ÄKTA™avant

Inspired to Accelerate your process development

有灵感的加速您的工艺开发

imagination at work

Evolution of ÄKTA™ 1996 – 2010

从1996到2010年AKTA 的发展

2009/10 ÄKTA avant

2009 - ÄKTAmicro™

2006 – New ÄKTApurifier

2005 – ÄKTAcrossflow™

2004 - ÄKTAxpress™

2002 – ÄKTA Crystal and ÄKTApilot™

2001 – ÄKTA add on´s

2000 – ÄKTA OligoPilot

1999 - ÄKTAprime™

1998 – ÄKTAFPLC™

1997 - ÄKTApurifier™

1996 - ÄKTAexplorer™

1982 – FPLC ™ and Mono Q/S

imagination at work

Designed for process development and scale-up.

工艺开发与中试放大

ÄKTAavant is based on customers´ need for speed, security and scalability during process development and Scale-Up.

Two versions for maximized performance

两款性能最佳的系统

ÄKTA™ avant 25

- Screening in small columns
  小柱子进行筛选实验
- Method optimization
  方法优化
- Challenging purifications
  纯化挑战性蛋白
- Small amounts of sample
  小量的样品
- High res. prep. Purification
  高分辨率制备纯化
- Optimized for column size i.d. 5-16 mm
  在直径5-26mm柱上进行优化

ÄKTA avant 150

- Scale-up process
  工艺放大
- Robustness testing
  稳健性实验
- Trouble shooting (scale-down)
  问题解决（缩小规模）
- Fine-tuning of process
  工艺的精细调节
- Optimized for column size i.d. 10-50 mm
  在直径10-50mm柱上进行优化

A complete workflow for Process development

一个工艺开发的完整流程

Predict 筛选 | *Optimize 优化&Scale-up 放大* | *Produce 生产*

PreDictor™

HTPD
- Media screening
  填料筛选
- Condition screening
  条件筛选

ÄKTA™ avant 25

Screening 筛选
Method optimization
方法优化
Column size i.d. 5-26 mm

ÄKTA avant 150

Scale-up process 放大工艺
Fine-tuning 精细调节
Robustness testing
稳定性测试
Column size i.d. 10-50 mm

ÄKTApilot™ ÄKTA ready

Scale-up optimized process
放大优化的工艺
Sanitary design
卫生设计
Column sizes from i.d. 50 mm

imagination at work

5 / GE 28-9577-83 / Version 4.0

ÄKTA™ avant

Setting the future industrial standard

ÄKTA™ avant, 设定新的行业标准

Inspired speed 卓越速度

imagination at work

GE 28-9577-83 / Version 4.0

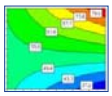
Speed 速度

ÄKTA™ avant has the capacity to significantly shorten the process development time, allowing you to get your products to the market faster

AKTA avant 可以显著性地缩短您工艺开发的时间，加快您的新产品上市

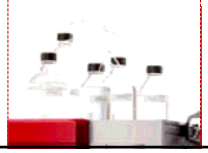
Maximum information, minimum experiments with DoE

DOE：最少的试验数量，最多的实验信息



Automation with BufferPro

BufferPro缓冲液自动配制提高自动化程度



Ease-of-use with Method editor

易用的方法编辑

imagination at work

7 / GE 28-9577-83 / Version 4.0

What is Design of Experiments (DoE)? 什么是实验设计？

DoE is a systematic way of changing process inputs and analyzing the resulting process outputs in order to quantify the cause and effect relationship between them while using a minimum number of runs.

实验设计是一个系统性方法，它通过同时改变不同的影响因子（输入），分析得到的输出结果，来定量研究它们之间的原因与结果之间的相互关系，运行的试验数量要求往往最少。

imagination at work

8 / GE 28-9577-83 / Version 4.0

DoE to identify design space 采用DOE 来确定设计空间

- Identify criticality of process parameters in relation to Critical Quality Attributes

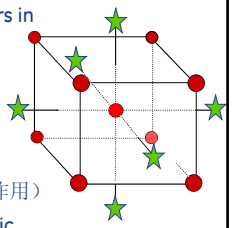
确定影响关键质量属性的主要工艺参数

- Understand how the effect of process parameters depend on each other (interactions)

了解工艺参数之间如何相互影响（相互作用）

- Basis for setting acceptable and realistic variability ranges for control space

将参数控制区域设定在可接受和可实现的变化范围



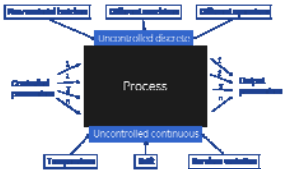
imagination at work

9 / GE 28-9577-83 / Version 4.0

Introduction

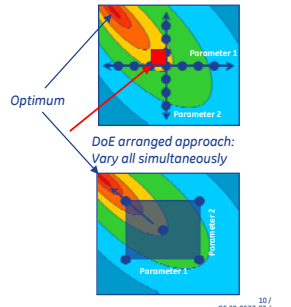
确定影响关键质量属性的主要工艺参数

- "Design of Experience"



Traditional approach:
Parameter 1 Fixed, Parameter 2 changed or
Parameter 2 Fixed, Parameter 1 changed

