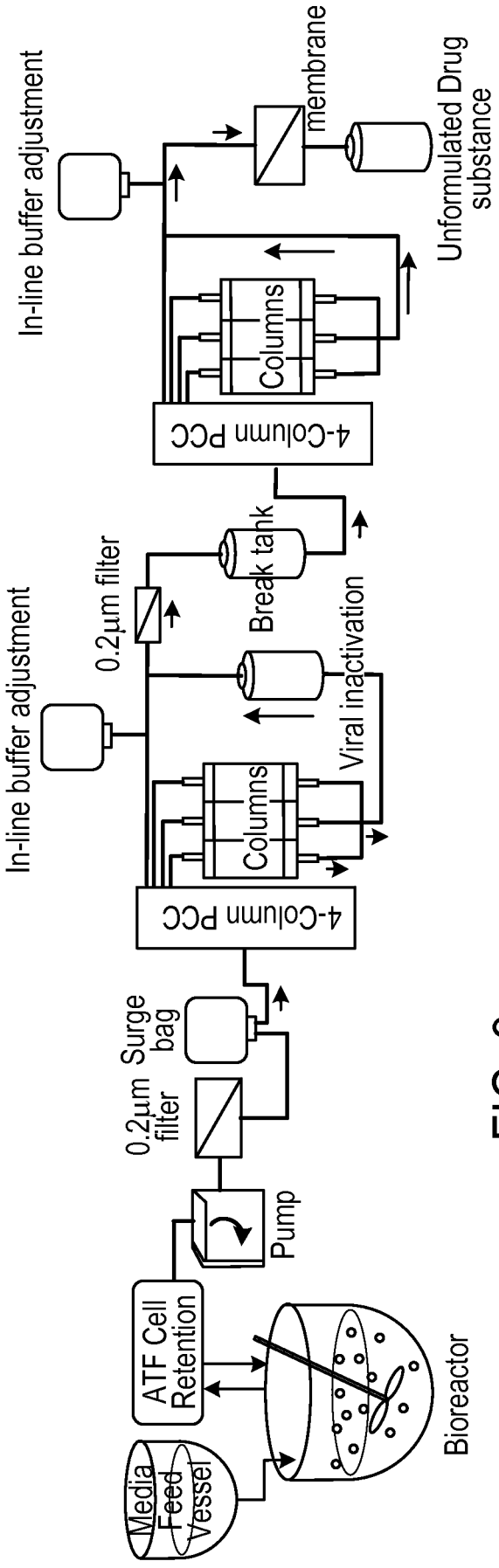

Media Feed Vessel
Bioreactor
ATF Cell Retention
Pump
0.2µm filter
Surge bag
4-Column PCC
Columns
Viral inactivation
In-line buffer adjustment
0.2µm filter
Break tank
4-Column PCC
Columns
In-line buffer adjustment
membrane
Unformulated Drug substance

