COURSE OVERVIEW PE0164
PEG (Polyethylene Gloycol) Manufacturing & Process Troubleshooting

Course Title
PEG (Polyethylene Gloycol) Manufacturing & Process Troubleshooting

Course Date/Venue
Please see page 3

Course Reference
PE0164

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of PEG (Polyethylene Gloycol) Manufacturing & Process Troubleshooting. It covers the applications of PEG in pharmaceuticals, cosmetics and industrial uses; the ethylene oxide (EO) and ethylene glycol (EG) chemistry catalysts use in PEG synthesis, reaction mechanisms and by-products and side reactions; the difference between batch versus continuous PEG production; the reactor types and configurations, process flow diagrams (PFDs) for PEG synthesis and key process parameters affecting PEG quality; and the equipment used in PEG manufacturing, safety considerations in PEG manufacturing and quality control and analytical techniques.

Further, the course will also discuss the ethoxylation reaction mechanism, catalyst selection and optimization, reaction conditions and process control; the automation and instrumentation purification, separation techniques and yield optimization strategies; the common production issues in PEG manufacturing, troubleshooting ethoxylation reactions and the temperature and pressure-related issues; the equipment malfunctions and preventive maintenance; and the quality control failures, troubleshooting, waste management and environmental compliance.

During this interactive course, participants will learn the process optimization techniques and scale-up challenges in PEG manufacturing; the advanced catalysis for improved efficiency, energy efficiency and sustainability; the role of IoT in process monitoring, predictive maintenance using AI, smart sensors for inline quality control and digital twins for PEG process simulation; the hazard identification in PEG plants, HAZOP and FMEA studies, fire and explosion risk mitigation and emergency shutdown procedures; the FDA, EU and REACH guidelines for PEG; the good manufacturing practices (GMP) for pharmaceutical PEG; and the environmental workplace safety regulations.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a good working knowledge on PEG (polyethylene gloycol) manufacturing and process troubleshooting
- Discuss the applications of PEG in pharmaceuticals, cosmetics and industrial uses
- Interpret ethylene oxide (EO) and ethylene glycol (EG) chemistry, catalysts use in PEG synthesis, reaction mechanisms and by-products and side reactions
- Differentiate batch versus continuous PEG production and identify reactor types and configurations, process flow diagrams (PFDs) for PEG synthesis and key process parameters affecting PEG quality
- Identify the equipment used in PEG manufacturing, safety considerations in PEG manufacturing and quality control and analytical techniques
- Discuss ethoxylation reaction mechanism and apply catalyst selection and optimization, reaction conditions and process control
- Identify process automation and instrumentation and apply purification and separation techniques and yield optimization strategies
- Recognize common production issues in PEG manufacturing, troubleshoot ethoxylation reactions and identify temperature and pressure-related issues
- Identify equipment malfunctions and apply preventive maintenance, quality control failures and troubleshooting, waste management and environmental compliance
- Employ process optimization techniques and discuss scale-up challenges in PEG manufacturing
- Carryout advanced catalysis for improved efficiency, energy efficiency and sustainability
- Discuss the role of IoT in process monitoring, predictive maintenance using AI, smart sensors for inline quality control and digital twins for PEG process simulation
- Apply hazard identification in PEG plants, conduct HAZOP and FMEA studies, and carryout fire and explosion risk mitigation and emergency shutdown procedures
- Assess FDA, EU, and REACH guidelines for PEG, good manufacturing practices (GMP) for pharmaceutical PEG, and environmental workplace safety regulations

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of PEG (polyethylene gloycol) manufacturing & process troubleshooting for process engineers, production supervisors & operators, maintenance engineers/technicians, quality control and quality assurance teams, R&D (research & development) teams, project managers, health & safety personnel, consultants and trainers.

Course Date/Venue

Session(s)	Date	Venue
1	May 18-22, 2026	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	July 19-23, 2026	Crowne Meeting Room, Crowne Plaza Al Khobar, an IHG Hotel, Al Khobar, KSA
3	September 06-10, 2026	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
4	Novemeber 01-05, 2026	Safir Meeting Room, Divan Istanbul, Taksim, Turkey

Course Fee

Abu Dhabi	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Al Khobar	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Dr. Lennart Johansson is currently the **Principal Consultant** of **Polymer Support Incorporation,** a company that provides **Analytical Services** to the **Plastics/Rubber Industry.** He is also the **Chairman** of the **European Colors & Additives Conference of Germany since 1995** and the **Board member** of the **Society of Plastics Engineers** (**SPE**). Dr. Johansson is an **International Expert** in **Polymers and Plastics/Rubber additives** with over **25 years** of industrial experience in this area. Further, he is an **Authority** in the **processes leading to degradation and aging of polymers for different industrial applications like tubes, pipes, cables, capacitors, films generators, motors and transformers**.