Optimum



DoE arranged approach:
Vary all simultaneously

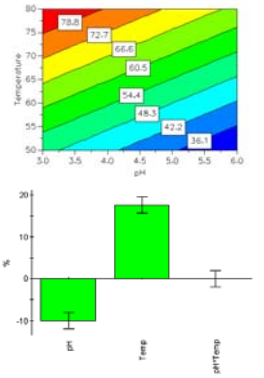
imagination at work

10 / GE 28-9577-83 / Version 4.0

工艺参数之间相互作用

Example - No interaction
Effect of pH independent of T

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$

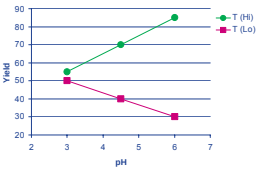


imagination at work

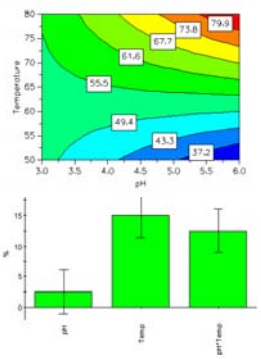
Version 4.0

工艺参数之间相互作用

Example - Strong interaction
Effect of pH reversed at high T



$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_{12} x_1 x_2$



imagination at work

The Model

X: known input - experimental settings, factors
Y: measured - response
b: unknown constant - determined by the regression model

Constant Term = response of Y when factors are 0

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_{12}X_1X_2 + b_{13}X_1X_3 + b_{23}X_2X_3 + b_{11}X_1^2 + b_{22}X_2^2 + b_{33}X_3^2$$

Linear Terms = main effects | Two-way Interaction Terms | Quadratic Terms

Fractional factorial design
Screening or Robustness testing

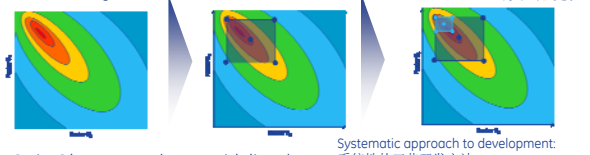
Full or Fractional factorial design
Screening

Composite design
Optimization

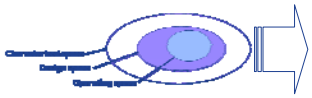
imagination at work

DoE and Quality by Design (QbD)
DOE 和质量源于设计

DoE Screening筛选 | *DoE Optimization优化* | *Operation and DoE Robustness运行和稳健性*



Or in QbD terms...(FDA guidelines)...

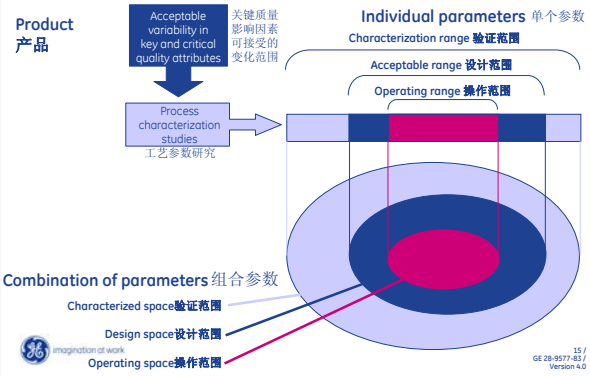


Systematic approach to development:
系统性的工艺开发方法
- Begins with predefined objectives
  起始设定好目标
- Emphasizes product and process
  强调产品和工艺
- understanding and process control
  理解和过程工艺控制
- Based on sound science and quality risk management 以科学和质量风险管理为基础

from ICH Q8(R)

imagination at work

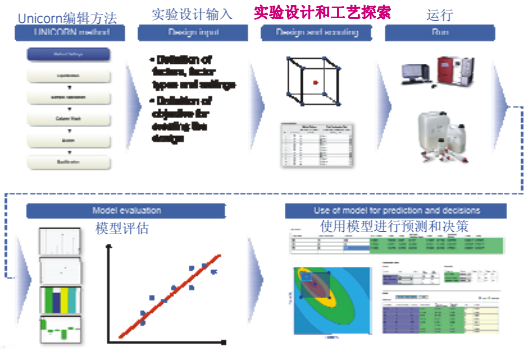
质量源于设计，设计区域



imagination at work

The DoE workflow DOE工作流程

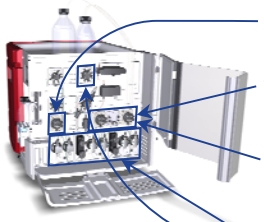
Unicorn编辑方法 | 实验设计输入 | **实验设计和工艺探索** | 运行



imagination at work

ÄKTA™ avant 25 & ÄKTA avant 150

-The possibility to automate process development
ÄKTAavant为自动工艺开发提供了可能

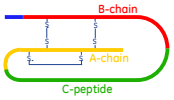


Sample conditions 样品条件	Load pH Load conductivity Load concentration Mass load Wash volume
Wash conditions 洗柱条件	Wash pH Wash conductivity Elution pH
Elution conditions 洗脱条件	Gradient elution Step elution level Collect peak Elution Additive
Entire process 整个工艺	Media type Column size Bed Height Flow rate Residence time

imagination at work

Background / Starting point 背景/起点

r-Pro-Insulin 重组胰岛素原



Mw ~11 000
pI ~ 5.2
8M Urea is needed to solubilize inclusion bodies of *r*-Pro-insulin 需要用8M的尿素来溶解重组胰岛素原包涵体