FIG. 9

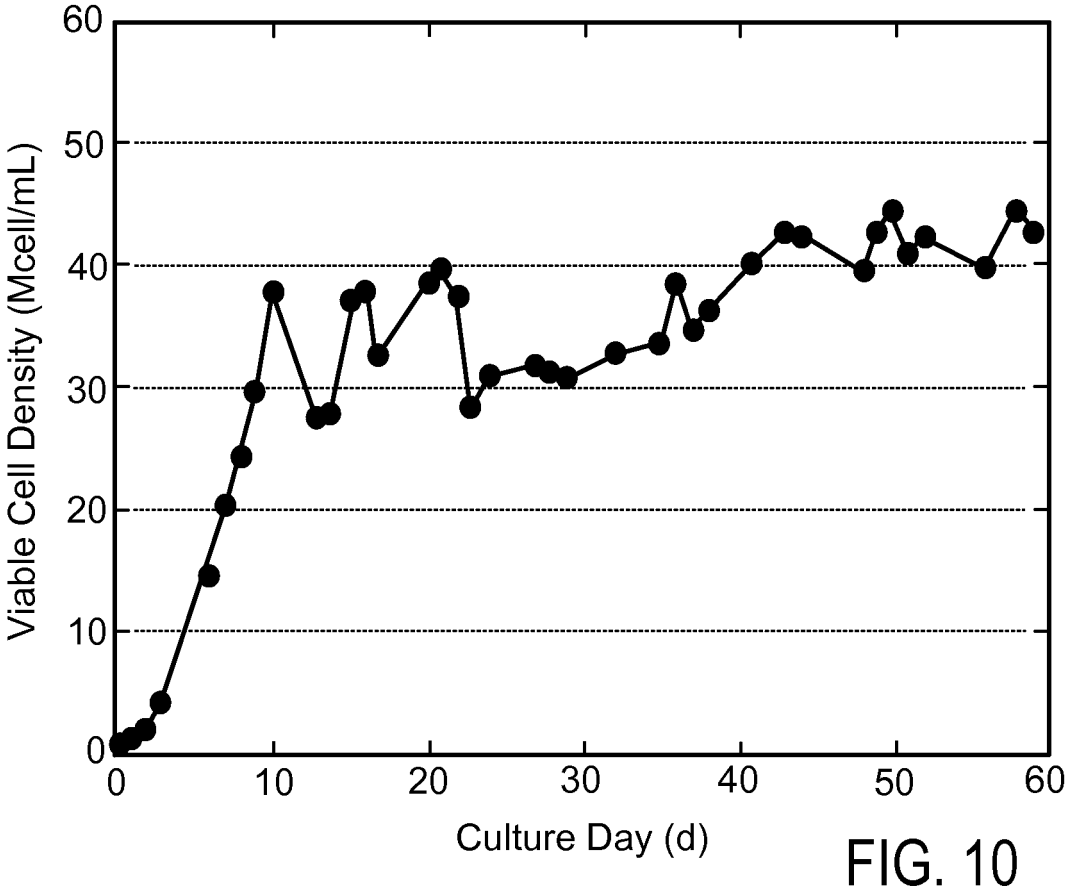

Viable Cell Density (Mcell/mL)
0
10
20
30
40
50
60
Culture Day (d)
0
10
20
30
40
50
60

