Basic Principles of Process Control Systems and Automation – Recipe-driven Operations

Your Objectives:

At the end of this lesson "Basic [ ] of Process Control Systems and Automation – Recipe-driven Operations" you should be able to prepare and reproduce the given recipe.

Introduction

A [ ] culture is a population of living cells maintained [ ] inside a bioreactor. Biogen uses continuous cell cultures derived from established cell lines that contain a [ ] population of cells. These cell lines allow Biogen to grow high-density [ ] of cells that produce its protein products.

In vitro = maintained outside a living body

Homogeneous = of the same kind

Cells are maintained in a liquid called **media** that contains the nutritional and growth factors necessary for promoting cell [ ] and replication. Typically, media includes the following:

- Water
- [ ]
- pH buffers
- Ions and trace minerals

- Amino acids
- [ ] and lipids
- Vitamins
- Growth factors, such as [ ]
- Fetal bovine serum (FBS)

In addition, the environment in which the cells reside must include:

- Air
- Water
- [ ]
- Appropriate temperature
- Appropriate pH

To successfully maintain a cell culture, it is necessary to provide conditions that closely resemble the cells' **in vivo** [ ].

[ ] = maintained in a living body

What is a process?

A process is a series of actions or operations that leads to a particular result. In Biogen's cell culture area, the process involves the steps and activities required to [ ] living cells that will secrete the proteins that have [ ] applications in treating one or more [ ]. Process control functions are the actions – monitoring, measuring, adjusting – that regulate what happens during the process.

Some of these controls are ; that is, an physically performs some actions that controls the process.

Other controls are fully , whereby are monitored, measured and adjusted by a computer system. The primary automated system used for process control at Biogen is called the Delta V Distributed Control System® (DCS). In certain cases, Delta V® is totally responsible for control. In others, an operator interacts with Delta V® via a **human-machine interface** (HMI) for initiating a specific action that will subsequently be performed by an automated device.

Controlling process variables

In a majority of processes, there are characteristics (, , conductivity) that will vary during the process itself. By , measuring, and adjusting these variables, we are able to optimise the success of a given process.

In pharmaceutical manufacturing, for instance, you a particular outcome every time a process is repeated. If the materials or flow of a change, the expected outcome may also change.

Since manufacturing operations are complex, many factors may disrupt the process. For that reason, it is important to establish controls that the process

so that even if an operation is disrupted or changed it is still possible to produce consistent [ ].

Automated control

Automated control, as was stated, means that a computer [ ], or [ ] device, is either partially or entirely in control of the process, by maintaining pre-set values (**setpoints**) and operating ranges for process variables. The role of a control system is to keep a process at a stable, [ ] state in spite of possible disturbances.

To control a process, it is necessary to measure, compare and [ ] anything that might upset or negatively alter a given process.

Automated systems and devices involves the following processes:

- [ ] data from sensors that monitor process variables
- Displaying data transmitted from sensors
- Recording data received from sensors
- [ ] received data to setpoints
- Determining the status of a variable
- Adjusting the variable by signalling a control device to modify a parameter
- [ ] operators to an out-of-range parameter so they may (re-)evaluate and resolve any setbacks.

The goal of a control system is to hold process variables at desired levels or setpoints. To do that, most automated systems use a **control loop** to gather information and respond to that information.

Pros & cons for recipe-driven operations:

Pros	**Cons**
_____ batch record	
Improvement of data through paperless output	Risk of system failure (&/ hardware)
Fewer activities	Surrogation of human operators less manpower
Establishing of repeatable and operations	
Review by exception	

Unlike traditional paper-based workflows, **release-by-exception** implies that the can be reviewed and addressed in real-time, and not after the fact. By moving to a paperless workflow, the number of exceptions can be reduced, as the manufacturing rules are enforced in real-time. The benefit is to reduce the time finished products are warehoused waiting for any exceptions to be

addressed. From a [ ] perspective, this reduces [ ] costs and increases overall [ ].

The pressures to meet [ ] goals while ensuring product quality adds stress to operations. Lack of visibility to these goals can lead to asset [ ], increased costs, and potential delays in delivering the product to market. To remain competitive and responsive towards [ ] requirements, avoid compromising targets; plan to meet them reliably, by digitizing your operations to ensure effective use of resources and time.

To meet production goals, you need to ensure that products are [ ] to specification and that all documentation and compliance requirements are met. Reducing excessive work in process inventory, eliminating the inefficient use of resources, and better management of operations will lead to increased profitability for Biogen.

Emerson's Syncade manufacturing execution system (MES) helps Biogen gain visibility and improve its manufacturing processes to [ ] production goals, and it will accelerate batch release times while ensuring reliable and [ ] production processes in a highly regulated environment.

The Syncade MES, with its use of innovative technologies, combines document, equipment and materials management with [ ] workflow so as to deliver a manufacturing system that is optimised for operational [ ].

Aufgabe Lückentext:

Folgende Wörter bitte in den Lückentext einfüllen.
Jedes Wort kommt einmal vor.
Bitte Gross- und Kleinbuchstaben beachten.

adjust, Alerting, activities, automated, business, Carbohydrates, cell, Collecting, Comparing, diseases, delivered, device, Electronic, efficiency, exceptions, environment, expect, Food, financial, feedback, grow, homogeneous, hormones, inefficiencies, integrity, in vitro, In vivo, inventory, manual, meet, market, metabolism, optimal, output, observing, operator, parameters, pressure, process, production, populations, Principles, regulate, reliable, reliability, repeatable, Salts, system, software, therapeutic, temperature, workflow