Cation, Anion exchangers and Multimodal resins may be used
阳离子、阴离子交换填料和多模式配基填料供选择
Complex sample, i.e. challenging analysis situation
复杂样品，　例如预先分析纯化的挑战性
Binding studies　non-bound protein in flow through
结合研究 ⟹ 穿透峰中的没有未结合蛋白
Elution studies　eluted protein in first elution
洗脱研究 ⟹ 在第一洗脱峰中洗脱蛋白

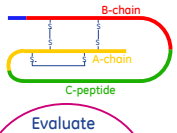
imagination at work

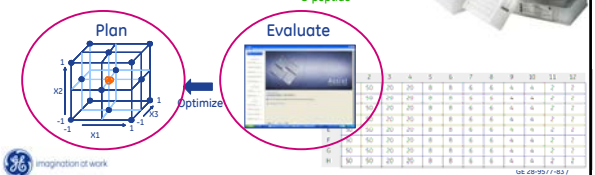
Aim of study 研究的目标

Fast and efficient development of a *r*-Pro-Insulin capture step through High Throughput Process Development (HTPD) to scale up

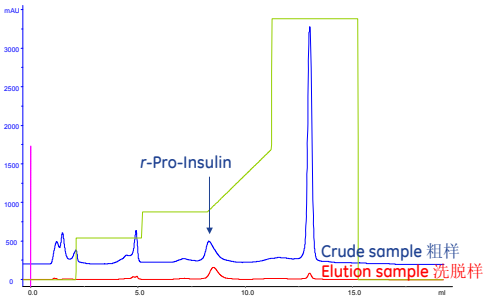
采用**高通量筛选板**快速有效地开发重组胰岛素原的捕获步骤，并进行放大

- 80 ≥ % Yield
- 80 ≥ % Purity





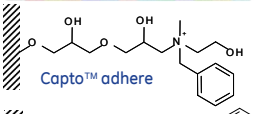
层析方法分析

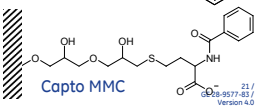


Column: Tricorn™ Mono Q™ 5/50,
Mobile phase: Tris-HCl pH 8, elution with salt (NaCl)
Injection volume: 50 µl
Chromatography System: ÄKTAexplorer™ 10

PreDictor™ Screening plates 高通量筛选板

Screening plates
Different media in same plate





2/6 µl for binding study
2/6 µl 用于结合研究
50 µl for elution study
50 µl用于洗脱研究

在PreDictor™ 板中的结合研究

Sample: 200 µl of total protein conc. 4.5 mg/ml
样品：200微升总蛋白，浓度为4.5毫克/毫升
i.e. 4 x diluted crude sample to adjust conditions
例如：对样品进行4倍稀释来调节缓冲液条件

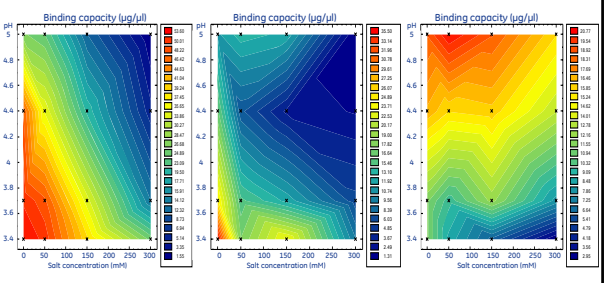
Resin volume: 2 and 6 µl 填料体积：2和6微升

pH-interval: 3.4 – 5.0 CIEX (and Capto™ MMC)
pH 间隔： 3.4-5阳离子交换（ 和Capto™ MMC）
~~5.3 – 8.1 AIEX (and Capto adhere)~~
5.3-8.1阴离子交换（ 和Capto adhere）

Salt concentration, NaCl:
0 – 300 mM CIEX 0-300mM 阳离子交换
~~0 – 150 mM AIEX 0-150mM~~ 阴离子交换

Result: No binding of *r*-Pro-Insulin to AIEX and Capto adhere

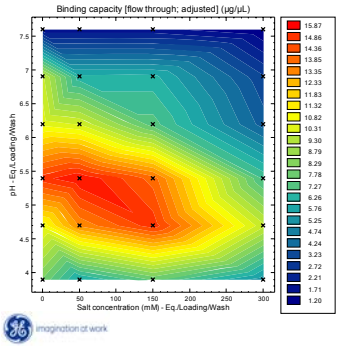
重组胰岛素原在阳离子上的结合载量



SP Sepharose™ FF | Capto S | Capto MMC

Conclusion: Capto MMC at 150 mM salt is chosen
结论：选择起始条件为Capto MMC 盐浓度150mM

在Capto™ MMC上pH的进一步实验- pH4-8



Conclusion:
Highest binding capacity= ~16mg/ml media at pH ~5.2 & 0-150 mM NaCl assuming that *r*-Pro-Insulin concentration is ~30% of total protein conc.