FIG. 10

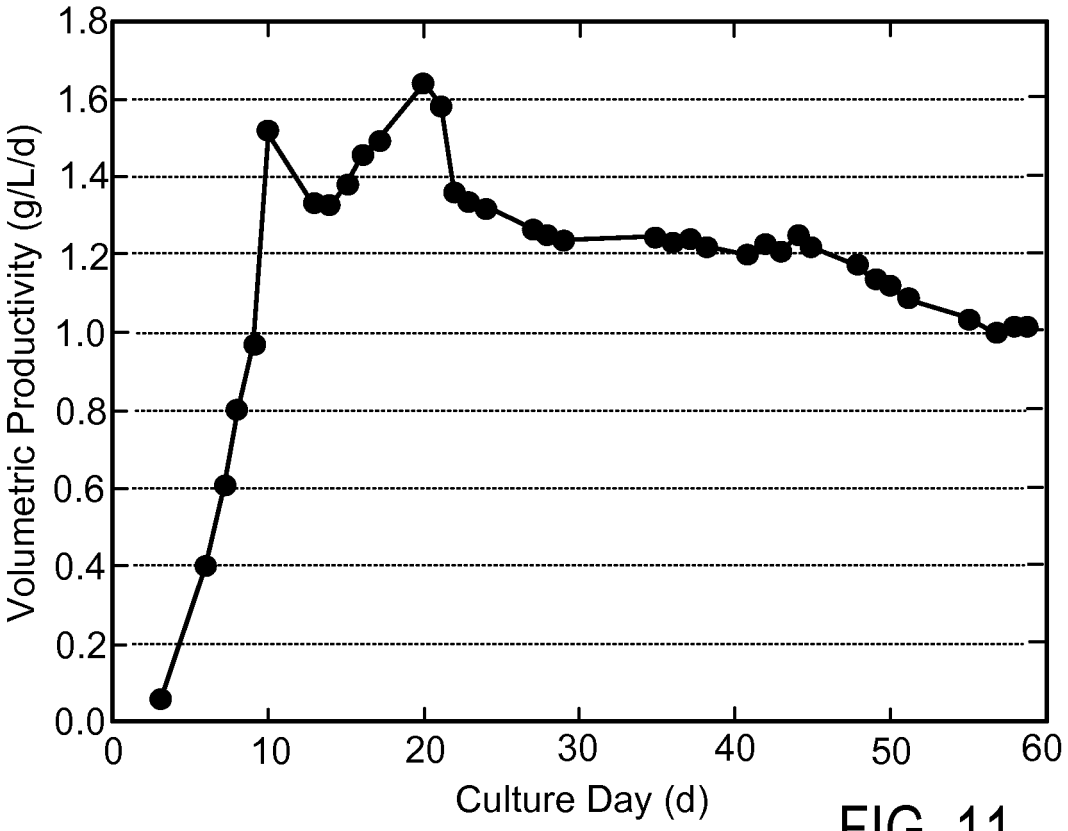

Volumetric Productivity (g/L/d)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
Culture Day (d)
0
10
20
30
40
50
60

