

MCM 1.2 // WS 2017/18 // Tutorial Sterile Filtration

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Die Sterilfiltration mit Membranfiltern ist eine der elementaren Grundoperationen in der chemisch-pharmazeutischen Prozessindustrie zur Reduktion einer Ausgangskeimbelastung (Bioburden) in Flüssigkeiten und Gasen. Ihre Anwendung erstreckt sich von der Filtration von Nähr- und Puffermedien, von Wirk-, Impfstoff- und Arzneimittelbulkware bis hin zur Be- und Entlüftung von Fermentern sowie Herstellungs- und Lagerbehältern. In denjenigen Fällen, in denen eine terminale Sterilisation des Arzneimittels nicht möglich ist, stellt sie sogar den letzten keimreduzierenden Schritt dar (Aseptische Arzneimittelfertigung). Vor diesem Hintergrund ist die Sicherstellung Unversehrtheit / Integrität der Filter und die Validierung des Filtrationsverfahrens einerseits und eine chargentreue Inprozesskontrolle andererseits von besonderer Bedeutung. Für die Auswahl und Beurteilung der Verfahren und Filterintegritätsmethoden ist es weiter von entscheidender Bedeutung die der Filtration zugrunde liegenden physikalisch-technischen Zusammenhänge zu verstehen.

Schlagwörter: Sterilfiltration; Filterintegrität; Bioburden; Porenweite; Siebeffekt; Adsorption; Hagen-Poiseuillesches Gesetz; Diffusion; Bakterienbeanschlagung; Bubble point; Wasserintrusion. (Zur Redaktionszeit noch nicht vollständig)

MASTER CLASS SERIES BIOCHEMICAL PROCESS ENGINEERING

Course design:	Semester 1	Semester 2	Semester 3	Semester 4	Semester 5
Subject oriented competencies	Introduction to pharmaceutical process industry ++ Products + Production factors + Business models + Process units + Primary & secondary manufacturing + Pharma logistics + P4 medicine + Future trends ++ Sterile process & plant engineering ++ Sterile facility applications & building services + Weighing & compounding + Cleaning, sterilization & decontamination + Sterile filtration + Clean media utilities + Clean room technology + Piping & instrumentation ++	Industrial manufacturing of sterile dosage forms ++ Small volume parenterals + Elementary process modules + Apparatus & machinery: washing, sterilization / depyrogenation, filling + Lyophilization + Inspection & packaging + Serialization ++ High hygienic systems design ++ Principles & state of the art practice + Materials + Particular & microbial contaminants + Barrier technology + Cleanliness zoning + Bio security levels + Active airlock technology + Decontamination ++	Industrial bioprocessing 1: Upstream processing ++ Commercially relevant bioprocesses + Cell isolation, banking & culture expansion + Inoculum & media development + Microorganism fermentation & Cell culture + Molecular farming ++ Industrial process automation ++ Automation structures & levels + Hardware & software requirements + object oriented programming + Batch & receipt management + Good Automated Manufacturing Practice ++	Industrial bioprocessing 2: Downstream processing ++ Purity & quality requirements + Bioprocession sectors + Separation of biomass + Cell disruption + Concentration of broth + Initial purification of metabolites + polishing ++ State of the art Bioanalysis ++ Sample preparation & extraction + Hyphenated techniques + Chromatographic methods + Ligand binding assays + Mass spectrometry + Nuclear magnetic resonance ++	Master theses & individual doctorates CLUSTER A Process Development & Intensification CLUSTER B Accelerated Product, Process & Plant Design CLUSTER C Integrated Engineering, Procurement, Construction Management & Validation CLUSTER D Knowledge based Life Cycle Management Expert Systems
Methodological expertise	Process industry related Good Engineering Practice ++ Professional design & engineering methods + Process & plant structure models + Measurement & control technology + calibration + engineering work during equipment life cycle ++ Pharmaceutical process validation 1 ++ Primary systems qualification + Design Qualification + Clean room validation + Planning & execution of equipment qualification work + Good Documentation Practice ++	Advanced facility design & engineering ++ Conceptual Design + Hygienic processes + Equipment arrangement + Structural & layout planning + Building services + Responsibilities & EPC-contracts ++ Pharmaceutical process validation 2 ++ Regulatory basis of validation + Validation strategies & master planning + Computerized systems validation + Methods & cleaning Validation + Sterile process & product validation ++	Fit-For-Purpose & remediation planning ++ Fit-For-Purpose analysis + Preventative maintenance programs + Corrective & preventive action (CAPA) + Transition planning + GMP-upgrade & remediation projects ++ Modern methods in process optimization ++ Lean core processes + Mathematical principles + Lean management & six-sigma tool kit + VMECA + Quality-Function-Deployment + Design-Of-Experiments + Process capability studies ++	Pharmaceutical in-process & quality control ++ Sampling strategies for raw materials, process bulk & finished products + Physico-chemical testing + Microbiological control program + Method evaluation + Media hold & fill + Validation batches ++ Process development & intensification ++ Optimization objectives & goals + Multipurpose plant strategies + Bench marks on agility & flexibility + Chances mode & effects analysis + Structure, energy, synergy & time approaches ++	
Professional	Professional project management 1+2	Project related business transactions ++ German Law of Obligations + Economic sectors & production factors + International accounting standards + Evaluation and distinction of assets and liabilities + Means of security ++	Program & portfolio management ++ Multi project management + Full-cost-accounting + Cost-of-sales-method + Project ownership & controlling + Advanced project & program analysis + Deviation management ++	Leadership in modern process industry world ++ Change & innovation management + Brand & business development + Marketing & organizational strategies + Business transformation + Knowledge management + Managing life domains balance ++	
	Sequencing of large biomolecules & biopolymers	Mathematics & modeling of transport phenomena	Introduction Genetic & metabolic engineering	Scientific positioning & study design	
	Introduction to immunology & pharmacology	Quality-by-Design & six-sigma-approach	Total Quality & Lean Management	Scientific thesis work as project task	

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Abb. 1: Modulübersicht zur Orientierung