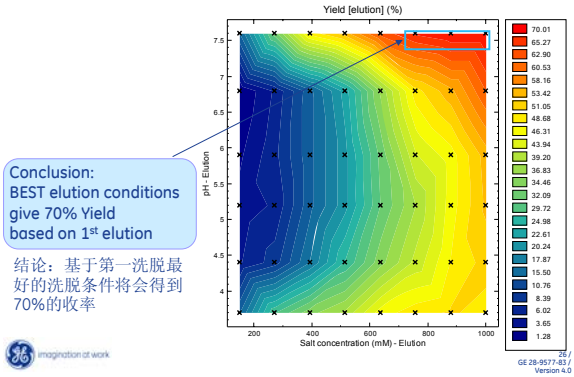
结论：

在pH ~5.2 & 0-150 mM NaCl 时具有最高的动态结合载量，假定重组胰岛素原的浓度为总蛋白浓度的约30%。

Capto™ MMC PreDictor™ 板上的洗脱实验

- 上样：总蛋白浓度为9毫克/毫升，上样180微升。例如：上样量为估算载量的80%。
- 填料体积：50微升
- pH间隔: 3.7-7.6
- 盐, NaCl: 150-1000mM
- 用pH 6 和8在一定的盐浓度下进行**全因子设计**

Elution of *r*-Pro-Insulin from Capto™ MMC
重组胰岛素原在Capto™ MMC上的洗脱条件

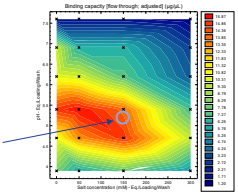


Conclusion:
BEST elution conditions give 70% Yield based on 1st elution

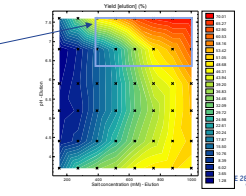
结论：基于第一洗脱最好的洗脱条件将会得到70%的收率

Conclusions from PreDictor™ study
用PreDictor™ 板研究的结论

1. 结合条件样品可以不加盐，最佳条件加入150mM NaCl
   起始样品pH应该调节到5.2



2. Elution conditions to be further optimized
   洗脱条件需要进一步优化
   pH > 6.2
   NaCl > 400 mM



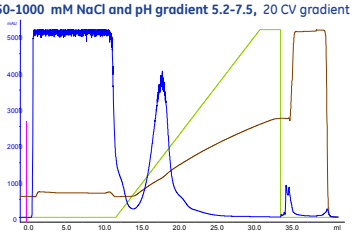
Optimization in Column Format
层析柱进行优化

Elution study 洗脱研究

Robustness 稳健性

Capto™ MMC gradient elution of *r*-Pro-Insulin
Capto™ MMC 梯度洗脱纯化重组胰岛素原

Loaded volume: 10 ml crude sample /ml media
Binding conditons: 50 mM Na Acetate + 150 mM NaCl pH 5.2 in 8 M urea. Res time 5 min
Elution: **150-1000 mM NaCl and pH gradient 5.2-7.5,** 20 CV gradient



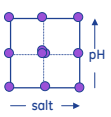
Conclusion: 1000 mM salt is not needed for elution
结论：洗脱不需要用到1M的盐

Elution optimization of *r*-Pro-Insulin on ÄKTA™ avant 25 system 在ÄKTA™ avant 25 系统上进行重组胰岛素原的洗脱优化

Experimental:

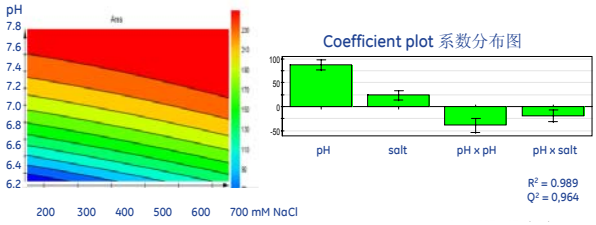
Column:	Tricorn™ 5/50 - Capto™ MMC
Res time:	5 min (0.2 ml/ml).
Sample:	Adjusted to pH 5.2 with HAc. 2.5 C.V. crude sample was loaded
Equilibration:	50 mM Na acetate + 150 mM NaCl pH 5.2*
Step elution:	Study **pH 6.2-8** and **150-750 mM** NaCl using Acetate/Phosphate/Formate **bufferPro** (CIEX 0-1M NaCl pH2-7)*

No. of experiments: 11 (3 center point included)
实验数目：11（包括3个中心点重复实验）



*Buffers in 8 M urea（缓冲液含8M的尿素）

Result: *r*-Pro-Insulin yield as a function of pH & NaCl concentration
结果：不同的pH & NaCl 浓度下重组胰岛素原的收率



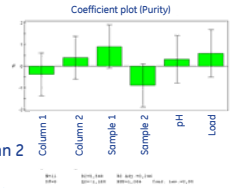
Conclusion: pH is most important for elution of *r*-Pro-Insulin. Adjustment of pH is enough for elution.
结论：在重组胰岛素原的洗脱中pH是非常重要的。调节pH对于洗脱就足够了。