FIG. 11

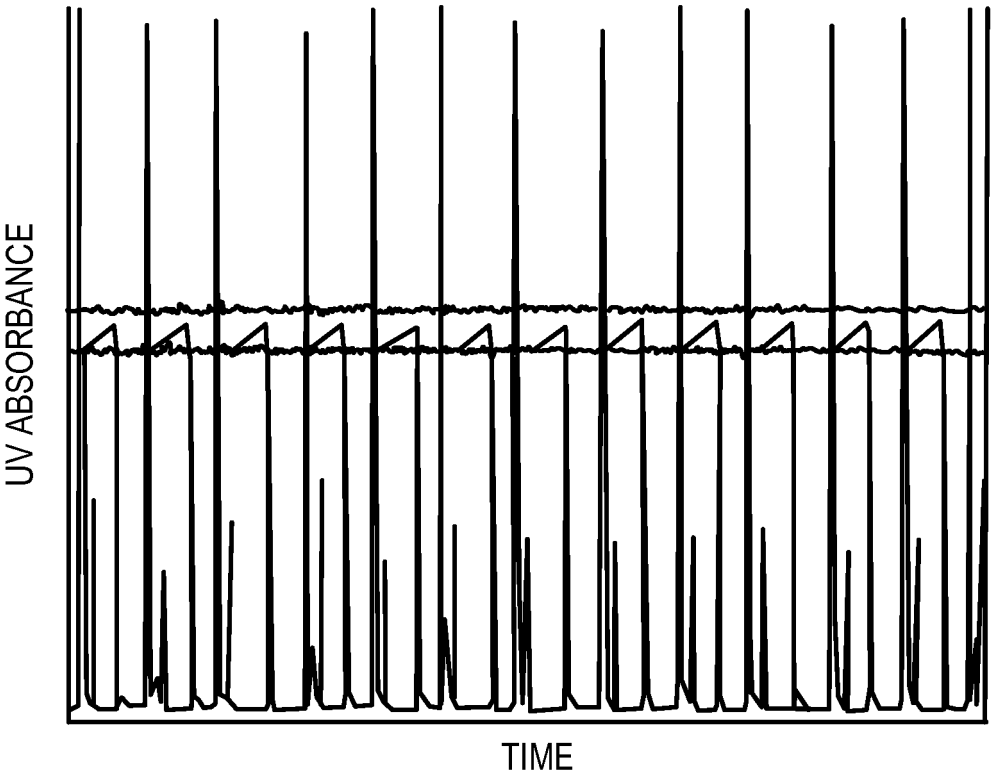


FIG. 12

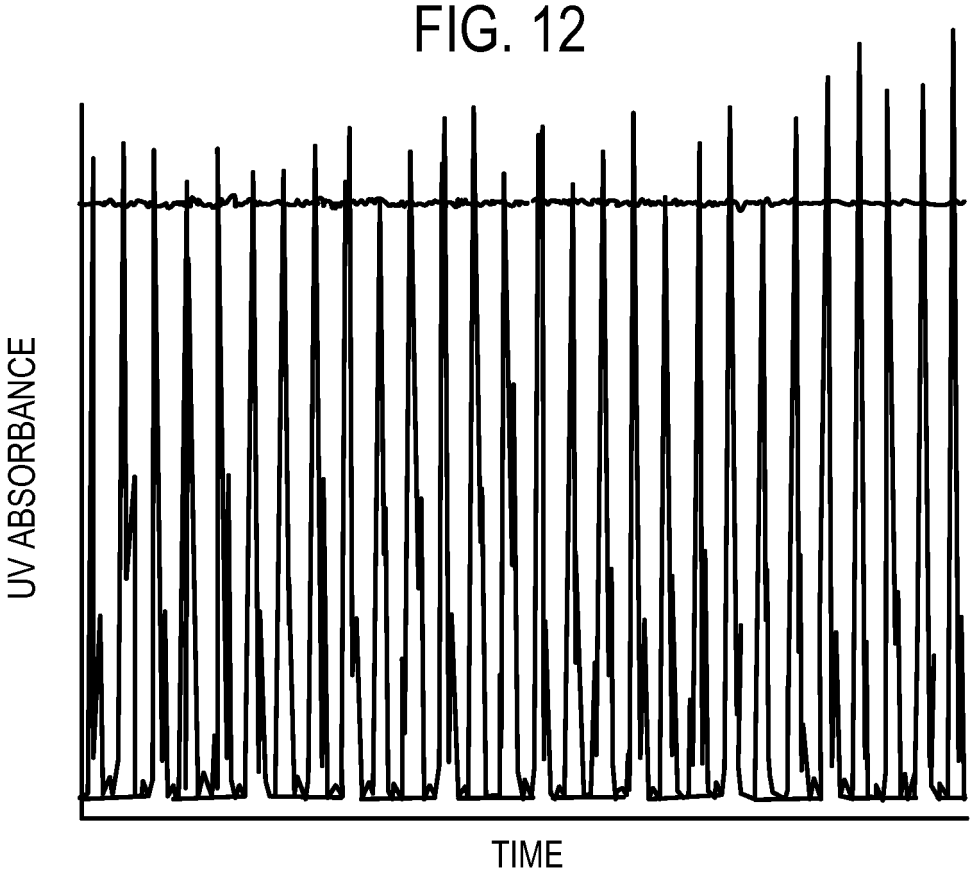


FIG. 13

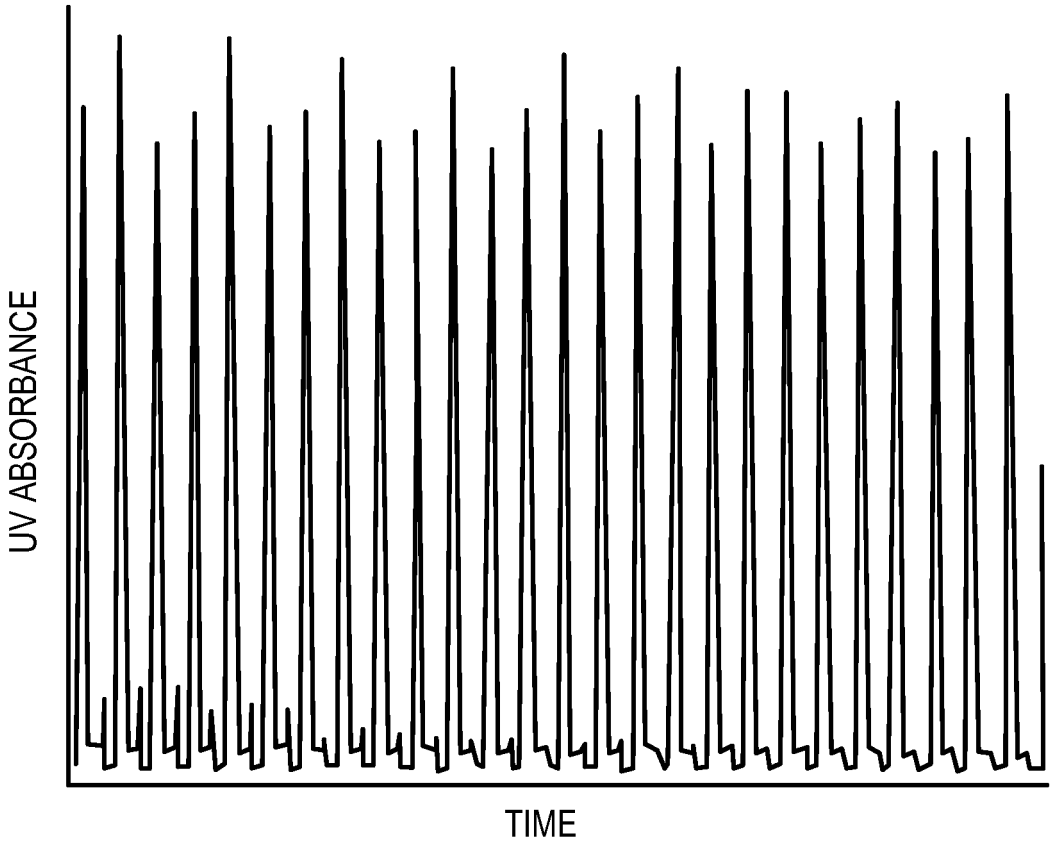