During his career life, Dr. Johansson worked as the **Manager of Process/ Polymer, & Development Engineer** for **Dyno Nobel**; as the **Senior Scientist and Project Leader** within the area of **Degradation and Stabilization of plastics**, for **ABB Corporate** where he was in charge of researches of **Aging of polymers**, **Aging of insulation liquids, Aging of cables, Improved performance for capacitors, Electrical treeing, Water treeing, Corona resistance** and **New filler materials.** Further, he worked as a **Chemical Engineer** for different **Plastics and Rubber** companies in **Sweden**, **Germany**, **Italy** and the **UK**.

Dr. Johansson has **five patents in Plastic industry**, and he published **tremendous number of Papers and proceedings**. His qualifications include **Bachelor, Master and PhD Degrees in Chemical Engineering** from **Lund University, Sweden**. Further, he is a **Certified Instructor/Trainer**.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Introduction to Polyethylene Glycol (PEG)*** *Definition, History, and Significance of PEG • Applications in Pharmaceuticals, Cosmetics, and Industrial Uses • Molecular Weight Variations and their Impact on Properties • Regulatory Standards for PEG Production*
0900 – 0930	***Raw Materials & Chemistry of PEG Production*** *Ethylene Oxide (EO) and Ethylene Glycol (EG) Chemistry • Catalysts Used in PEG Synthesis (Alkaline & Acid-Based) • Reaction Mechanisms (Polymerization Process) • By-Products and Side Reactions*
0930 – 0945	*Break*
0945 – 1100	***PEG Production Process Overview*** *Batch versus Continuous PEG Production • Reactor Types and Configurations • Process Flow Diagrams (PFDs) for PEG Synthesis • Key Process Parameters Affecting PEG Quality*
1100 – 1230	***Equipment Used in PEG Manufacturing*** *Reactors (CSTR, Plug Flow, and Batch) • Heat Exchangers and Temperature Control Systems • Separation Units (Distillation, Filtration) • Storage and Handling of Raw Materials & Products*
1230 – 1245	*Break*
1245 – 1320	***Safety Considerations in PEG Manufacturing*** *Hazardous Properties of Ethylene Oxide • Personal Protective Equipment (PPE) Requirements • Safety Protocols for Reactor Handling• Emergency Response Procedures*
1320 – 1420	***Quality Control & Analytical Techniques*** *Viscosity, Molecular Weight, and Purity Testing • Karl Fischer Titration for Water Content Analysis • Chromatographic Methods (GC, HPLC) • FTIR and NMR for Structural Analysis*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Ethoxylation Reaction Mechanism*** *Stepwise Ethoxylation Process • Factors Affecting Polymer Growth• Role of Catalyst in Reaction Kinetics • Impact of Reaction Temperature and Pressure*
0830 – 0930	***Catalyst Selection & Optimization*** *Acidic versus Basic Catalysts • Homogeneous versus Heterogeneous Catalysts • Catalyst Poisoning and Deactivation • Recovery and Regeneration of Catalysts*
0930 – 0945	*Break*

0945 – 1100	***Reaction Conditions & Process Control*** *Temperature and Pressure Optimization • Stirring and Mixing Efficiency • Influence of Reaction Time on Product Quality • Monitoring Polymer Chain Growth*
1100 – 1230	***Process Automation & Instrumentation*** *Process Control Loops for PEG Production • Online Monitoring of Reaction Parameters • SCADA and PLC Applications in PEG Plants • Sensor Technologies for Quality Assurance*
1230 – 1245	*Break*
1245 – 1320	***Purification & Separation Techniques*** *Removal of Unreacted Ethylene Oxide • Solvent Extraction and Drying • Filtration Techniques for Impurity Removal• Distillation Methods for PEG Fractionation*
1320 – 1420	***Yield Optimization Strategies*** *Minimizing Side Reactions • Reactor Design Improvements • Impact of Feedstock Purity on Yield • Waste Minimization Techniques*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Common Production Issues in PEG Manufacturing*** *Inconsistent Molecular Weight Distribution • Unwanted By-Products (Dioxane, Aldehydes) • Equipment Fouling and Clogging • Process Upsets Due to Catalyst Deactivation*
0830 – 0930	***Troubleshooting Ethoxylation Reactions*** *Low Conversion Rates and Incomplete Reaction • Excessive Polymerization Leading to High Viscosity • Formation of Undesired Oligomers • Effect of Feedstock Variability*
0930 – 0945	*Break*
0945 – 1100	***Temperature & Pressure-Related Issues*** *Overheating and Thermal Degradation of PEG • Pressure Fluctuations Affecting Polymerization • Energy Inefficiencies and Heat Loss • Cooling System Malfunctions*
1100 – 1230	***Equipment Malfunctions & Preventive Maintenance*** *Reactor Scaling and Fouling Problems • Pump Failures and Flowrate Inconsistencies • Corrosion in Process Pipelines • Heat Exchanger Efficiency Losses*
1230 – 1245	*Break*
1245 – 1320	***Quality Control Failures & Troubleshooting*** *Batch Inconsistencies in PEG Viscosity • Impurities Affecting Pharmaceutical-Grade PEG • Inaccurate Analytical Results in Laboratory Testing • Cross-Contamination Issues in Storage and Transfer*