Suggested loading and elution conditions for capture step of *r*-Pro-Insulin
对重组胰岛素原捕获步骤中的上样和洗脱条件

Resin:	Capto™ MMC
Loading:	Adjust pH of crude sample to 5.2
	Load 2.5 x Column Volumes
Step elution:	50 mM Phosphate buffer pH 8.0
	150 mM NaCl
	8 M Urea

Robustness experiments: Purification of proinsulin on Capto™ MMC & ÄKTA™ avant 25 system
稳健性实验：在ÄKTA™ avant 25 系统上用Capto™ MMC 进行重组胰岛素原纯化

Experimental: 实验
- Elution 洗脱 pH: 7.8-8.2
- Samples 样品: S1 & S2
- Sample load 上样量: 2.3-2.7 ml
- Media batch. 填料的批次: Column 1 & Column 2



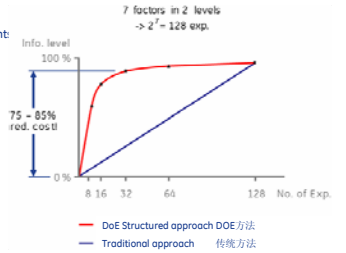
No. of experiments 实验数目: 11 (3 center point included , 包括3个中心点)

Conclusions: Stable results supports that these conditions will give robust purity results
结论：稳健性实验支持该工艺条件下工艺运行的稳定性

DoE reduces your cost 实验设计降低开发成本

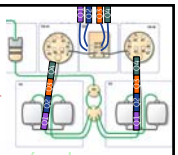
Design of Experiments allows the maximum amount of information to be obtained from a minimum number of experiments. By improving efficiency, both time and money are saved
实验设计通过最小的实验数量获得最大的实验信息量。通过提高效率节省金钱和时间。

- Design of Experiments (DoE) is integrated in UNICORN™ 6
  实验设计软件整合到UNICORN™ 6中
- Reach the same result in 16-32 experiments as you would with 128 experiments using the traditional approach!
  用传统的方法进行128个实验得到的结果，采用DOE 只需要进行16-32个实验

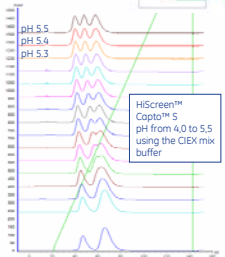


BufferPro – Automatic buffer preparation 自动缓冲液配制

AKTA avant 具有BufferPro , 在线缓冲液配制功能，每个缓冲液和pH值的配置可以节省30min



- Completely automated, advanced on-line buffer preparation
  完全自动化的，先进的在线缓冲液配制
- Buffers are made in analogy with manual preparation: corresponding acids or bases used for pH adjustment
  配制的缓冲液模拟手动配制，用相应的酸和碱调节pH
- Actual mixing ratios and buffer recipes are provided
  提供了实际的混和比例和缓冲液配方
- Allows for easy and quick pH-scouting
  允许简单但快速的pH探索



16 pH steps 0.1 units apart, with no manual buffer titration at all!

Increased ease of use in UNICORN™
新的UNICORN 软件更加简单易用

UNICORN 6 includes a new Method Editor, replacing the method wizard. No new text programming is required, new components immediately ready - save a day's work!

UNICORN 包括一个新的方法编辑器代替了原来的方法向导。预编的模块程序段，可以拽到新的运行方法中使用—这样可以节省重复编程的时间

- Contains all instructions used for controlling the chromatographic run
  包括可以控制所有层析方法运行的向导
- New user interface for easy viewing and editing of run properties
  对于新使用者的界面友好，并易于编辑
- Use pre-defined methods / phases or program your own
  用预定义的方法/模块来编辑你的程序
- Easy and flexible method creation
  简易和方便的方法创建
  - Drag and drop from the phase library
    可以从方法库中进行拖拽即可

Method Editor

imagination at work

37 / GE 28-9577-83 / Version 4.0

System & sample pumps set up to save time
新的配置的系统泵和样品泵可以节省您的时间

ÄKTA™ avant sample and system pumps have the same technical design and run independently, no re- plumbing is necessary, - save a day's work per week!

AKTA avant 的系统和样品泵采用同样的技术设计，并可以独立运行，不需要更换不同粗细的管道。-每周可以节省一天的工作时间。

Save time on ... 节省时间在：

- Column cleaning 柱子清洗
- Equilibration 平衡
- Regeneration 再生
- Injection valve configuration
  上样阀的配置
- pH measurement in/out of line
  在线和不在线的pH 校准
- Flow restrictor in/out of line
  限流器的在线和离线
- Software reprogramming
  软件的再编程

imagination at work

38 / GE 28-9577-83 / Version 4.0

ÄKTA™ avant
Setting the future industrial standard

设定新的工业标准

Inspired scalability
卓越的放大性

imagination at work

39 / GE 28-9577-83 / Version 4.0

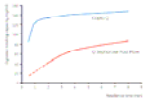
Scalability 放大性

ÄKTA™ avant ensures smooth transition from product discovery to production through direct, reliable scalability using the same media

AKTA avant 确保可以在相同的填料上从工艺的开发到生产进行直接放大

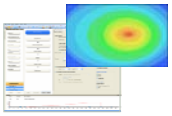
Exploit the advantages of modern BioProcess™ media

探索现代工业填料及其优势



UNICORN™ 6 - A higher standard of intelligence.