FIG. 14

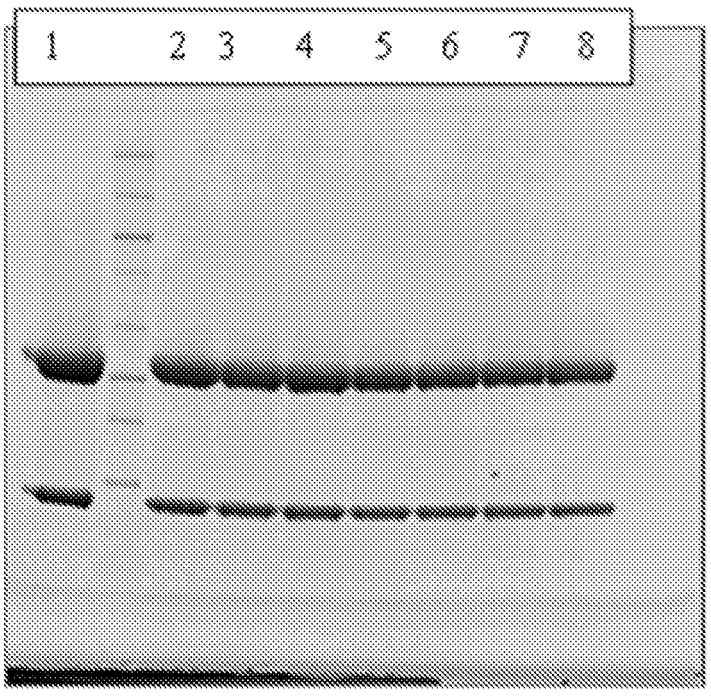


FIG. 15

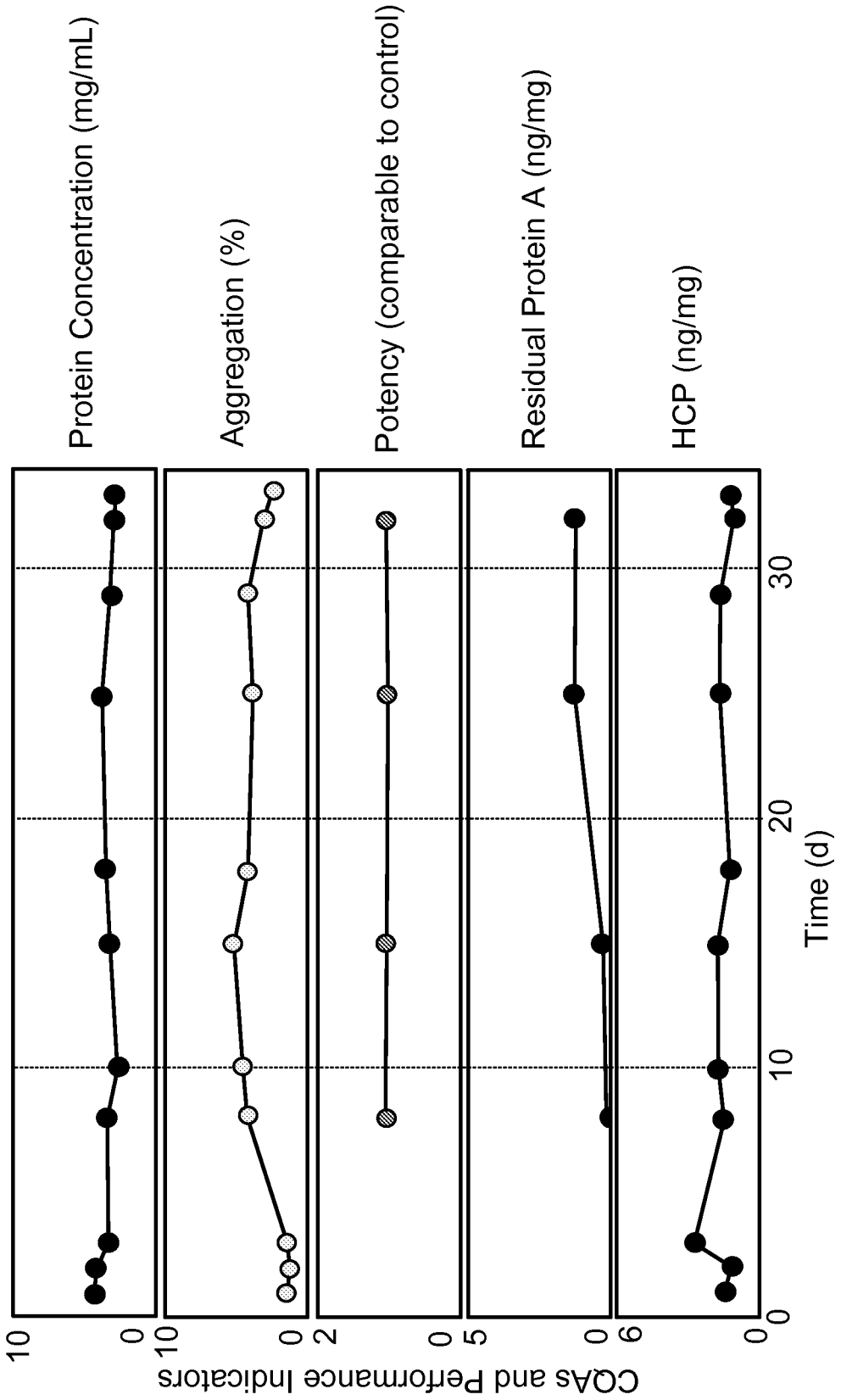

Protein Concentration (mg/mL)
Aggregation (%)
Potency (comparable to control)
Residual Protein A (ng/mg)
HCP (ng/mg)
10
0
10
0
2
0
5
0
6
0
0
10
20
30
Time (d)
CQAs and Performance Indicators

FIG. 16