1320 – 1420	***Waste Management & Environmental Compliance*** *Handling PEG Production Waste • Treatment of Ethylene Oxide Emissions • Regulatory Compliance for Effluents • Sustainable Production Practices*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Process Optimization Techniques*** *Data-driven Process Improvements • Statistical Process Control (SPC) • Lean Manufacturing Principles for PEG Production • Use of AI and Machine Learning in Process Control*
0830 – 0930	***Scale-Up Challenges in PEG Manufacturing*** *Differences Between Lab-Scale and Industrial-Scale Production• Process Intensification Techniques • Pilot Plant Design Considerations • Equipment Scaling and Cost Analysis*
0930 – 0945	*Break*
0945 – 1100	***Advanced Catalysis for Improved Efficiency*** *Novel Catalyst Developments for PEG Synthesis • Nano-Catalysts and their Role in Polymerization • Catalyst Recycling Technologies • Case Studies of Industrial Catalyst Improvements*
1100 – 1230	***Energy Efficiency & Sustainability*** *Reducing Energy Consumption in PEG Reactors • Renewable Feedstock Alternatives • Carbon Footprint Reduction Strategies • Economic Analysis of Green Production Methods*
1230 – 1245	*Break*
1245 – 1320	***Digitalization & Industry 4.0 in PEG Manufacturing*** *Role of IoT in Process Monitoring• Predictive Maintenance Using AI • Smart Sensors for Inline Quality Control • Digital Twins for PEG Process Simulation*
1320 – 1420	***Case Studies & Best Practices in PEG Industry*** *Benchmarking Against Global Manufacturers • Lessons from PEG Production Failures • Successful Process Optimization Case Studies • Future Trends in PEG Manufacturing*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

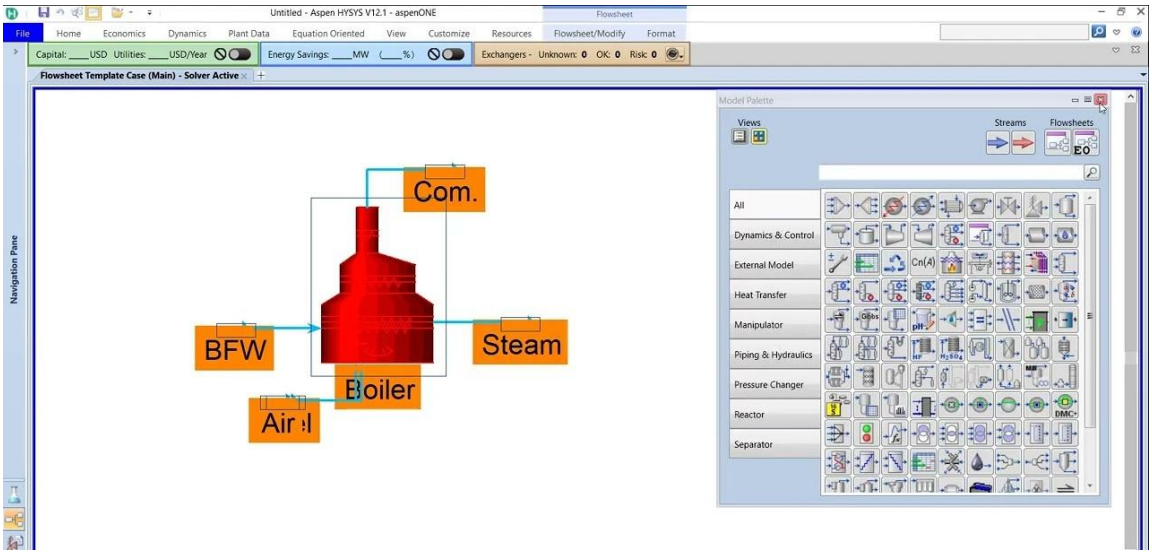
Day 5

0730 – 0930	***Hands-On Troubleshooting Workshop*** *Simulated Case Studies of Common PEG Process Failures • Group Discussions on Root Cause Analysis • Corrective Action Strategies• Implementing Troubleshooting Frameworks*
0930 – 0945	*Break*

0945 – 1045	***Risk Assessment & Safety Drills*** *Hazard Identification in PEG Plants • Conducting HAZOP and FMEA Studies • Fire and Explosion Risk Mitigation • Emergency Shutdown Procedures*
1045 – 1200	***Compliance with Global Regulations & Standards*** *FDA, EU, and REACH Guidelines for PEG • Good Manufacturing Practices (GMP) for Pharmaceutical PEG • Environmental and Workplace Safety Regulations • Documentation and Record-Keeping Requirements*
1200 – 1215	*Break*
1215 – 1345	***Final Project & Process Optimization Proposals*** *Developing a Process Improvement Plan • Identifying Key Performance Indicators (KPIs) • Presentation of Findings and Recommendations • Feedback and Evaluation*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

ssSimulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art "ASPEN HYSYS" simulator.



ASPEN HYSYS V12.1 Simulator

Course Coordinator

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