UNICORN 6-一个更高标准的智能软件



Scalability from start to finish

从开始就考虑到可放大性

imagination at work

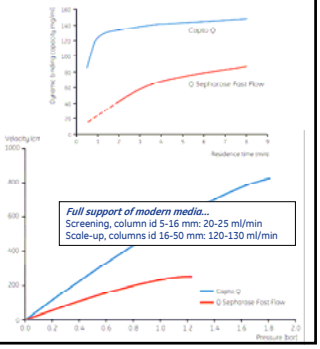
GE 28-9577-83 / Version 4.0

Increase your productivity with high flow media
采用高流速填料增加您的生产力

ÄKTA™ avant has flow rate and pressure specifications that support modern, high flow BioProcess™ media such as MabSelect™ and Capto™, allowing for smooth scale-up

AKTA avant 的流速和压力参数可以支持现代的高流速工业层析介质，如MabSelect™ and Capto™, 这些都适合工艺的放大

- Direct scalability to process scale, using the same media 用同样的填料直接放大到工业规模
- Increased productivity with high dynamic binding capacity at high flow 在高流速下具有高的结合载量增加了生产力
- Increased yield with rapid mass transfer 具有快速的传质增加了收率
- Reduced process time with high volume throughput 更大体积的流速可以减少工艺操作时间
- Cost-effective processing 工艺的成本效率



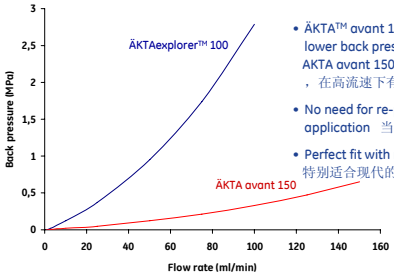
Full support of modern media...
Screening, column id 5-16 mm: 20-25 ml/min
Scale-up, columns id 16-50 mm: 120-130 ml/min

imagination at work

Any application without re-plumbing
对于任何应用没有限制

ÄKTA avant allows higher flow rates and lower back pressure, supporting modern BioProcess media

AKTA avant 允许高流速和低反压，支持采用现代的工业层析填料

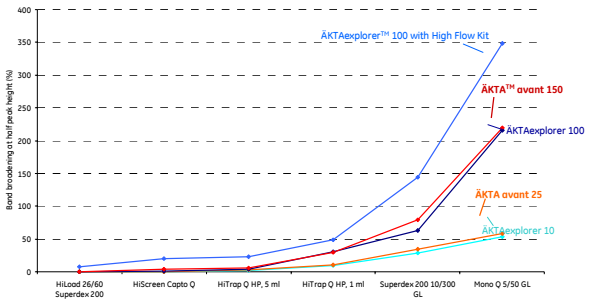


- ÄKTA™ avant 150 offers higher flow rates and lower back pressure than ÄKTAexplorer 100
  AKTA avant 150相对于AKTA explorer 100来说，在高流速下有低的反压
- No need for re-plumbing when changing application 当改变应用时**不需要更换管道**
- Perfect fit with modern BioProcess™ media
  特别适合现代的工业层析填料

imagination at work

42 / GE 28-9577-83 / Version 4.0

但峰的展宽并不逊于Explorer



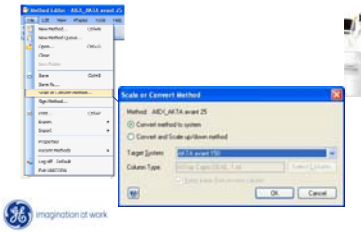
imagination at work

Seamless scalability in UNICORN™ 6
在UNICORN 6上无缝放大

Save time with automatic conversion of methods between different scales

在不同的规模之间采用自动转换的方法可以节省时间

- Quick and easy rescaling between ÄKTA™ avant 25 and 150
  在AKTA avant 25和150 之间可以快速和简易的进行转换
- Automatic adjustment of system specific settinas
  Avant25和150之间系统参数可自动转换



imagination at work

Dedicated column formats for method screening
采用专用的柱子进行方法的筛选

Use HiScreen™ pre-packed columns - save a day's work and make scale up easy!

采用Hiscreen 预装柱既节省时间还容易放大

- Save time on packing , preparation of gel, hardware and solutions, column testing and possible re-packing 节省了装柱、凝胶的准备，硬件和缓冲液，柱子测试和可能重装柱子
- 10 cm bed height - ideal for method optimization and parameter screening
  10厘米柱床高度对于方法的优化和参数的筛选是理想的
- Easily connected in series 易于串联
- Scalable to BioProcess™ columns packed with the same media using the same process fluid velocities 在同样的线性流速下用同样的填料可以直接放大到工业层析柱
- 19 different BioProcess media available
  HiScreen型号有可选的19种不同的工业层析填料

imagination at work

Reliable, reproducible and easy to use!

Pressure stable empty columns 压力稳定的空柱子

Pressure stable HiScale™ columns are compatible with modern BioProcess media

压力稳定的HiScale 柱子适合匹配现代的工业层析填料

- Pressure stable up to **20 bar (2 MPa)** 压力可以达到20bar (2 MPa)
- Complements the XK column series – equivalent wet parts 和XK 柱子是互补的—具有相同的液体接触部件
- Available with three different inner diameters (16, 26 and 50 mm)
  and two different lengths (20 and 40 cm)
  具有3种不同的内径(16, 26和50mm)
  和2种不同的长度(20 and 40 cm)
- Double flow for column packing on ÄKTA™ avant 25 and 150 (50 and 300 ml/min)
  双倍流速的柱子装填
  AKTA avant 25用50ml/min,
  AKTA avant 150用300ml/min.

imagination at work

Robust, intuitive design and easy to use!

Predictable scale up to production scale
对放大到生产规模的可预测性

Reproducible column packing and convenient scale-up with ÄKTA™ avant 150 and AxiChrom™

用AKTA avant 150轻松自动装填AxiChrom 柱子，重复性好且易于放大

- The AxiChrom column platform simplifies column handling at scales from process development to full-scale production
  Axichrom柱系列所构建的平台，简化了从工艺开发柱到大规模生产柱的柱选择与处理
- Intelligent Packing of AxiChrom™ 50 and 70 on ÄKTA avant 150
  在AKTA avant 150 上可以进行AxiChrom™ 50 and 70的智能化装填
- User guidance in UNICORN™ 6 ensures optimally packed beds and decreases user dependence
  UNICORN 6装柱指南确保最佳柱装填并减少对使用者经验的依赖
- Process chromatography is made easier, safer and more efficient!
  层析过程变得更加简单、安全和有效

imagination at work

ÄKTA™ avant
Setting the future industrial standard

Inspired security

卓越的安全性

imagination at work

Security 安全性

ÄKTA™ avant incorporates cutting-edge functionality critical to achieving real security throughout the development process

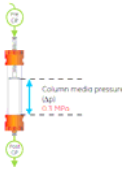
AKTA avant 设计了预警功能而保证了整个工艺开发过程的安全性

Cooled fraction collector for true sample integrity

收集器的致冷功能保护样品的活性

Reliable column protection with differential pressure measurement

柱前柱后压力测量对于柱子和凝胶的保护更加可靠



UniTag scanning for complete traceability

二维码扫描跟踪记录柱子使用与清洗记录

Fraction collector for optimal security
半导体致冷的收集器提高样品安全性

Hassle-free overnight running, outstanding reproducibility and sample security!

过夜运行时，可重复性和样品安全性的杰出保障

- Temperature control (6 to 20°C) allows samples to be cooled and protected

  温度可以控制至6到20度来冷却和保护样品
- Cassettes and rack trays available for micro titer plates up to 250 ml bottles

  收集托盘和管架，支持从微孔板到250毫升收集瓶等各种不同体积
- Load up to six cassettes in any combination

  可以任意组合6个收集管架
- Automatic detection of tube rack type

  收集架的类型可以自动检测
- Spill-free fractionation

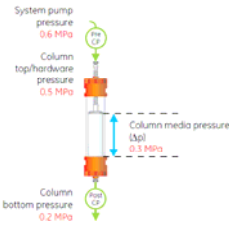
  无溅出收集

Fraction collector

Precolumn pressure and delta pressure (ΔP)
柱前压和柱前柱后压差(ΔP)

For increased operational safety, the pressure difference over the packed media bed (ΔP) is continuously measured. 为了增加操作安全性，AKTAavant持续监测加在柱床上的压力降

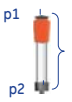
- Pressure sensors integrated into the column valve 柱阀上整合了2个压力传感器
  - Before the column to protect column hardware 柱前的压力设置保护柱子
  - After the column, the pressure difference is calculated over the packed media bed (ΔP) 柱前柱后压力降可以直接计算出来用于保护柱床凝胶
- Automatic pressure-flow control to prevent overpressure 自动的压力流速控制模式来避免因堵柱而超压运行
- Pressure sensors are also connected to the system and sample pumps 系统泵和样品泵也设计了压力传感器



Pressure limit – Definitions 压力限制-定义

Column hardware pressure limit is the pressure where the column breaks (normally = starts leaking).
柱子硬件的最大耐压是指引起柱子开始破裂的压力(通常等同柱子开始渗漏压力)

Maximal pressure over the packed bed, Δp is the pressure when the bed starts to compress.
柱床最大耐压， Δp是指柱床开始压缩时候的压力

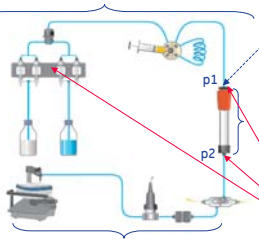


$\Delta p = p1 - p2$

What affects the different pressure limits?
什么因素影响不同的最大耐压值

柱前产生的压力 Pressure generated before the column

The pressure at this position affects the column hardware pressure limit (= pre-column pressure)
此处压力影响柱子硬件最大耐压（等同柱前压）

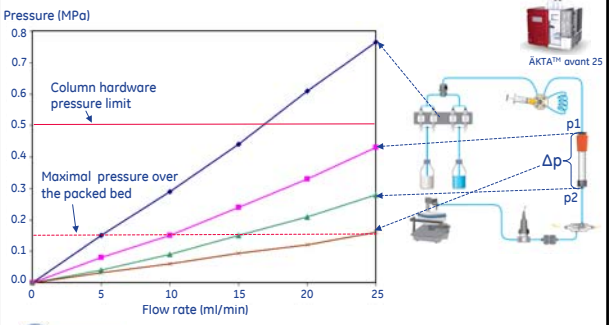


Pressure over the packed bed = delta column pressure, Δp
柱床压力=柱前后的压差Δp

Pressure generated after the column 柱后产生的压力

Pressure sensor压力感应器

Additional pressure sensors eliminate unnecessary errors 增加压力感应器消除不必要的错误



Column handling optimized for sample security 柱子管理功能最大化地保护样品的安全

Remove the risk of failed runs due to column performance, lifetime expiry &/or misuse, by keeping track of the columns with the Column Logbook and UniTag labels

AKTAavant通过柱子的记事本和二维码标签扫描来预防由于柱效、效期和/或误用而导致的纯化失败

- Identification - Column type and ID identified through matrix code

  识别－序列号和二维码识别层析柱
- Traceability - View column data and run history

  跟踪－柱参数和运行使用历史
- Security - Set limits for different parameters e.g. allowed number of runs between CIP or Column Performance Test

  安全－设置限制参数，如清洗之间的最大运行次数或测试柱校

Easy identification, automatic traceability and outstanding security of operation!

UniTags

ÄKTA™ avant

Setting the future industrial standard

设定新的行业标准

Inspired technology

卓越的技术

System orientation 系统概览

System flow-path

Innovative setup and components
创新的设计和组件

Minimized down time during service with easily accessible front mounted units
易于接触正面部分组件，可节省维护时间

- One wet working area easily accessed by simply by rotating the unit
  和液体接触的工作区域通过旋转很容易接触到
- Components have same geometry, the modules can be quickly exchanged
  同样结构的部件，模块化很容易更换

Cabinet with easy access

Instrument Display

- 5,7" TFT touch screen display
- Shows selected run data
- Has pause/continue functionality

UV Monitor UV

- No optical fibers accessible eliminating risk of damage - increased safety
- Easy to change flow cells: 2 and 10 mm
- True optical path length identified automatically

Mixer

- Mixer sizes 0.6, 1.4 and 5 ml
- Integrated in-line filter

Optional Components

- Extra air sensor (before sample pump or before column)
- Up to 3 extra valves

Multi-functional units

Sophisticated valve design 精巧的阀门设计

Completely redesigned valves - versatile system setup for easy method development
全新的阀门设计-全能的系统设计使工艺的开发更简单

- Increased productivity and yield is obtained with the column valve: it connects up to 5 different columns and has built-in reversed flow functionality
  多柱位柱阀增加了生产力和产率；新设计柱阀具有**5个柱位，并具备正反流控制功能**
- Valve w. integrated pH-electrode enables easy calibration and automatic by-pass of electrode
  pH 计阀门可以自动控制在线或离线，并简化了校正工作

Injection Valve

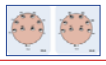
- Multiple sample application techniques without re-plumbing
- System pump and Sample pump can be run simultaneously

pH Valve (& Monitor)

- Built-in bypass of pH flow cell
- Built-in positions for pH calibration and storage
- Built-in bypass of flow restrictor

Inlet Valves

- Built-in air sensor useable with all inlets



Column Valves

- Up to five column positions
- Built-in bypass position
- Built-in flow direction change (reversed flow)
- Built-in pressure sensors before and after column

Outlet Valve

- Waste and Frac positions
- Up to 10 outlet positions

Multi-functional units

ÄKTA™ avant

Reducing weeks to days... 工艺开发从几周缩短到几天

- Shorten process time with modern resins 现代高流速填料可缩短工艺运行时间
- Save 1 day's work with easy and flexible method creation and reduce learning time to less than half! 采用易学和灵活的运行方法编辑使得学习的时间减少了一半,可减少每周一天的工作量。
- Apply DoE to significantly reduce your development costs
  应用DOE可以显著性减少工艺开发的成本。
- Save 30 min per buffer and pH value with BufferPro
  自动缓冲液配制功能每次可节省30分钟配制缓冲液的时间。
- Save 1 day's work with system & sample pump set up to run independently & with no need for re-plumbing. 系统泵和样品泵分别独立运行和不需要更换管路可以每次节省一天的工作时间
- Save 1 day's work with pre-packed columns
  用预装柱可以节省一天的装柱时间
- Limited service down-time with easily accessible wet side & modular set up 方便易接触的各个液体部件可以减少维护时间
- Save time by running safely over night 仪器可安全的过夜运行可以节省时间
- ...

... while giving you outstanding scalability and sample security 充分提供样品的安全性和可放大性

Thank you